<table>
<thead>
<tr>
<th>No</th>
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<td>1</td>
<td>Severin Grabski</td>
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<td>3</td>
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<td>4</td>
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<td>Enterprise Risk Management as a Strategic Governance Mechanism in IT-enabled Transnational Supply Chains</td>
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<td>6</td>
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<td>7</td>
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<td>8</td>
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<td>11</td>
<td>Nikolaos Kakkos and Panagiotis Trivellas</td>
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<td>Roisin Mullins, Chatzichristos Christos, and Federico Iannacci</td>
<td>An empirical study of ERP implementation, in Small and Medium Enterprises in Greece</td>
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<td>Alexandros E. Garefalakis, Augustinos Dimitras and Pandelis V. Zisis</td>
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<td>Factors Affecting Accountants’ Job Satisfaction and Turnover Intentions: A Structural Equation Model</td>
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KEYNOTE SPEECH

ERP - Partly Cloudy with Chance of Risk and Resiliency

Severin Grabski
Michigan State University, USA

What will the future of ERP and ERP research look like? In this presentation, past ERP research is reviewed to provide a basis to help identify future research trends and needs. In particular, the role of cloud computing within ERP environments is discussed. The risks that are incurred as an organization switches from an on-premises ERP system to a cloud-based ERP systems are addressed. Other areas of research are also identified, including simulations and the importance of change management as it relates to users' behavior.

Professor Grabski has over 30 publications (or forthcoming publications) in various journals and peer-reviewed books, including works in MIS Quarterly, Journal of the Association for Information Systems, International Journal of Accounting Information Systems, Decision Sciences, The Journal of Information Systems, Information Technology & People, Cornell Quarterly, Journal of Applied Social Psychology, and Journal of Accounting Literature. He is an associate editor for the International Journal of Accounting Information Systems and is on the editorial board of the Journal of Information Systems and has served as an ad hoc reviewer for numerous journals including Decision Sciences, MIS Quarterly and Computing Surveys. Professor Grabski is a past-president of both the Information Systems and the Artificial Intelligence/Emerging Technologies (now known as Strategic and Emerging Technologies) sections of the American Accounting Association. He received the "Notable Contribution to the Literature" award from the Information Systems section, and has also received the "Outstanding Educator" award from the Strategic and Emerging Technologies section. He has been involved in various consultancy projects and was a Visiting Professor at the University of Tasmania. He is also currently a senior faculty advisor for instructional technology support to the Vice-Provost, Libraries, Computing & Technology. Professor Grabski's current research and teaching interests are in the field of enterprise and accounting information systems, their valuation, and in the semantic modeling of accounting phenomena.
KEYNOTE SPEECH

The Coming Age of Continuous Assurance

Miklos A. Vasarhelyi
KPMG Professor of AIS, Rutgers Business School
Technology Consultant, AT&T Labs

Over the last few decades, businesses all over the world have been transformed by powerful information technologies. It has been called the “Now Economy”, characterized by 24/7/365 globalized operations, customer interaction and management decision making. These transformations have affected the entire business cycle and entailed major electronization of business (Vasarhelyi & Greenstein, 2003) incorporating a multiplicity of technologies into organizational processes. Financial processes have also evolved substantially supported by evolution of IT in every aspect of its functions. Typically IT and financial processes have evolved ahead of the assurance process. Assurance has lagged held back by the conservatism of its practitioners, stifling obsolete regulation, and the lack of social and economic forces to make it progress.

The emerging field of Continuous Auditing (CA) attempts to better match internal and external auditing practices to the reality of the IT-enabled entity in order to provide stakeholders with more timely assurance. Presentation discusses the three key components of Continuous Assurance: 1) continuous data auditing (CDA), 2) continuous control monitoring, and 3) Continuous Risk Measurement and Audit (CRMA) and makes inferences towards the future.

\[\text{\footnotesize\textsuperscript{1}}\] The author thanks Qi Liu for her advice on this paper.
Information Integrity
Assurance & Control Guidelines

J. E. Boritz
American Institute of CPAs
Canadian Institute of CAs
Thassos Island 2011
Information

• Information is the subject matter of a disclosure
• Information includes events and instances and some related meta-information
• Management describes the events and instances comprising the information
• Management makes assertions regarding its description of the events and instances comprising the information that is the subject matter of the disclosure.
Management’s assertion

- Presents a description of the **events** or **instances** measured including the following:
  - **The intended use of the information**
  - **Definition of the information**
  - **The date as of which the instances were observed or the period of time during which the events occurred**.
  - **The source/origin of the population of events or instances**
  - **The factors in addition to date/period of time that determined the inclusion/exclusion of events or instances in the population**
Management’s assertion

• Presents a description of the attributes of the events or instances measured including the following information:
  – The definition of the attributes
  – The unit(s) of measurement
  – The accuracy/correctness/precision of measurement

• Presents a description of the input, processing and output occurring after initial measurement to creation of the information
Management’s assertion

- Presents a description of the **meta information provided with** the description of the events and instances

  - Classification of data
  - Access rights
  - Who handles the information/custodianship?
  - Standard under which the information is produced
  - Location of the information
  - Version of information
  - Retention/disposal requirements
  - Lineage
  - Assurance
Management’s assertion

• including the following:
  – The relationship of the meta information to the information
  – Definition of the meta-information presented
  – Source(s)/origin of the meta information
  – The accuracy/correctness/precision of the meta-information
Criteria for evaluating the fair presentation of the information that is the subject matter of the disclosure.

- The **population** of the information is **valid** for the intended use
- The **population** of the information is (materially) **complete**
- The **attributes of the events or instances** presented are **sufficient for the intended use**
- The information is **sufficiently accurate/precise** for its intended use
Criteria (cont’d)

• The information has been processed accurately (consistent with the description of input/processing/output)
• The meta information is valid for the intended use of the information
• The meta information is sufficient for the intended use of the information
• The meta information is accurate/correct/sufficiently precise for the intended use of the information
Framework

Risk Magnifiers:
- Complexity, Nature, Malicious Intent, etc.

Environment
- Information Integrity and Information Integrity Attributes

Process

Content

Domains

Controls

Risks by Stage of Lifecycle
- Creation
- Operation
- Change
## Enablers by Domain

<table>
<thead>
<tr>
<th>Domain</th>
<th>Type of Content</th>
<th>Content Type of Media</th>
<th>Metadata</th>
<th>Link to Process</th>
<th>Link to Environment</th>
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<td>Type of Content</td>
<td>Creation, Operation, Change Practices</td>
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<tr>
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<tr>
<td>Process</td>
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<td>Creation, Operation, Change Practices</td>
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<td>Common/Unique Phases</td>
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<td>Information governance</td>
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<td>Link to Environment</td>
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<td>Link to Corporate Governance</td>
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Creation Risk

Magnifiers - Complexity, Nature, Malicious Intent, etc.

Change Risk

Operation Risk
## Risk Factors by Domain

<table>
<thead>
<tr>
<th>Risk Factors by Domain and Stages of Lifecycle</th>
<th>Creation</th>
<th>Operation</th>
<th>Change</th>
<th>Magnifiers – Complexity, Nature, Malicious Intent, etc.</th>
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<tr>
<td>• Type,</td>
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<tr>
<td>• Metadata, etc.</td>
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<tr>
<td><strong>Process</strong></td>
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<td>• 4 Phases,</td>
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<tr>
<td>• Nature, etc.</td>
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<tr>
<td><strong>IS Environment</strong></td>
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<td>• 8 Enablers</td>
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## Conceptual View of Control List

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<th>Attributes/Assertions</th>
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<th>Current/ Timely Cut-off/ Synchronized</th>
<th>Valid/ Authorized Classification</th>
<th>Accurate/ Correct/ Unbiased/ Neutral/ Presentation</th>
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<td><strong>IS environment Controls</strong></td>
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<tr>
<td>- Organized by category and sub-type</td>
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<tr>
<td>- Risk Category</td>
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<tr>
<td>- Intentional/Unintentional</td>
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<tr>
<td>- Preventive/Detective</td>
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<tr>
<td>- Cross referenced to Information Integrity Attributes and Enablers</td>
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<tr>
<td>- Cross-reference to leading frameworks</td>
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<td><strong>Process Controls Aimed at Achieving Information Integrity Attributes</strong></td>
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<td>- Organized by processing phase and sub-type</td>
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<tr>
<td>- Risk Category - Intentional/Unintentional</td>
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<tr>
<td>- Preventive/ Detective</td>
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<td>- Rated as to effectiveness by attribute</td>
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<td>Control</td>
<td>ITG Ref</td>
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<td>Info Integrity</td>
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</tr>
<tr>
<td>1. File each record in a significant and planned sequence to facilitate retrieval.</td>
<td>AT</td>
<td>C</td>
<td>C</td>
<td>S</td>
</tr>
<tr>
<td>2. Document and enforce record retention procedures.</td>
<td>AT</td>
<td>C</td>
<td>D</td>
<td>P</td>
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<tr>
<td>3. Retain copies of source documents until the transactions are processed.</td>
<td>AT</td>
<td>C</td>
<td>D</td>
<td>P</td>
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<tr>
<td>4. Define error correction procedures and responsibilities.</td>
<td>E</td>
<td>C</td>
<td>D</td>
<td>P</td>
</tr>
<tr>
<td>5. Provide a unique identification for each record.</td>
<td>AT</td>
<td>C</td>
<td>D</td>
<td>P</td>
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<tr>
<td>6. Provide as an integral part of system design, methods of tracing data backward and forward through the information system.</td>
<td>AT</td>
<td>C</td>
<td>D</td>
<td>P</td>
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<tr>
<td>7. Provide users with the software capability to analyze and evaluate data.</td>
<td>AT</td>
<td>C</td>
<td>D</td>
<td>P</td>
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<tr>
<td>8. Regulate error handling and analysis.</td>
<td>E</td>
<td>C</td>
<td>D</td>
<td>P</td>
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</tbody>
</table>

Object is error tracking or analysis of error, but no documentation of procedures required.
The coming age of continuous monitoring and auditing

ICESAL July 2011
Thassos, Greece

Miklos A. Vasarhelyi
KPMG Professor of AIS, Rutgers Business School
Technology consultant, AT&T Labs
Outline

• The AICPA (ASEC) CDR
  – The “lego” audit

• The Real Time Economy
  – Electronic measurement and reporting (XBRL)
  – Monitoring and control

• Continuous Assurance
  – Continuous data assurance
  – Continuous control monitoring
  – Continuous risk management and assessment

• Evolving towards the future
The Real Time Economy
The Common Data Repository
Latencies

Time it takes to perform a process

Time it takes to pass information between processes

It may take time to reach a decision

Time it takes for a decision to lead to an outcome

Business Process 1

Business Process 2

Decision

Outcomes

Outcome latency

Decision latency

Inter-process latency

Intra-process latency
Electronic measurement and reporting (XBRL)

- XBRL although a very positive step on the route towards automation perpetuates some of the weaknesses of the “paper oriented” reporting model
  - Audits to improve their social agency function should be of corporate measurement and databases not of financial reports
  - XBRL is a rigid model not fit for representing the interlinked fuzzy boundary organizations of today
  - As most substantive regulatory based changes XBRL presents a series of unintended consequences including
    - Pressure toward standardization of reporting
    - Facilitation of more frequent reporting
    - Evolutionary force towards the standardization of the semantics of accounting reporting
    - A poor conduit to represent corporate transactions (XBRL/FR)

- XBRL/FR will eventually lead to XBRL/GL –great airline effects
Continuous Audit (CA) vs Continuous Monitoring (CM)

Continuous Auditing Performed by Internal Audit

- Gain audit evidence more effectively and efficiently
- React more timely to business risks
- Leverage technology to perform more efficient internal audits
- Focus audits more specifically
- Help monitor compliance with policies, procedures, and regulations

Continuous Monitoring Responsibility of Management

- Improve governance – aligning business/compliance risk to internal controls and remediation
- Improve transparency and react more timely to make better day-to-day decisions
- Strive to reduce cost of controls and cost of testing/monitoring
- Leverage technology to create efficiencies and opportunities for performance improvements

From CA/CM as Preventive Care against Fraud by James R. Littley and Andrew M. Costello, KPMG
Five levels of RTE processes

- Business Process
- Measurement of the processes
- Relationship models
- KPI monitoring
- Continuous monitoring and assurance
Continuous Assurance
An evolving audit framework

Report level Assurance

Process level Assurance

Data level Assurance

Assurance of Reports

Assurance of Key Processes

Assurance of Data elements

- Compliance reports becoming commonplace
- Traditional audit is an instance of RLA
- Generated and modified by different processes

- Process reviews a la Systrust
- Internal or outsourced
- Third party processes are to become the norm
- Intra and Inter process controls an issue

- XML/XBRL datum
- Generated and modified by different processes
- Balkanization of data
- Control/Assurance tags
An evolving continuous audit framework

- Automation
- Sensoring
- ERP
- E-Commerce

Continuous Risk Monitoring and Assessment
Continuous Data Audit
Continuous Control Monitoring

Continuous Audit
Continuous data assurance
Continuous Process Auditing at AT&T (1986-1991)
CPAS effort

- This methodology will change the nature of audit procedures and the effort involved in audit work.

Alerts, Causal linkage, Confirmatory extranets, CRMA

Follow the life cycle of the audit, data rich, new methods

Audit by exception
Continuity Equations / Long Distance Billing

reservations

flights

Billing

collections

Receiving Call
detail data from
independent
telephone
companies in
mag. tapes

Creating datasets
one-to-one
many-to-many
one-to-many'

Splitting call
detail into
files to be
posted to
different
billers

Posting from one
biller file to accounts
in several billing
cycles

Rating each
Billable
Customer

1 2 3 4 5
CPAS OVERVIEW

System

System Operational Reports

Data Flow Diagrams

Reports

Analytics

Metrics

Database

Alarm

Filter

Operational Report

Operation Report

Operational Report

DF-level 1

DF-level 2

DF-level 0

DF-level 1
Billing System - Customer Billing Module

Overview

Extract Customer Accounts → Calculate Amount Due → Update Billing Info

Journal Files

Format Bill → Print Bill

Process Errors

Table

Errors

Cases

Accounts Missing: 10

Missing: 10

1000

998

2

0
Billing System - Overview

Percent Of Accounts Successfully Billed

Percent Billed

Mean: 89.076923076923
 StdDev: 21.872591442494


98  98  99  100  97  95  98  67  85  99  100  99

4/1/89
4.3 LDS Billing Subfunctions

Units: Records

Input Volumes to Message Validation
PE: 60    RPC: Silver Springs

Order fulfillment
prod/svc. request

<table>
<thead>
<tr>
<th>Date</th>
<th>11/27/89</th>
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<tbody>
<tr>
<td>RPC</td>
<td>Silver Springs</td>
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<td>PE</td>
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<td>Units: Records</td>
<td>4.3 LDS Billing Subfunctions</td>
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<td>prod/svc. request</td>
<td>fulfillment</td>
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<td>Order</td>
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<td>Input Volumes to Message Validation</td>
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<tr>
<td>PE: 60    RPC: Silver Springs</td>
<td>PE: 60    RPC: Silver Springs</td>
</tr>
</tbody>
</table>

**Graph Details:**
- **x-axis:** Oct 1989 - Nov 1989
- **y-axis 1:** Minutes (x100k) messages (x100k)
- **y-axis 2:** Minutes / msg

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- **x-axis:** Oct 1989 - Nov 1989
- **y-axis 1:** Minutes (x100k) messages (x100k)
- **y-axis 2:** Minutes / msg

**Legend:**
- **Input Volumes to Message Validation**
- **Order**
- **Product/SVC Request**
- **Fulfillment**

**Key Points:**
- PE: 60
- RPC: Silver Springs
- Graphs showing input volumes and message validation metrics.

**Note:**
- The document is a snapshot of a FlowFront - Interactive Flow Diagram Viewer interface, showing analysis data and graphs for LDS Billing Subfunctions.
Flowchart: Message Processing

Functional Level: UPE, RPE
Hierarchical Level: 1
Parent Process: CAM
Primary Source of Information: Business LDS 4.3
Functional and System Process Flows: AT&T End User Profile

1.0 PURPOSE
• To edit messages entering the system
• To guide and rate messages
• To reject messages that are in error to the Message Investigation Unit (MIU)
• To send messages that should be billed in another PE or by the LEC there via the Returns and Transfer function

2.0 MAJOR INPUTS
• Usage tapes from the Local Exchange Companies
• Independent Telephone Companies (ICOs)
• Recorded Information Collection System (RICS)
• Correct Messages from MIU
• Messages from other parts of the Billing system
• Control Accounts (formerly Auditors Prefix)

3.0 MAJOR OUTPUTS
• Guided and rated messages passed to APE billers for bill preparation
• Messages sent to other parts of the Billing system or returned to the LEC
• Dropped messages that should be billed in another billing system
• Errors to MIU

4.0 PROCESSES
Itau-Unibanco projects

- Branch monitoring through KPIs and transaction monitoring
- Transitory Accounts
- Product Sales Project
- Implementation considerations
  - Hiring a systems integrator
  - Effect on downstream systems
  - Behavioral changes
Branch Monitoring

• Heuristics for 17 monitoring procedures that monitor about 1400 branches are being re-calculated
• Have retained IBM as the “systems integrator” for hardware expansion and systems implementation of continuous audit analytics
• Is focusing on transitory accounts
  – About 10,000 general ledger accounts
  – Unclear how many are transitory
  – Range a large number of business units
Unibanco – Some CA Program Features

• Automated monitoring of over 5 million customer accounts on a daily basis using 25 automated procedures to:
  – Detect errors
  – Deter inappropriate events & behaviors
  – Reduce or avoid financial losses
  – Help assure compliance with existing laws, policies, norms and procedures

• Examples of “low hanging fruit:”
  – Customer advances
  – Excess over credit limit
  – Returned checks
  – Federal tax payment cancellations
  – TED emissions (should this be omissions?)
Unibanco – Advances to Clients Monitoring

Histórico da Monitoração de Adiantamento a Depositantes

<table>
<thead>
<tr>
<th>Contas em AD</th>
<th>Total de contas sem limite</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
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</table>

Value Axis

- Acompanhamento
- Monitoradas
- Qtde Contas s/limite
Transitory Accounts

• Level 1
  – Analytic review of all accounts

• Level 2
  – Monitoring of risky accounts at the mainframe level

• Level 3
  – Daily analytics on transactions and generic characteristics of high risk accounts
  – Generic filter to analyze daily transactions of particular accounts flagged in daily level 2 monitoring

• Level 4 (future)
  – Continuity equations and relationships
Overall Quality of each account

- Skewed (skewness > 1)
  - Y
  - Peaked (Kurtosis > 1)
    - Y
      - Lowest Bound (e.g., P90)
    - N
      - Peaked (Kurtosis > 1)
        - Y
          - Low Bound (e.g., P95)
        - N
          - Normal Bound (e.g., P99)

or
Continuous Data Assurance (CDA) at HCA

- HSP is a large national provider of healthcare services, composed of locally managed facilities that include numerous hospitals and outpatient surgery centers.
- IT internal audit provided access to unfiltered extracts from their transactional databases, comprising all procurement cycle daily transactions from October 1st, 2003 through June 30th, 2004: Over 500,000 data points.
- Dataset mimics what a CDA system has to deal with: highly disaggregate data flowing through CA system in real time.
- Audit procedures have to be developed for this environment.
Lessons from HCA project

• Intricate processes can and must be monitored
• This may be done at the transaction levels, in addition to more aggregate levels
• Models are necessary that are adaptive and can react to current circumstances
• Errors may be automatically corrected
• A tool may be derived from the performed work that could be superior to existing tools
Metlife

- Data stream of over 200K wire transfers
- Data only currently available for the wires and the records possess little information
- Little context knowledge of the major feeding streams
- No fraud training data available
- Worked during the audit supplementing the audit team work
- Developed a series of data filters relating to specific conditions and trends
- Working on an aggregate weighting model
- Need in the field verification of picked data
Metlife (Project 2-3)

- Usage of clustering techniques to extract aberrations in data in parallel to the above discussed effort
- Usage of clustering techniques in the evaluation of exceptions in life insurance claims
Visualizing combination of attributes, we will be able to see similarity and differences among claims.
We can cluster claims using different group of attributes and flag the claims from specific groups in specific clusters.

Several clustering of different groups of attributes can make up the score.
P&G (work with the audit innovation team)

- KPI projects
- Automating order to cash
- Vendor files / duplicate payments
- Risk dashboard
KPI project

- Company has facilities in over 160 countries
- Some facilities are manufacturing, some are pure distribution and sales
- Content is local and world sourced
- Substantive part of the work is building models for inventory and sales flow and trying to understand / model the level and flow variables
- The objective is to detect out of the normal events both of business and exception nature (errors and fraud)
- There are 4 large ERPs feeding the data / data is extracted in ACL and modeled in SAS
- 16 different models have been developed and are being tested
Order to cash project -> selective automation

- This project aims to selectively automate parts of the audit using order to cash as the context
  - Audit action sheets
  - Taxonomization of protocols
  - Change of nature of evidence
  - Classification of automation level
    - Manual
    - Deterministic
    - Table comparison
    - Historical / stochastic
  - Architecture of the Structure
  - Prototyping of selected models
Continuous control monitoring
Siemens projects

• Focused on audit automation
  – **First project** looked at automating CCM in SAP
  – **Second project** focused on a wider scope of automation
  – A **third project** would think about reengineering the audit action sheets
  – The **fourth project** aims at formalizing SOD, activities, and control structures
The Siemens project learnings

- ERPs are very opaque
- Ratings schema are used and desirable
- 20-40% of the controls may be deterministically monitored
- Maybe other 20-40% may be convertible to be monitorable
- New form of alarm evidence that we do not know how to deal
- Continuous risk management and assessment needed for weighting evidence and choice of procedures
Continuous Risk Monitoring and Assessment

Assurance on Risk Management
Increasing emphasis on risk assessment

- In compliance with SOX, management must monitor internal controls to ensure that risks are being assessed and handled well.
- With ERM companies should identify and manage all risks to achieving its objectives.
- In compliance with Basel, banks are required to assess their overall capital adequacy in relation to their risk profile.
- Regulatory authorities have encouraged financial institutions to validate their risk-related models to increase the reliability of their risk assessment.
• KRI provides early warning systems to track the level of risk in the organization
• KRI can be identified through analysis of key business activities
  – 6 steps for KRI identification (Scandizzo, 2005)
• Well identified and computed KRIs provide a reliable basis for computing the riskiness of firm for specific risk, such as operational risk, liquidity risk, as well as the overall riskiness of firm.
  – \( f(KRI(i), KRI(ii), ..., KRI(n)) = \text{Risk exposure} \)
  – External risk factors may be mapped manually into the computation of KRIs and risk exposure.
Evolving towards the future
Opportunities for monitoring and audit

- Creating Control system measurement and monitoring schemata (control dashboard)
- Creating standards for Business Process Monitoring and Alarming (to be able to detect variance)
- Exclude not time sensitive variables (e.g. depreciation, airport fees, etc)
- Creation of alternative real-time audit reports for different compliance masters
• [http://raw.rutgers.edu](http://raw.rutgers.edu)
  - A wide range of presentations / videos and papers from the multiple CA and CR conferences promoted by Rutgers

• [http://raw.rutgers.edu/icesal](http://raw.rutgers.edu/icesal)
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Enterprise Risk Management as a Strategic Governance Mechanism in IT-enabled Transnational Supply Chains

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Abstract

As organisations increasingly face the need to compete for market share by building highly integrated global supply chains, governance of these complex relationships becomes a major strategic challenge. Research reporting high failure rates for collaborative alliances with supply chain partners makes formation of global supply chains a high risk venture. This study examines the influence of strategic ERM processes on improving supply chain capability while mitigating risks. ERM has become a major strategic management focus and researchers suggest this momentum arises from the need for governance mechanisms that counter the ineffectiveness of government intervention and cooperation in cross-border relationships. We survey 207 organisations on their perceptions of their own ERM processes and a specific supply chain partner’s absorptive capacity, B2B e-commerce business risk, and the global business risk associated with that partner relationship. The results support theorised relationships positing that stronger ERM promotes higher levels of partner absorptive capacity, lower B2B risk, and lower associated global business risk. Results further show that associated global business risk is reduced through managing and controlling partner absorptive capacity and B2B risk. Additional analyses show that stronger ERM is associated with partners being from countries with cultural traits conducive to strong supply chain performance.

Keywords: enterprise risk management, absorptive capacity, B2B e-commerce, IT

1. INTRODUCTION

Organisations are increasingly reliant on networks of transnational alliances to compete successfully in a global marketplace (Buhman et al., 2005). Most firms no longer compete individually, but rather compete in an environment where market competition is based on supply chain versus supply chain (Sutton, 2006). As this business model becomes the norm, pressure increases on organisations to develop strong relationships and interconnections with global supply chain partners (Daniel & White, 2005). Such highly integrated relationships are invariably dependent on enhanced collaboration enabled by business-to-business (B2B) e-commerce technologies (Lee et al., 2003; Prater & Ghosh, 2006). But, such collaborative relationships do not come easily and necessitate that linked partners have the capacity for strong internal integration of B2B (Iacovou et al., 1995; Prater & Ghosh,
However, the benefits from strong interconnections can easily be negated (or worse) if associated risks from these interconnections are not adequately monitored, controlled, and managed (Bensaou & Anderson, 1999; Buhman et al., 2005; Handley & Benton, 2009).

The benefits from highly integrated relationships within supply chains are derived primarily through information and knowledge sharing (McEvily & Marcus, 2005). This information and knowledge sharing only has value, however, if the supply chain partners have the capability to absorb and use the knowledge to enable interorganisational learning (Myers & Cheung, 2008). The ability of individual supply chain partners to integrate strategic information and create knowledge from shared information is termed absorptive capacity. Malhotra et al. (2005, 145) define absorptive capacity as 'the set of organisational routines and processes by which organisations acquire, assimilate, transform, and exploit knowledge to produce dynamic organisational capabilities'. Without absorptive capacity, sharing information with a supply chain partner provides limited benefit while conveying all of the risks and vulnerabilities that come with sharing strategic information (Arnold et al., 2010).

Risks are the counterbalancing components of interorganisational relationships. Arnold et al. (2010) provide evidence on how absorptive capacity and risks weigh against each other as organisations determine the level of commitment and information sharing they are willing to afford a supply chain partner. Their results demonstrate the need for supply chain partners to increase absorptive capacity and reduce their level of B2B e-commerce risk in order to strengthen the relationship with a potential strategic partner. Khazanchi & Sutton (2001) view B2B e-commerce risk as deriving from three basic components: technical, operational, and business level risks. Business level risks form the key strategic level concern as they relate to an organisation’s integration of their B2B capability into their business processes and their strategic readiness for leveraging B2B capability (Sutton et al., 2008). Prior research consistently shows that heightened levels of risk reduce an organisation’s willingness to engage with a supply chain partner and if they do engage, these heightened risks impede the formation of strong interorganisational linkages (Aron et al., 2005; Nicolaou & McKnight, 2006; Goh et al., 2007; Arnold et al., 2010).

Interorganisational risks are heightened in transnational relationships where monitoring from a distance becomes more difficult as the jurisdictional basis of law is blurred when relationships cross national boundaries, and cultural incompatibilities increase the risk of miscommunication and tension between partners. Power (2007, 66) posits that organisations’ desire to manage uncertainty has led to widespread adoption of strategic enterprise risk management (ERM) as a mechanism for forcing standardisation across organisations. These ERM processes create a ‘global governance structure without the need for government intervention and cooperation’. This is consistent with Beasley & Frigo (2007) who note that rapid changes in information technology, explosive growth of globalisation and outsourcing, and intense competition make it substantially more difficult for boards and senior executives to maintain effective governance over complex portfolios of risk. This complex environment necessitates strategic ERM processes capable of regularly identifying and evaluating how events, scenarios, and forces of change will impact business strategy and performance (Beasley & Frigo, 2007). An important aspect of
strategic ERM is the focus on identifying both threats (risks with negative effects) and opportunities (risks with positive effects) (Hillson, 2002; Lam, 2003; Olsson, 2007; Collier, 2009). From an ERM perspective, an opportunity not pursued is a risk (Paladino, 2008).

The purpose of this study is to explore the effectiveness of strategic ERM in achieving higher benefit opportunities and lower risk threats in the formation of supply chain relationships. ERM is viewed as a strategic governance mechanism for improving the capability of transnational supply chain relationships. The focus is specifically on whether organisations with stronger ERM structures develop supply chain alliances with greater levels of absorptive capacity and lower levels of associated risk. In addition, these interrelationships between ERM, absorptive capacity and risk are examined for their association with reduced levels of overall global business risk associated with a supply chain partner. Data were collected from 207 participants working for North American companies with offshore supply chain partners. Participants were solicited based on their strong knowledge of the relationship with an offshore supply chain partner and knowledge of that partner’s performance capabilities.

Results from the study provide strong support for the theorised model. Results indicate that strategic ERM is perceived as an effective governance structure—stronger ERM processes are associated with increased supply chain partner’s absorptive capacity, lower partner B2B e-commerce risk, and lower overall global risk assessments. The relationship between ERM and overall global risk assessment is fully mediated by the level of the supply chain partner’s absorptive capacity and the partner’s perceived B2B e-commerce risk level, suggesting that ERM reduces overall partner risk through these two key relationship components. Subsequent testing for potential cultural effects indicates that ERM removes any effect of culture on absorptive capacity, B2B e-commerce risk, or overall global risk. On the other hand, results also show that organisations with stronger ERM processes tend to partner with organisations from countries where societal practices tend to reduce the likelihood of risk. This suggests ERM is likely to be a strategic focus in the selection and retention of supply chain partners, and possibly is reflective of greater cultural awareness.

This study contributes in several ways to the research on governance of global supply chains. First, the results indicate that strategic ERM leads to stronger governance over transnational supply chain partners. This stronger governance strengthens the supply chain by promoting higher levels of absorptive capacity that are instrumental for interorganisational learning, and through mitigation of B2B e-commerce risks that could threaten the viability of the supply chain and weaken information and knowledge sharing. Second, the results indicate that strategic ERM processes reduce overall global risks by addressing the opportunities (absorptive capacity) and threats (B2B e-commerce risk) associated with supply chain relationships. Third, the effect of culture on transnational supply chain relationships has been much debated in the literature. The results of additional tests related to culture indicate that organisations with strong ERM processes tend to be associated with organisations from countries with less risky societal practices.
The remainder of this paper is presented in four sections. The next section presents the theory and background leading to the hypotheses. The following two sections present the research methods and results of the empirical study, respectively. The final section provides concluding thoughts on the implications of the research, associated limitations, and avenues for future research.

2. BACKGROUND, THEORY & HYPOTHESES

ERM is a relatively new strategic management philosophy that has rapidly come to dominate board discussions and management focus. As Power (2007, viii) suggests, risk committees did not exist ten years ago, but now they are “mandatory features of organisational life”. Audit committee chairs on board of directors note they routinely discuss strategy and risk at every board meeting (EACLN & NAACLN 2008). ERM is directly related to strategy setting and is viewed as a critical component for organisations to achieve core objectives (Beasley & Frigo, 2007). Executive management views ERM as the key means for assuring risk and control efforts support overall business performance (Ernst & Young, 2008a).

The emphasis on organisational governance has forced a standardisation of ERM practice across organisations. ERM has developed as a global governance structure to fill the void from a lack of government intervention and cooperation to otherwise provide legal structures governing transnational relationships (Power 2007, 66). This is particularly troubling to boards and executive management given growing evidence of high failure rates in supply chain relationships primarily due to high risk levels associated with such relationships (Das & Teng, 2001). Estimates place the failure rate as high as 60 percent (Lam 2003). The risks are perceived to be even higher in cross-cultural alliances (Aron et al., 2005). Extending control structures into the intricacies of these supply chain relationships is necessary for maximisation of ERM benefits while at the same time being a driver behind ERM adoption (Ernst & Young, 2008b). Thus, the global governance structures afforded to organisations through ERM processes help meet the needs and demands of transnational relationships (Power 2007, 66). As a result, risk management and corporate governance have become inextricably linked (Bhimani 2009).

This discussion is not intended to infer risks were not managed prior to the advent of ERM, but that ERM has become much more salient in today’s globally connected business environment (Taylor et al. 2006). While many associate this growth with concerns over financial risk management, ERM is more strategically oriented. As Beasley & Frigo (2007) note, the concern by board members over strategic risks as the greatest threat to their companies (53 percent) far outweighs those that see financial risk as the key concern (15.7 percent). The strategic nature of ERM has evolved from roots in strategic planning, operations management, performance management, managerial control, and systems security. ERM aligns risk management with business strategy and embeds a risk management culture throughout the organisation’s business operations (Collier 2009, 49). Inherent in this strategic orientation is recognition that while risk management has its roots in monitoring threats, the strategic nature of ERM necessitates a broader focus on also identifying, assessing, and seizing opportunities (Hillson 2002; Olsson 2007; Beasley & Frigo, 2007; Collier 2009).
Ballou & Heitger (2008) note that a key part of substantial business risk emanates from increasing interdependencies with other organisations, increasing global competition, evolving technologies, and ever-shortening product life cycles. To address these pressures, organisations have little choice but to establish closer ties up and down the supply chain as information and knowledge sharing are increasingly seen as critical differentiators between high and low global supply chain performance (Buhman et al., 2005; Cousins et al., 2006). But, information and knowledge sharing bring risks that require attention before collaboration is increased (Kumar & VanDissel, 1996).

ERM is key to improving resource allocation decisions, managing supply chains, improving reputation, maintaining brand, and improving profitability (Collier 2009, 56). Organisations should only increase coordination and facilitate information and knowledge sharing when suppliers have skills they need and risks can be controlled (Bensaou & Anderson, 1999). This is consistent with Arnold et al.’s (2010) findings that increased commitment and information sharing is associated with higher levels of partner absorptive capacity and lower B2B e-commerce risk. In the following subsections, these relationships are further explored within the context of ERM’s role.

2.1 ERM and Opportunities: Absorptive Capacity

With ERM’s focus on the strategic management level of organisations, opportunities evolve as equally important as threats in considering risks that should be managed proactively (Hillson 2002). However, while organisations frequently speak equally in terms of opportunities and threats, research shows that many organisations struggle to effectively implement processes to monitor and react to opportunities (Olsson 2007). There is a natural progression in ERM implementation and development whereby processes are developed first for compliance and threat prevention, second to minimise uncertainty surrounding business operations, and third to manage opportunity risks (Collier 2009, 46). As ERM processes mature and strengthen, organisations are in better position to focus on opportunities and increase benefits from supply chain relationships.

The greatest opportunities accrue from supply chain relationships that evolve into tight collaborations. Interactions between supply chain partners develop much further when there is an implied sense of knowledge sharing, decision making, and collective rewards (Tomkins, 2001). Research in transnational relationships provides similar findings (Cheung et al., 2010). To achieve successful knowledge sharing, high level information sharing must facilitate the overall knowledge capability of the supply chain relationship (McEvily & Marcus, 2005). But as Nicolaou & McKnight (2006) demonstrate, organisations must first assure partners are competent and reliable before willingly committing to partnering relationships that increase information sharing. This relationship between capability and commitment/information sharing has been shown to be strong in transnational relationships (Arnold et al., 2010).

Arnold et al. (2010) focuses specifically on absorptive capacity as a key capability that is opportunity based (i.e., they also examine B2B e-commerce capability, but from a threat perspective). This is consistent with McEvily & Marcus (2005) who view information sharing as arising only when it permits joint problem-solving between an organisation and its trading partner and when it allows the partner to leverage shared
information for mutual benefit. Trading partners’ ability to leverage information for mutual benefit explains why global supply chain organisations strengthen collaborations with partners and foster high levels of information sharing; sharing and leveraging of information builds the capability of the supply chain to jointly react to business environment changes (Malhotra et al., 2005). This capability to leverage information is founded in an absorptive capacity paradigm that focuses on organisations’ ability to acquire, assimilate, and exploit knowledge in a manner conducive to identifying and seizing opportunities (Zahra & George, 2002).

As noted before, organisations build supply chain relationships when partners have skills an organisation needs and risks can be controlled (Bensaou & Anderson, 1999). The interest at this point is on the ‘skills organisations need’ which from an ERM perspective includes supply chain partner’s absorptive capacity—the ability to take shared information and knowledge to enhance the capability of identifying and seizing opportunities. This leads to the first hypothesis:

**H1** As an organisation’s ERM processes strengthen, an organisation’s supply chain partner’s absorptive capacity will be higher.

This effect may occur several ways. Partner selection is one way to control risks (Dekker, 2008); as organisations strengthen ERM, they may increasingly select supply chain partners compatible with opportunity-based ERM processes. ERM focused organisations should also detach from partners who do not have the level of absorptive capacity to assist the organisation in its focus on opportunities. Finally, organisation may assist supply chain partners in developing greater capabilities in order to improve relationship performance (Khazanchi & Sutton, 2001).

### 2.2 ERM and Threats: B2B E-Commerce Business Risk

Global supply chains exist and thrive because of advances in technology; technology is key to making global supply chains work (Prater & Ghosh, 2006). Interorganisational dependencies are created through B2B e-commerce linkages that enable increased information sharing. With these dependencies come increased concerns over controls (Nicolaou, 2000). If potential threats are too high, organisations will be unwilling to share information and grow collaborative relationships (Nicolaou & McKnight, 2006).

To thrive in B2B e-commerce enabled supply chains, individual members must have the information technology function in place to participate and survive; a failure to merge back office systems seamlessly with business processes leaves a supply chain partner ill-equipped to react to strategic needs, cut cycle times or react to business environment changes (Khazanchi & Sutton, 2001; Straub & Watson, 2001). Risk measures cannot focus just on trading partners’ performance in current supply chain relationships, but must recognise relationships are dynamic and supply chain partners’ preparedness for future events is critical (Khazanchi & Sutton, 2001; Hallikas et al., 2004; Paladino, 2008; Sutton et al., 2008).

Khazanchi & Sutton (2001) theorise three levels of B2B e-commerce risk in interorganisational relationships. Through a case study and survey of a large number
of small to medium-sized suppliers, they synthesised risks from B2B e-commerce as including technical, operational, and business-level risks. While technical and operational levels were important, Sutton et al. (2008) found that they were reflective of business-level risk and that business-level risk was most critical to long-term viability and future readiness. B2B e-commerce business-level risks relate to supply chain partners’ ability to identify and appropriate benefits from B2B linkages, capture and retain all electronic transactions, meet legal and regulatory requirements, and act upon potential work flow improvements (Khazanchi & Sutton, 2001; Sutton et al., 2008). Thus, these business-level risks are of most concern as organisations look towards more collaborative relationships with a supply chain partner (Lin et al., 2007).

The true benefits in collaborative relationships come from a combination of information and knowledge sharing, and control of risks (Buhman et al., 2005). Organisations should only enter into partnering relationships when supply chain partners have skills the organisation needs and risks can be controlled (Bensaou & Anderson, 1999). As noted earlier, Arnold et al. (2010) show the joint impact of increased absorptive capacity and decreased B2B e-commerce risk on commitment and information sharing with transnational supply chain partners. Given strategic ERM’s focus on identifying and controlling threats, stronger ERM processes should be associated with lower supply chain partner B2B e-commerce risk. This leads to the second hypothesis:

H2 As an organisation’s ERM processes strengthen, an organisation’s supply chain partner’s B2B e-commerce business risk will be lower.

Similar to the effects of ERM on absorptive capacity, this association could occur for multiple reasons, including supply chain partner selection (Dekker, 2008), partner de-selection, and/or assistance from the organisation in improving the supply chain partner’s processes (Khazanchi & Sutton, 2001).

Khazanchi & Sutton’s (2001) discussion of B2B e-commerce risk in supply chain partner relationships focuses in part on partners’ capability to integrate B2B throughout their processes and partners’ strategic readiness for adapting to future business environment changes. These characteristics are also indicative of supply chain partner absorptive capacity. Thus, organisations that increase their absorptive capacity should also increase their knowledge related to the dynamic nature of B2B e-commerce supported supply chain activities. Accordingly, as organisations apply strategic ERM processes to manage supply chain relationships, part of the effect on decreasing B2B e-commerce risk should flow through absorptive capacity. This leads to the third hypothesis:

H3 As an organisation’s supply chain partner’s absorptive capacity increases, the supply chain partner’s B2B e-commerce business risk will decrease, reflecting a partial mediation of the relationship between the organisation’s strength of ERM and the partners B2B e-commerce business risk.

2.3 ERM and Threats: Global Business Risk
Organisations and the business environment surrounding them are not static and risk status changes continuously. In interorganisational environments, risks can arise from changes in the network, customer needs, partner strategies, and competitors’ actions (Hallikas et al., 2004). These risks should be mitigated before locking in a supply chain partner (Aron et al., 2005).

Given global supply chains’ dependence on technology to function (Prater & Ghosh, 2006), controlling B2B e-commerce risk is a major part of controlling overall risk. As defined by Khazanchi & Sutton (2001), B2B e-commerce risk directly relates to strategic threats associated with supply chain partners’ ability to maintain current B2B e-commerce linkages with associated underlying operational processes, and partners’ ability to maintain a clear understanding of the business environment and how B2B e-commerce and operational processes may need to adapt. Lower B2B e-commerce risk should lead to reduction in overall global business risk associated with a supply chain relationship. This leads to the fourth hypothesis:

**H4** As an organisation’s supply chain partner’s B2B e-commerce business risk decreases, the global business risk associated with that supply chain relationship will also decrease.

Effective strategic ERM is capable of monitoring, identifying, and reacting to events and scenarios that may impact business strategy and performance. Despite ERM processes being designed to provide the governance structures needed to maintain well-controlled supply chain relationships in cross-border situations (Power, 2007, 66), these transnational relationships provide challenges for effective monitoring. The basic premises of ERM suggest ERM processes should reduce uncertainty in these relationships (Power, 2007, 186), so there should be a reduction in global business risk when ERM processes are strengthened. The key is understanding how risk is reduced.

As noted throughout this section, absorptive capacity (and general capability building) and risks are widely viewed as the underlying determinants of increased collaboration, commitment, and information sharing (Bensaou and Anderson, 1999; Nicolaou 2000, Buhman et al., 2005; Nicolaou & McKnight, 2006; Arnold et al., 2010). To the degree absorptive capacity encompasses a partner’s ability to add value in a supply chain relationship, absorptive capacity should capture the major component of global business risk associated with identifying and seizing opportunities. Likewise, per Khazanchi & Sutton (2001) and reinforced by focus groups participants involved in B2B risk monitoring (Sutton et al. 2008), control over B2B e-commerce should reflect the primary component of transnational supply chain relationships that can be managed at the threat-level. Thus, while ERM is expected to have a decreasing effect on global business risk, in a transnational setting the ERM effect should occur through increased partner absorptive capacity and decreased partner B2B e-commerce risk. This leads to the fifth hypothesis:

**H5** As an organisation’s ERM processes strengthen, the global business risk associated with a supply chain partner relationship will decrease, however, this effect will flow through supply chain partner absorptive capacity and supply chain partner B2B e-commerce business risk.
Again, this effect may occur for several reasons, including partner selection (Dekker, 2008), partner de-selection, and assistance from the organisation in improving partner capabilities (Khazanchi & Sutton, 2001).

2.4 ERM and Cross-Cultural Effects

Culture has proven a difficult concept to understand in terms of effects on transnational supply chain relationships. Much of the debate has centred on whether Hofstede’s (1997) work provides a viable measure for cultural differences. An attempt to expand upon Hofstede’s work has been under way for two decades (House et al., 2004) yielding some commonalities (e.g., power distance, uncertainty avoidance), but also yielding additional cultural dimensions (e.g., institutional collectivism, in-group collectivism, humane orientation, performance orientation, future orientation, assertiveness). Some dimensions appear important to supply chain partner relationships (e.g., future orientation, performance orientation, uncertainty avoidance), while others appear less consequential (e.g., gender equality, humane orientation, in-group collectivism).

Research to date provides little clarity on the effects of culture for transnational supply chain relationships, yielding conflicting results (Griffith & Meyers, 2005; Cai et al., 2006; Balakrishnan et al., 2007; Tsui et al., 2007; Myers & Cheung, 2008; Arnold et al., 2010; Cheung et al., 2010). Arnold et al. (2010) look specifically at the impact of culture on absorptive capacity and B2B e-commerce risk, finding no significant differences across a broad cross-section of countries. Similarly, Cheung et al. (2010) find no effect of culture on knowledge-sharing. However, Griffith & Meyers (2005) find that organisations adapting to cultural differences are able to extract performance gains. Culture may be a shifting phenomenon; Cai et al. (2006) and Balakrishnan et al. (2007) provide evidence that cultural barriers are disappearing in countries such as China and India as organisations gain experience in these countries.

Absent a strong case for predicting cultural effects, an exploratory study is undertaken to examine whether the Globe Study analysis of countries provides insights on cultural impacts. Considering that Power (2007, 66) views ERM as a global governance structure for cross-border relationships, Power would seemingly expect ERM to displace cultural effects on absorptive capacity, B2B e-commerce risk, and global business risk as it applies to transnational supply chain relationships. Likewise, ERM is expected to impact partner selection (Dekker, 2008) suggesting that stronger ERM processes may actually consider cross-cultural differences in the partner selection process. Accordingly, two research questions are considered related to possible cultural effects:

R1 Do the cultural dimensions of a supply chain partner’s country impact the partner’s absorptive capacity, B2B e-commerce business risk, or associated global business risk?

R2 As an organisation’s ERM processes strengthen, do the countries in which supply chain partners are selected differ based on cultural traits consistent with risk management?
3. RESEARCH METHOD

The purpose of this study is to examine the role of ERM in governing transnational alliances engaged in B2B e-commerce. To examine this issue, we collected survey data from individuals familiar with the B2B e-commerce operations of their organisation’s transnational alliances. The data were analysed using structural equation modeling. The following sections further discuss the respondents’ demographics, survey instrument development, and model validation.

3.1 Respondents

To participate in the study, respondents needed to have an understanding of their company’s governance processes as well as technical e-commerce level knowledge of their organisation’s transnational alliances. A survey company was used to target potential respondents that possessed this specific knowledge set. The survey company initially identified 18,500 potential respondents and sent email solicitations to participate in the study. The solicitation generated 6,668 (36.04 percent) responses. The following screening questions were used to assess whether the potential respondents met the study criteria.

1. In which country is your company based?
2. What are your job responsibilities?
3. Does your company use any non-North American supplier or outsourcing companies?
4. How familiar are you with these non-North American supplier or outsourcing relationships?

The only acceptable answer for the first question was a North American country. A potential respondents who answered “No” to question 3, was automatically excluded. Question 4 was measured on a five point Likert-type scale from 1, not at all familiar, to 5, very familiar. Only respondents who answered 4 or 5 met the criteria. Potential respondents who did not meet the study’s requirements were not forwarded to the survey. Potential respondents who met the screening criteria were directed to the survey materials, and the survey was closed after 268 responses were logged. The responses were reviewed for completeness and 61 were eliminated because the respondents either failed to respond to all item measures for latent constructs used in this study or responded “no basis for answering” to some of the item measures. This process yielded a sample of 207 respondents employed at North American organisations engaged in transnational supply chain relationships. Of the respondents, 30 (14.5 percent) of the supply chain partners were located in China, 30 (14.5 percent) were located in the United Kingdom, 23 (11.1 percent) were located in India, and 23 (11.1 percent) were located in Canada. Ninety (43.5 percent) of the remaining partners were located in 41 different countries, each of which individually represented less than 6 percent of the total sample; 11 (5.3 percent) did not respond to this question. Most (79.3 percent) of the supply chain relationships were in place for three or more years. The largest industry concentration was manufacturing (35.8 percent), followed by wholesale/retail (13.5 percent), and consulting (7.7 percent); each of the remaining industries individually accounted for less than 7 percent of the total sample. Summary demographic data are presented in Table 1. Hypothesis testing is conducted on the full sample.
To address the research questions, we examined whether the cultural societal practices of the supply chain partner directly influenced the theoretical relationships and also the relationship between ERM and these cultural societal practices. “Society practices” scores developed in the GLOBE study of 62 countries (House et al., 2004) were used for this purpose. Not all of the 62 GLOBE countries were supply chain partners in the current study. Further, 16 of the partners represented in our study were not represented in the GLOBE study. Supply chain partners not represented in the GLOBE study (and omitted from the transnational analyses) are: Antigua (2), Armenia (1), Bahamas (1), Belgium (1), Belize (1), Cambodia (1), Croatia (1), Dominican Republic (1), Iraq (1), Liberia (1), Peru (1), Romania (1), Trinidad (1), United Arab Emirates (1), Uruguay (1), and Uzbekistan (1). Removing the non-GLOBE supply chain partners yielded a sub-sample of 179 responses from 28 countries. This subset of the data was used to examine the cross-cultural implications for the current study. Country clusters and “society practices” for this subset of the study data are presented in Table 2.

3.2 Survey development

The research model, which is shown in Figure 1, includes ERM, absorptive capacity knowledge, B2B e-commerce risk, and overall global business risk associated with the supply chain partner. A five point Likert-type scale, where 1 represents strongly agree and 5 represents strongly disagree, was used to collect data for each of the construct item measures. Respondents also had a 6th choice for all item measures, which was “no basis for answering”. In order to capture data specific to transnational relationships, respondents were asked to think of one supply chain partner (an overseas supplier or outsourcer with whom they were very familiar) when responding to the survey questions.

Committee on Sponsoring Organisations (COSO) (2004, 1) defines ERM as a process that aligns organisational risk appetite and strategy, enhances risk response decisions, reduces operational surprises and associated costs, identifies and manages integrated responses to cross-enterprise risks, proactively identify and realise opportunities, and improve capital allocation. However, ERM processes differ among organisations and ERM “represents a mixed bag of reformist, organising sensibilities in the name of risk.” (Power, 2007, 67). Since this study focuses on the strategic use of ERM in governing supply chain partnerships, ERM measures previously developed and validated by Arnold et al., (2011) are employed. These measures were chosen as they are reflective of activities typically associated with strategically and holistically balancing risk and opportunity enterprise-wide, and denote an organisation's level of ERM.

The measures of B2B e-commerce risk employed in this study were developed and validated by Arnold et al., (2010). B2B e-commerce is a fundamental component of transnational relationships, and these measures are deemed appropriate as they
were specifically designed to assess supply chain partner’s level of B2B e-commerce business risk. These measures are also consistent with prior research examining aspects of B2B e-commerce risk (Khanzanchi & Sutton, 2001; Nicolaou & McKnight, 2006; Sutton et al., 2008).

The items used to measure overall global business risk associated with the supply chain relationship were developed specifically for this study. These measures focus on the level of overall global business risk associated with transnational relationships. As such this is an overall measure of business risk related to transnational supply chain relationships.

The items used to measure absorptive capacity knowledge creation were previously developed and validated by Malhotra et al., (2005). These items are reflective of knowledge created as the result of a supply chain relationship and assess how well the relationship allows an organisation to “develop a better understanding of and response to the market and competitive environment” (Malhotra et al., 2005, 154). The item measures for each of the latent construct are shown in Table 3.

3.3 Measurement Model Validation

The research model shown in Figure 1 has latent variables that are both exogenous and endogenous (B2B e-commerce risk and absorptive capacity knowledge); therefore, structural equation modeling (AMOS 16.0) is used to validate the measurement model, assess the structural model fit, and test the hypothesized relationships (Hair et al., 2010). Confirmatory factor analysis (CFA) is used to examine the overall fit of the measurement model as well as to assess construct, convergent, and discriminant validity. Key fit statistics for assessing overall measurement model fit include the chi-square statistic ($X^2$), the root mean squared error of approximation (RMSEA), the goodness-of-fit index (GFI), and the comparative fit index (CFI). Evidence of good fit varies based on sample size and the number of observed variables (Hair et al., 2010); the current measurement model has a sample size of 207 with 17 observed variables. The CFA fit statistics ($X^2 = 139.08$, $df = 108$, $p = 0.024$, RMSEA = 0.04, GFI = 0.93, and CFI = 0.99) provide evidence of an overall good fit for the measurement model.

The second step in assessing the measurement model consists of examining the convergent and discriminant validity of the latent constructs. One measure of ERM was not included in the analyses due to a wording error in the on-line survey presentation. As shown in Table 3, the standardised factor loading of each of the measures is greater than 0.70 except for the GBR1 item measure for overall global business risk which was 0.28; this measure was dropped and not included in the data analyses. The composite reliability and average variance extracted for each of the latent constructs exceed 0.70 and 0.50 respectively; the factor loadings and composite reliability together with the average variance extracted support convergent validity of the latent variables (Fornell & Larker, 1981; Hair et al., 2010). In addition, as shown in Table 4, the average variance extracted for each of the constructs exceeds the squared inter-construct correlations, which supports discriminant validity.
(Hair et al., 2010). None of the inter-construct correlations exceeds 0.85 (not shown), providing additional support for discriminant validity (Kline, 2005).

When collecting survey data to measure attitudes and beliefs, the possibility of social desirability bias as well as common method bias exists (Bagozzi & Yi, 1990; Bamber & Iyer, 2002; Podsakoff et al., 2003). The current study provided respondents anonymity to reduce this potential effect of social desirability bias (Podsakoff et al., 2003). Partial least squares (Smart PLS 2.0 2005) was used to evaluate whether common method bias was a serious concern in the current study. Consistent with Liang et al., 2007, a latent construct “the common factor” was added to the research model; all of the study indicators were included as indicators of the common factor (Podsakoff et al., 2003). As shown in Table 5, the research model factor loadings are all significant (p < .001) while the common method factor loadings are not significant. In addition the average variance explained by the research model factor loading is 73.6 percent, while the average variance explained by the common method factor loadings is 0.4 percent. These results indicate that common method bias is not a problem in the current study (Podsakoff et al., 2003; Liang et al., 2007).

### 4. STRUCTURAL MODEL ESTIMATION AND RESULTS

As with the measurement model, covariance based structural equation modeling (Amos 16.0 2007) is used to test the research model. Estimates of direct, indirect, and total effects are derived from bootstrap sample of 1000 iterations using the bias-corrected percentile method with a confidence level of 95% as described in Preacher and Hayes (2004) and Preacher et al (2007). The fit statistics, shown in Figure 2, indicate that the overall fit of the research model is good ($X^2 = 144.09$, df = 109, $p = 0.014$; RMSEA = 0.04; GFI = 0.93, and CFI = 0.98). As presented in Figure 2 and Table 6, all hypotheses are supported.

| Figure 2 |
| Table 5 |

H$_1$ predicts that an organisation’s strength of ERM is positively related to supply chain partner’s absorptive capacity. As shown in Figure 2, the relationship is significant ($p < 0.001$) and positive (+0.65), indicating that stronger ERM facilitates leveraging of a supply chain partner’s absorptive capacity.

H$_2$ predicts that an organisation’s ERM adeptness is negatively related to the perceived level of B2B e-commerce risk. The results support this prediction; stronger ERM is associated with lower B2B e-commerce risk. The direct effect of ERM on B2B e-commerce risk is -0.51, $p < 0.001$, and the indirect effect is -0.18 (-.27*0.65) for a total effect of -0.69. The effect of absorptive capacity on B2B e-commerce risk is examined in H$_3$. As hypothesized, results indicate a significant ($p < 0.01$), negative association (-0.27) between absorptive capacity and B2B e-commerce risk. The significant indirect effect of ERM on B2B e-commerce risk through absorptive
capacity combined with the significant direct effect of ERM on B2B e-commerce risk supports the hypothesized partial mediation of the relationship between organisation’s strength of ERM and the supply chain partner’s B2B e-commerce risk. In tandem, these results also suggest increased absorptive capacity helps reduce supply chain partner’s B2B e-commerce risk.

The effect of B2B e-commerce risk on overall global business risk is significant (p < 0.05) and positive (+0.25) as hypothesized (H4), indicating that decreased B2B e-commerce risk has a significant impact on overall global business risk. H5 predicts stronger ERM processes are negatively related to overall global business risk and that this effect will flow through supply chain partners’ B2B e-commerce risk and absorptive capacity. Although the direct effect of ERM on overall global business risk is not significant (-0.04, p= 0.41), the total impact of ERM on overall global business risk is -0.21 ((-0.27*0.65*0.25) + (-0.51*0.25) - 0.04), which supports H5. To further examine these results, tests were conducted on the relationship between ERM and overall global business risk by isolating the direct relationship and the results were significant and in the hypothesized direction (-0.17, p < 0.05). In tandem, these results indicate that absorptive capacity and B2B e-commerce risk fully mediate the impact of ERM adeptness on overall global business risk (Baron & Kenny, 1986).

Prior research examining the impact of cultural differences on transnational supply chains is both limited and mixed (Griffith & Meyers, 2005; Tsui et al., 2007; Meyers & Cheung, 2008; Arnold et al., 2010). In this study, country and cultural societal clusters developed by the GLOBE study of 62 countries (House et al., 2004) were used to create control variables to determine the effect of culture on the research model relationships. Not all of the GLOBE countries were represented by supply chain partners in the current study, and some of the data collected for the current study was for partners located in countries not included in the GLOBE study. The GLOBE study also calculated scales for country societal practices and country societal values for each of the nine dimensions studied; the nine dimensions are performance orientation, future orientation, gender equality, assertiveness, in-group collectivism, institutional collectivism, power distance, human orientation, and uncertainty avoidance. For the purpose of this study, societal practices scales were used as these scales reflect the extent of engagement in a particular behavior while the societal value scores reflect how things should be. The clustering of the countries and the scores for societal practices for each of the nine dimensions are presented in Table 2.

To address the first research question (R1), two tests are conducted. First, a dichotomous variable (supply chain partners in the same cluster as the respondent were coded 0 and all others were coded 1) was created; adding this control variable to the research model did not change strength or direction of the hypothesized relationships and country cluster was not significant. Second, dimension variables for each of the nine GLOBE dimensions were created (the societal practices scales as shown in Table 2 were used to code each supply chain partner) and used as control variables in the research model; again the results were not significant.

R2 considers the relationship between ERM and cultural traits of supply chain partners. To examine R2, the relationship between ERM and each of the dimension variables for each supply chain partner was examined. The results indicate that
uncertainty avoidance (+0.18, p < 0.05), future orientation (+0.17, p < 0.05), and performance orientation (+0.17, p < 0.05) were significant and positively related to ERM. Power distance was negative and marginally significant (-0.15, p < 0.10) and the remaining dimensions were not significant. Uncertainty avoidance, performance orientation, and planning for the future are all of particular importance in supply chain management (Khazanchi & Sutton, 2001). The lack of significance of supply chain partner dimension variables for the research model coupled with the corresponding significant relationships with ERM suggests that organisations have incorporated supply chain partner societal characteristics considerations into their overall ERM process as they identify and lock into a set of supply chain partners.

5. CONCLUSIONS AND SUMMARY THOUGHTS

The purpose of this study was to explore the effectiveness of strategic ERM in building opportunity capability and minimising threats in an organisation’s supply chain relationships. ERM has been posited to provide a global governance structure that facilitates controlled transnational supply chain relationships (Power 2007, 66). This study focused on one aspect of opportunity capability (absorptive capacity) and one aspect of threat minimisation (B2B e-commerce business risk). Absorptive capacity represents the ability of a supply chain partner to leverage information in order to increase the opportunities available through the collaborative relationships. High absorptive capacity provides the potential for benefits that justify the sharing of information and knowledge. B2B e-commerce business risk focuses more on the threat aspect of risk, and relates to the technology and integration of that technology into the supply chain partner’s business processes to promote performance. Another important aspect is that of preparedness for future change, a capability that is key to responding successfully in dynamic and competitive supply chain settings.

The results of the current study provide strong support for the theorised model, indicating that ERM both promotes absorptive capacity and mitigates B2B e-commerce business risk, along with associated overall global business risk. The results are also supportive of the theorisation that absorptive capacity and B2B e-commerce business risk are key components for influencing overall global business risk associated with a supply chain partner relationship. This is consistent with a view of ERM as an effective governance structure for addressing the complexities of transnational supply chain relationships.

Two research questions were also explored that related to the effects of culture in transnational supply chain relationships. The results provide insights into how ERM may relate to controlling and/or minimising the effects of culture on supply chain risk. In exploring the first question, the results show that the various components of culture have no apparent effect on the supply chain partner’s absorptive capacity, partner’s B2B e-commerce business risk, or the global business risk associated with the relationship; ERM remained the dominant effect on each of the variables and none of the cultural dimensions were significant.

In exploring the second research question, the results show that there is an effect of ERM on certain cultural dimensions. Three dimensions were significantly and positively associated with ERM: uncertainty avoidance, future orientation, and performance orientation. The positive relationship with uncertainty avoidance would
suggest that organisations with stronger ERM processes tended to collaborate with supply chain partners whose culture is oriented towards reducing the likelihood of future uncertain events. The positive relationship with future orientation suggests organisations with stronger ERM processes tend to collaborate with partners from cultures whose people are more intrinsically motivated, focus on long-term strategies, and tend to be more adaptive. The positive relationship with performance orientation suggests organisations with stronger ERM tend to collaborate with partners from cultures where there is an emphasis on rewards achievement, where they view improvement as requiring feedback, and the culture promotes competitiveness and assertiveness. All three of these dimensions are indicative of cultures that accept control processes while maintaining a competitivenss and performance focus.

5.1 Implications for Theory

The results of the study provide significant support for the emerging theorisations on the role of ERM as a global governance strategy. ERM theory posits that ERM is a strategic management focus that is oriented towards controlling risks at all levels of the organisation. Risks are viewed as encompassing both good risks (opportunities) and bad risks (threats). Consistent with Power’s (2007) theorisations on ERM as a dominant strategic management initiative, the results of the study demonstrate ERM processes impact on both building capability and mitigating threat in supply chain relationships. ERM appears to be a viable governance mechanism for addressing management control issues derived from transnational supply chain partner relationships.

The results build upon Arnold et al.’s (2010) findings that absorptive capacity and B2B e-commerce business risk have significant counterbalancing influences on organisations’ willingness to commit to a supply chain partner and to increase levels of information sharing. This study’s focus on ERM processes provides insights into how organisations effectively manage supply chain relationships in order to increase supply chain partner levels of absorptive capacity while also decreasing partner levels of risk. Together, the two studies provide evidence of a conceptual link between strategic ERM as a governance mechanism for global supply chains and the development of collaborative relationships based on high levels of commitment and information sharing. High levels of commitment and information sharing are considered key to successful strategic supply chain partnerships (Daniel & White, 2005; Malhotra et al., 2005; Park et al., 2005; Arnold et al., 2010).

5.2 Implications for Practice

There are also significant implications from this study’s research findings for organisations participating in supply chains. These implications are tightly aligned with the implications for theory. First, the research demonstrates the value to organisations of implementing ERM as a strategic management focus and as a governance mechanism in global supply chain environments. Power (2007, viii) notes that a little over a decade ago there were no risk committees, but now they are considered mandatory parts of organisational governance. The results of this study suggest that the emphasis on ERM as a strategic management focus may be appropriate given the apparent benefits. Likewise, Power’s (2007, 66) view of ERM
as a governance mechanism for global supply chains also holds as an effective means of managing key aspects of supply chain partner relationships.

Second, much of the momentum behind ERM has arisen from various global regulations mandating corporate maintenance of internal control processes and reporting by management in their corporate annual reports on the effectiveness of these internal controls. Research has shown that many organisations have treated these regulations simply as compliance exercises and have not taken on the control emphasis as an integral part of organisational management. This research has also shown that organisations focusing on compliance have often hindered the flexibility of their internal processes and their own supply chain performance, while organisations taking a more strategic orientation consistent with strategic ERM processes have better flexibility and performance (Sutton et al., 2009). The results of this study extend the implications of adopting a strategic ERM focus to improved management and governance of supply chain partners and presumably improved supply chain performance among external members as well.

5.3 Limitations and Future Research

The results of the study should be considered in light of the inherent limitations and their implications for future research. One consideration should be that similar to prior related studies, the focus here has been on transnational supply chain partners with which the organisation has strong familiarity. Thus, the study may be limited in its ability to project on the role of ERM in the partner selection and integration processes. However, as noted in the hypotheses development, the findings in this study likely capture a combination of ERM effects on partner selection, partner de-selection, and an organisation's assistance of its partners in building capability. Further exploration of these potential sources of effects would be beneficial in future studies.

The potential for response bias always exists in a survey situation as certain types of respondents may be more likely to participate in such a study. Participation was voluntary and respondents needed to have e-mail in order to be contacted and Internet access in order to respond. However, both e-mail and Internet access should be available to virtually all individuals in our population of interest given the focus of this study (e.g. e-commerce).

The results could also be affected by the target population being participants based in North America. The role of strategic ERM could be of greater benefit to North American organisations based on both national and corporate culture effects. However, given the focus of ERM effects on enhancing supply chain partners' absorptive capacity while mitigating the partners' B2B e-commerce business risk, it seems likely that the results would be of interest to non-North American companies who face the same challenges with developing and evolving global supply chains that are competitive on a global level. Future research would be beneficial that examines these relationships from the perspective of non-North American organisations.

The findings in this study on the benefits of strategic ERM suggest a more in-depth analysis of strategic ERM processes would also be beneficial. The ERM literature has begun to discuss levels of ERM practice to categorise the variance observed in this
study and others as to the strength of ERM processes (Collier 2009; Olsson 2009). This opens opportunities to use multi-level analyses to examine differences in management and governance strategies for supply chain relationships based on firms adopted level of ERM integration. Research that better explores the drivers behind and characteristics associated with levels of ERM integration are probably needed first for such studies to produce meaningful findings. Regardless, additional research that helps increase the understanding of the development, evolution and integration of strategic ERM processes is in great need as the research stream moves forward.
References


Committee of Sponsoring Organizations of the Treadway Commission (COSO) (2004) 


ERNST & YOUNG (2008a) *Internal Controls: From Compliance to Competitive Edge* (EYGM Limited).


### Table 1. Demographic Information

<table>
<thead>
<tr>
<th>Panel A: Gender</th>
<th>Frequency (n = 207)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>134</td>
<td>64.7</td>
</tr>
<tr>
<td>Female</td>
<td>69</td>
<td>33.4</td>
</tr>
<tr>
<td>Not answered</td>
<td>4</td>
<td>1.9</td>
</tr>
<tr>
<td><strong>Panel B: Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 25</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>25 to 40 years</td>
<td>140</td>
<td>67.6</td>
</tr>
<tr>
<td>40+ years</td>
<td>63</td>
<td>30.4</td>
</tr>
<tr>
<td>Did not answer</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Panel C: Experience with current employer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 to 2 years</td>
<td>17</td>
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</tr>
<tr>
<td>3 to 10 years</td>
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</tr>
<tr>
<td>10+ years</td>
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<td>26.6</td>
</tr>
<tr>
<td>Did not answer</td>
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<td>4.8</td>
</tr>
<tr>
<td><strong>Panel D: Current Position</strong></td>
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<td></td>
</tr>
<tr>
<td>C-level executive / Owner</td>
<td>75</td>
<td>36.2</td>
</tr>
<tr>
<td>Vice President / Director</td>
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<td>12.1</td>
</tr>
<tr>
<td>Managers</td>
<td>64</td>
<td>30.9</td>
</tr>
<tr>
<td>All Other</td>
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<td>20.8</td>
</tr>
<tr>
<td><strong>Panel E: Organizational Structure</strong></td>
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<td></td>
</tr>
<tr>
<td>Publicly traded</td>
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<tr>
<td>Not publicly traded</td>
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<td>35.7</td>
</tr>
<tr>
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<td>0.5</td>
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<tr>
<td><strong>Panel F: Organizational Size</strong></td>
<td></td>
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</tr>
<tr>
<td>Less than 50 employees</td>
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<td>8.2</td>
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<td>51 – 100 employees</td>
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<td>101 – 500 employees</td>
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<tr>
<td>501 – 1,000 employees</td>
<td>47</td>
<td>22.7</td>
</tr>
<tr>
<td>1,001 – 5,000 employees</td>
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<tr>
<td>5,001 – 20,000 employees</td>
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<td>More than 20,000 employees</td>
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<td>12.1</td>
</tr>
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<td>Did not answer</td>
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<td>0.5</td>
</tr>
<tr>
<td><strong>Panel G: Organizational Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>86</td>
<td>41.5</td>
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<td>Service Provider</td>
<td>55</td>
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<tr>
<td>Distributor</td>
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<td>12.1</td>
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<td>1.0</td>
</tr>
<tr>
<td><strong>Panel G: Industry</strong></td>
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<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>74</td>
<td>35.8</td>
</tr>
<tr>
<td>Wholesale/retail</td>
<td>28</td>
<td>13.5</td>
</tr>
<tr>
<td>Consulting</td>
<td>16</td>
<td>7.7</td>
</tr>
<tr>
<td>Technology</td>
<td>13</td>
<td>6.3</td>
</tr>
<tr>
<td>Construction</td>
<td>11</td>
<td>5.3</td>
</tr>
<tr>
<td>All other</td>
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<td>28.5</td>
</tr>
<tr>
<td>Did not answer</td>
<td>6</td>
<td>2.9</td>
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<tr>
<td><strong>Panel G: Supply Chain Partner Location</strong></td>
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<td></td>
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<td>China</td>
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<td>14.5</td>
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**Panel G: Supply Chain Age**

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Table 2. Country clusters and societal practices of supply chain partners based on GLOBE (2004)

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<tr>
<th>Country Cluster</th>
<th>N (179)</th>
<th>Assertiveness¹</th>
<th>Future Orientation¹</th>
<th>Gender Equality¹</th>
<th>Humane Orientation¹</th>
<th>In-Group Collectivism¹</th>
<th>Institutional Collectivism¹</th>
<th>Performance Orientation¹</th>
<th>Power Distance¹</th>
<th>Uncertainty Avoidance¹</th>
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</table>

1 Higher scores indicate stronger societal practices
### Table 3. Item Measures and Tests of Convergent Validity

<table>
<thead>
<tr>
<th>Item Measure</th>
<th>Item Measure Name</th>
<th>Factor Loadings</th>
<th>Composite Reliability</th>
<th>Average Variance Extracted</th>
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<tbody>
<tr>
<td><strong>Enterprise Risk Management (Arnold et al. 2008)</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Regarding risk management activities in your company</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>• Our company performs a thorough enterprise-wide risk assessment at least once a year</td>
<td>ERM1</td>
<td>0.74</td>
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</tr>
<tr>
<td>• Our company is able to identify events that may affect the achievement of our objectives</td>
<td>ERM2</td>
<td>0.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Our risk management procedures provide the necessary information top management needs to monitor changes that could impact our company’s well-being</td>
<td>ERM3</td>
<td>0.74</td>
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<td></td>
</tr>
<tr>
<td>• One focus of our ERM is the strength of our internal control system for risk identification</td>
<td>ERM4</td>
<td>0.77</td>
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</tr>
<tr>
<td><strong>Absorptive Capacity Knowledge (Malhotra et al. 2005)</strong></td>
<td>Working with Company ABC has helped you</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Better understand the market segments you serve (rc)</td>
<td>ACK1</td>
<td>0.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Better understand the needs of customers (rc)</td>
<td>ACK2</td>
<td>0.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Better understand new or emerging markets (rc)</td>
<td>ACK3</td>
<td>0.80</td>
<td></td>
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<tr>
<td>• Better understand intentions and capabilities of your competitors (rc)</td>
<td>ACK4</td>
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<td>• Find better way of distributing/selling the products (rc)</td>
<td>ACK5</td>
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<tr>
<td><strong>B2B E-commerce Risk (Arnold et al. 2010)</strong></td>
<td>Considering B2B e-commerce capabilities, how would you rate Company ABC’s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Understanding of the strategic nature of the B2B e-commerce relationship?</td>
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<tr>
<td>• Understanding of the benefits of the B2B e-commerce relationship?</td>
<td>B2BR2</td>
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<tr>
<td>• Reengineering of business processes to facilitate B2B e-commerce transaction requirements?</td>
<td>B2BR3</td>
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<tr>
<td>• Management of data, transmission security, and auditability?</td>
<td>B2BR4</td>
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<td>• Ability to fulfill legal obligations initiated via B2B e-commerce transactions?</td>
<td>B2BR5</td>
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<tr>
<td><strong>Overall Global Business Risk</strong></td>
<td>Indicate your level of agreement with the following statements regarding Your Company’s B2B e-commerce relationship with Company ABC</td>
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<tr>
<td>• The overall business risk associated with this relationship is minimal, (d) (rc)</td>
<td>GBR1</td>
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</table>

<sup>a</sup> Composite reliability score calculated for each factor and average variance extracted from the item measures.
The overall business risk associated with Company ABC is greater than that of most of Your Company’s other INTERNATIONAL supply chain partners. (rc)  

<table>
<thead>
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The overall business risk associated with Company ABC is greater than that of most of your Company’s DOMESTIC supply chain partners. (rc)  

<table>
<thead>
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<th>Code</th>
<th>Score</th>
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The overall business risk associated with company ABC is of great concern to Your Company. (rc)  

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One ERM measure (not shown) was dropped due to a wording error in the on-line survey presentation; this measure was “Our company regularly evaluates the effectiveness of internal controls for mitigating identified risks Management has effective processes to respond to identified risks.”

(d) – Dropped

(rc)- Reverse coded
Table 4. Test of Discriminant Validity

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<td>Absorptive Capacity Knowledge</td>
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<td>Overall Global Business Risk</td>
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### Table 5. Test of Common Method Bias

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<td>0.05</td>
</tr>
<tr>
<td>ERM3</td>
<td>0.96***</td>
<td>-0.11</td>
</tr>
<tr>
<td>ERM4</td>
<td>0.91***</td>
<td>-0.03</td>
</tr>
<tr>
<td>ACK1</td>
<td>0.85***</td>
<td>0.01</td>
</tr>
<tr>
<td>ACK2</td>
<td>0.78***</td>
<td>0.09</td>
</tr>
<tr>
<td>ACK3</td>
<td>0.87***</td>
<td>-0.01</td>
</tr>
<tr>
<td>ACK4</td>
<td>0.91***</td>
<td>-0.09</td>
</tr>
<tr>
<td>ACK5</td>
<td>0.86***</td>
<td>-0.01</td>
</tr>
<tr>
<td>GBR2</td>
<td>0.91***</td>
<td>0.03</td>
</tr>
<tr>
<td>GBR3</td>
<td>0.92***</td>
<td>0.01</td>
</tr>
<tr>
<td>GBR4</td>
<td>0.90***</td>
<td>-0.04</td>
</tr>
<tr>
<td>B2BR1</td>
<td>0.75***</td>
<td>-0.07</td>
</tr>
<tr>
<td>B2BR2</td>
<td>0.77***</td>
<td>-0.05</td>
</tr>
<tr>
<td>B2BR3</td>
<td>0.79***</td>
<td>-0.05</td>
</tr>
<tr>
<td>B2BR4</td>
<td>0.91***</td>
<td>0.06</td>
</tr>
<tr>
<td>B2BR5</td>
<td>0.94***</td>
<td>0.11</td>
</tr>
</tbody>
</table>

**Average Variance Extracted**  
0.736  
0.004

*** p-value < 0.001  
* None of the factor loading are significant (p <0.05)
Table 6. Bias-Corrected Percentile Method Bootstrap Results

<table>
<thead>
<tr>
<th>Panel A—Direct Effects</th>
<th>Path</th>
<th>Mean</th>
<th>Standard Error</th>
<th>95% Confidence Interval</th>
<th>p-value (one-tail)</th>
<th>Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ERM to ACK</td>
<td>0.65</td>
<td>0.05</td>
<td>0.53 - 0.74</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>ERM to B2BR</td>
<td>-0.51</td>
<td>0.09</td>
<td>-0.68 - -0.32</td>
<td>0.001</td>
<td>-0.004</td>
</tr>
<tr>
<td></td>
<td>ACK to B2BR</td>
<td>-0.27</td>
<td>0.09</td>
<td>-0.44 - -0.08</td>
<td>0.008</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>B2BR to GBR</td>
<td>0.25</td>
<td>0.13</td>
<td>-0.01 - 0.51</td>
<td>0.021</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>ERM to GBR</td>
<td>-0.04</td>
<td>0.13</td>
<td>-0.26 - 0.23</td>
<td>0.409</td>
<td>0.004</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B—Indirect Effects</th>
<th>Path</th>
<th>Mean</th>
<th>Standard Error</th>
<th>95% Confidence Interval</th>
<th>p-value (one-tail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERM to B2BR</td>
<td>-0.18</td>
<td>0.06</td>
<td>-0.30 - -0.05</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>ACK to GBR</td>
<td>-0.07</td>
<td>0.05</td>
<td>-0.18 &lt;-0.01</td>
<td>0.023</td>
<td></td>
</tr>
<tr>
<td>ERM to GBR</td>
<td>-0.17</td>
<td>0.09</td>
<td>-0.37 - 0.01</td>
<td>0.027</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel C—Total Effects</th>
<th>Path</th>
<th>Mean</th>
<th>Standard Error</th>
<th>95% Confidence Interval</th>
<th>p-value (one-tail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERM to ACK</td>
<td>0.65</td>
<td>0.05</td>
<td>0.53 - 0.74</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>ERM to B2BR</td>
<td>-0.69</td>
<td>0.05</td>
<td>-0.77 - -0.57</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>ACK to B2BR</td>
<td>-0.27</td>
<td>0.09</td>
<td>-0.44 - -0.08</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td>ACK to GBR</td>
<td>-0.07</td>
<td>0.05</td>
<td>-0.18 &lt;-0.01</td>
<td>0.022</td>
<td></td>
</tr>
<tr>
<td>B2BR to GBR</td>
<td>0.25</td>
<td>0.13</td>
<td>-0.01 - 0.51</td>
<td>0.028</td>
<td></td>
</tr>
<tr>
<td>ERM to GBR</td>
<td>-0.21</td>
<td>0.08</td>
<td>-0.35 - -0.04</td>
<td>0.009</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. Research Model

Enterprise Risk Management → H5 (-) → Overall Global Business Risk

H1

 Absorptive Capacity Knowledge → H3 (-) → B2B E-Commerce Risk

H2 (-)

H4
Figure 2. Research Model

Enterprise Risk Management → H1 +0.65*** → Absorptive Capacity Knowledge → H2 -0.51*** → B2B E-Commerce Risk → H3 -0.27** → Overall Global Business Risk → H4 +0.25* → H5 -0.04

*p < 0.05  
**p < 0.01  
***p < 0.001

$X^2 = 144.09$, df = 109, $p = 0.014$

GFI = 0.93  
CFI = 0.98  
RMSEA = 0.04
Surveying experts on IT governance factors and their impact on underlying goals

Waldo Rocha Flores and Marlene Gevriye
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waldorf@ics.kth.se

Abstract
Ensuring effective enterprise IT governance is a challenging task. There are numerous factors that need to be implemented, and their effectiveness is difficult to assess. At the same time effective enterprise IT governance is important as it is the single most important predictor of the value an organization generates from IT. Research in the field of IT governance effectiveness has traditionally investigated different ITG mechanisms functioning as enablers or inhibitors for IT success. However, for achieving IT success the fundamental goals of IT governance are needed to be fulfilled. This paper seeks on bridging this gap in the academic literature by reporting the results of a survey of 40 ITG experts on factors attaining fundamental goals of IT governance. The results are presented in a descriptive fashion and suggest that factors concerning involvement of board-level executives attain fundamental targets more effectively, while factors generally regarded as “hygienic factors” (e.g. time-efficiency) is regarded as less effective. The results also provide empirical input of potential relationship between factors and their underlying goals open for discussion and other researchers might find interesting hypotheses to test in their work.

Keywords: IT governance, IT governance factors, expert survey.

1. Introduction
Enterprises are largely dependent on Information Technology (IT) as it provides a broad range of services to the enterprise and its customers. This dependency has raised the question of how well IT meets its objectives and how IT should be appropriately managed to achieve enterprise strategy and objectives successfully (ISACA, 2003) (Van Grembergen and De Haes, 2008). IT governance (ITG) addresses these issues by providing processes, organizational structure, control, and relational mechanisms, that ensures that the enterprise’s IT sustains and extends the organization’s strategy and objectives (Van Grembergen and De Haes, 2008) (Weill and Ross, 2004).

A frequently cited study showed that organizations with superior ITG gain profits 25% higher than those with meagre governance (Weill and Ross, 2004). Furthermore, the same study showed that “effective ITG is the single most
important predictor of the value an organization generates from IT”. Apparently, it is important for enterprises’ to have an effective ITG in place.

ITG effectiveness is affected by many factors. It has therefore been a natural trend for researchers to empirically investigate the impact of different types of factors on ITG effectiveness. Traditionally, many research papers has focused on empirically investigating organizational factors (e.g. organizational structure, top management support, organizational size, and culture/ethics) as IT governance drivers for internal process efficiency (e.g. process maturity). These studies further relate internal efficiency to ITG effectiveness and external measures such as firm-level performance or IT outsourcing decisions (Simonson, Johnson and Ekstedt 2010)(Syaful and Green 2009) (Prasad, Heales and Green 2010).

Unfortunately, there is little empirical evidence on factors affecting the fundamental goals of IT governance. ISACA (2003) and Van Grembergen and De Haes (2008) argue that the purpose of ITG governance, fundamentally is to direct IT endeavours, to ensure that IT’s performance meets the following goals: alignment of IT with the business to maximise promised benefits, and achieve business objectives, responsible use of IT resources, and appropriate management of IT-related risks. However, none of them can be managed properly if they are not measured. Therefore having a measurement function in place is also essential for effective IT governance.

This paper seeks on bridging this gap in the academic literature. We recognizes these fundamental ITG goals as vital for achieving external quality of IT governance endeavours. The paper focuses, therefore on empirically investigating factors that affect these underlying goals. The contribution of this paper is an empirical overview of how experts assess the impact of factors on ITG goals. 40 ITG experts were surveyed to provide a dataset of descriptive fashion that can answer the question: How do experts assess the impact of ITG factors that are needed to be considered for effective achievement of ITG goals?

This paper does not aim to reach in-depth regarding each of the investigated factors; it rather aims at gaining an understanding of the relative impact of these factors and thus provides empirical input of potential relationship between factors and their underlying goals for discussion and other researchers might find interesting hypotheses to test in their work. The paper, further only investigate the factors affecting its specific underlying goal without aiming at investigating the dependency between the goals, and how a mix of these together can effect effective ITG as a whole. This question is left open for future research.

The rest of the paper is structured as follows. First, some related work is discussed. Then, the research framework is presented including the IT governance factors and their underlying goals. The paper then turns to describing the methodology of the research performed, and explain how the respondent were identified, how the survey was carried out and how the data was analysed. Finally, the result of the survey is presented and discussed.
2. Related work

IT governance fundamentally concerns IT delivery of value to the business by aligning IT and business, and mitigating IT risks. However, IT governance endeavours need to be supported by adequate IT resources and measured to ensure that the results are obtained (ISACA, 2003). In this paper, 5 important goals related to these concerns have been identified from ISACA (2003) and (Van Grembergen and De Haes 2008). Each of these goals are needed to be fulfilled for effective ITG, and in this paper factors affecting them have empirically been investigated. To the knowledge of the authors, this has not earlier been explored to its full potential, and therefore this paper explores this matter further. The research that has been published in relation to the present paper is now outlined.

Simonson, Johnson and Ekstedt (2010) have performed a study regarding the correlation between internal ITG process maturity defined by COBIT, and ITG performance defined by Weill and Ross (2004). By collecting data from case studies in 35 European organizations and analysing statistical correlations of the dataset, internal processes such as: definition of the organization and quality management were identified to have the strongest correlation to ITG performance. Furthermore, processes, such as problem management, showed no correlation.

Five hypotheses, regarding the potential relationship between different ITG inhibitors (Lack of communication, Inadequate stakeholder involvement, Lack of clear ITG principles and policies, Lack of clear ITG processes and Inadequate support of financial resources) and the negative effect on ITG success of Korean firms were empirically investigated in Lee, et al. (2008). By using multiple regression analysis, it was shown that all five inhibitors negatively affected IT success of the firms.

The purpose in (Syaful och Green 2009) was to examine what ITG mechanisms (e.g. IT steering committee and IT organizational structure) generate more effective overall ITG, in the most cost-efficient way. In addition, a sub question was to empirically examine the relationship between effective ITG and the level of IT outsourcing decisions. To answer these questions, 176 members of the Information Systems Audit and Control Association (ISACA) in Australia were surveyed. By analysing the proposed hypotheses, the authors concluded that mechanisms such as the existence of ethic or culture compliance in IT, corporate communication systems and involvement of senior management in IT correlates with effective ITG.

Prasad, Heales and Green (2010) used a capabilities-based approach to obtain a deeper understanding of ITG effectiveness. An integrative model was developed to investigate if IT steering committee affect the internal process performance, trough IT-related capabilities, which in turns affect customer service process performance and firm-level performance. The model was tested empirically by a field survey. The results revealed that executive management driven IT governance initiatives exhibit higher levels of IT-related capabilities. Further, the authors also found that higher levels of IT-related capabilities demonstrate improvement in internal process-level performance. This improvement in internal process-level
performance influenced improvement in customer service, and overall improvement in firm-level performance.

Van Grembergen and De Haes (2008) investigated the potential relationships between factors such as IT governance structures, processes and relational mechanisms and governance outcomes, i.e. IT governance effectiveness. The paper identified that such relationships exists by conducting six case studies in Belgian organizations. The paper uses the external metric of effectiveness defined by Weill and Ross (2004). The external metric denoted as *IT governance performance* is based on one of the ITG objectives, the goal of achieving a better fusion between the businesses and IT. Although this is a well-recognised metric (Simonson, Johnson and Ekstedt 2010), it leaves out the other fundamental underlying goals: responsible use of IT resources, appropriate management of IT-related risks and the performance measurement function.

Thus far, research on ITG effectiveness has not offered much empiric input on factors affecting their underlying goals which in turn lead to successful IT governance. The primary research presented in this paper focus on factors that impact the fundamental goals of ITG, looking less at external measures such as firm-level performance or IT outsourcing decisions. As first argued by Van Grembergen and De Haes (2008) the paper proposes that successful external business quality derived from IT governance endeavours requires fulfilment of fundamental ITG goals, and this fulfilment further enables the achievement of external measures (e.g. firm-level performance, IT outsourcing decisions) of ITG successfully.

3. Research framework

This study incorporates IT governance goals, and IT governance factors. To achieve a sufficient degree of content validity, the factors were retrieved from well-recognized best-practice literature (ISACA, 2003). The factors and the corresponding goals are detailed in the following subsections.

3.1 IT governance goals

In this paper, 5 important goals related to fundamental concerns of IT governance and needed to be attained for effective ITG were identified. These were identified from ISACA (2003) and Van Grembergen and De Haes (2008) and categorised as follows: Value Delivery (VD), Strategic Alignment (SA), IT Risk Management (RM), IT Resource Management (ITREM), and Performance Measurement (PM). In the following, these are described and how they are attained (ISACA, 2003).

- **SA**: The domain targets to ensure that investment in IT is in harmony with its strategic objectives by building the capabilities necessary to deliver business value. The goal of SA is attained if the linkage of business and IT plans are ensured. Moreover, the IT value proposition is defined, maintained and validated, and IT operations are aligned with enterprise operations
- **VD**: This domain ensures that the value deliveries from IT services are on-time, within budget and of appropriate quality. In business terms, this is often
translated into: competitive advantage, elapsed time for order/service fulfilment, customer satisfaction, customer wait time, employee productivity and profitability. The goal of VD is attained if the value proposition throughout the delivery cycle is executed, ensuring that IT delivers the promised benefits to the strategy, concentrating on optimizing costs and proving the intrinsic value of IT.

- **RM:** The RM domain elevates the importance to display good enterprise governance to shareholders and customer. The goal of RM is attained if senior corporate officers are aware of the risks by, a clear understanding of the enterprise’s appetite for risk, understanding of compliance requirements, transparency about the significant risks to the enterprise and embedding of risk management responsibilities into the organization.

- **ITREM:** Managing resources focus on the use and allocation of IT resources (people, applications, technology, facilities, data) in servicing the needs of the enterprise. The target of ITREM goal is attained if the investments and management of critical IT resources are optimal. Key issues are related to the optimization of staff knowledge and infrastructure.

- **PM:** This domain concerns the measurement functions used to measure things such as the organization's current state and capability. The goal is attained if the strategy implementation, project completion, resource usage, process performance and service delivery are tracked and monitored.

### 3.2 IT governance factors

The factors and the corresponding goals are presented in table 1. All factors are given an identification number. This numbering does, however, not represent hierarchical order or chronology; it is used to illustrate which factors that were categorized in relation to the desired target to attain. Thus, factor 1.1-1.7 are studied against the degree of attainment in relation to the SA target, factor 2.1-2.7 are studied against the degree of attainment in relation to the VD target, factor 3.1-3.7 are studied against the degree of attainment in relation to the RM target, factor 4.1-4.7 are studied against the degree of attainment in relation to the ITREM target and factor 5.1-5.7 are studied against the degree of attainment in relation to the PM target.

**Table 1. ITG factors and their underlying goals Part 1**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 It is clear what IT is doing</td>
<td>Strategic Alignment</td>
</tr>
<tr>
<td>1.2 IT projects deliver what they promised</td>
<td></td>
</tr>
<tr>
<td>1.3 IT core competencies are maintained at a level to meet required enterprise strategic objectives.</td>
<td></td>
</tr>
<tr>
<td>1.4 The making of major IT-decisions is time-efficient</td>
<td></td>
</tr>
<tr>
<td>1.5 The enterprise and IT align their objectives</td>
<td></td>
</tr>
<tr>
<td>1.6 The board articulates and communicates the business direction to which IT should be aligned</td>
<td></td>
</tr>
<tr>
<td>1.7 IT is a regular item on the agenda of the board and is addressed in a structured manner</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. ITG factors and their underlying goals Part 2

<table>
<thead>
<tr>
<th>Factor</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 The management of IT investment agreements is evaluated</td>
<td>Value Delivery</td>
</tr>
<tr>
<td>2.2 End users are satisfied with the quality of the IT service</td>
<td></td>
</tr>
<tr>
<td>2.3 IT projects do not often go over budget</td>
<td></td>
</tr>
<tr>
<td>2.4 IT meets business expectations to create competitive advantages</td>
<td></td>
</tr>
<tr>
<td>2.5 IT projects deliver what they promised</td>
<td></td>
</tr>
<tr>
<td>2.6 The board provides well-articulated strategies for how IT-projects can prevent deliver failures.</td>
<td>Risk Management</td>
</tr>
<tr>
<td>2.7 The board has a clear view on the major IT investments from a risk and return perspective</td>
<td></td>
</tr>
<tr>
<td>3.1 Incorporated regular assessments of risk relevance are carried out</td>
<td></td>
</tr>
<tr>
<td>3.2 The risk management responsibilities are embedded within the organization</td>
<td></td>
</tr>
<tr>
<td>3.3 IT management follow-up risk exposures</td>
<td></td>
</tr>
<tr>
<td>3.4 Education within the organization to establish common language is carried out</td>
<td></td>
</tr>
<tr>
<td>3.5 How risks can be avoided is clarified</td>
<td></td>
</tr>
<tr>
<td>3.6 The board is aware of potential conflicts between the enterprise divisions and the IT function</td>
<td></td>
</tr>
<tr>
<td>3.7 The board is regularly briefed on IT risks to which the enterprise is exposed, including compliance risks</td>
<td></td>
</tr>
<tr>
<td>4.1 Management and support of IT systems is carried out by staff with appropriate and adequate skill</td>
<td>IT Resource Management</td>
</tr>
<tr>
<td>4.2 The workforce planning is improved to ensure maintenance of skilled staff</td>
<td></td>
</tr>
<tr>
<td>4.3 The IT staff has access and is offered appropriate working tools to develop the needed skills</td>
<td></td>
</tr>
<tr>
<td>4.4 The internal knowledge is leveraged to increase stakeholder value</td>
<td></td>
</tr>
<tr>
<td>4.5 Skilled IT resources are attracted to the organization successfully</td>
<td></td>
</tr>
<tr>
<td>4.6 The board is aware of the latest developments in IT from a business perspective</td>
<td></td>
</tr>
<tr>
<td>4.7 The board is assured of the fact that suitable IT resources, infrastructures and skills are available (including external resourcing) to meet the required enterprise strategic objectives</td>
<td></td>
</tr>
<tr>
<td>5.1 The current performance of IT is measured.</td>
<td>Performance Measurement</td>
</tr>
<tr>
<td>5.2 The current capabilities are analysed to identify gaps.</td>
<td></td>
</tr>
<tr>
<td>5.3 IT assets are being well-managed.</td>
<td></td>
</tr>
<tr>
<td>5.4 The organization has a view on how much is invested in IT compared to other like organizations</td>
<td></td>
</tr>
<tr>
<td>5.5 The organization is getting independent assurance on the achievement of IT objectives and the containment of IT risks</td>
<td></td>
</tr>
<tr>
<td>5.6 The board obtains regular progress reports on major IT projects</td>
<td></td>
</tr>
<tr>
<td>5.7 The board obtains IT performance reports illustrating the value of IT from a business driver perspective (customer service, cost, agility, quality, etc.)</td>
<td></td>
</tr>
</tbody>
</table>
4 Methodology

In this study, relationships between factors and their underlying goals have been empirically investigated by surveying experts. Quantitative data was collected through face-to-face surveys distributed to 40 strategically chosen experts in the ITG domain. The following subsections outline how the sample was selected, the structure of the survey, and how the collected survey data was analyzed.

4.1 Selection of ITG experts

A thorough selection of experts based on expert criteria is important in order to achieve reliability and high quality of the performance of the study. In the present study the survey participants were strategically chosen to assure that they possessed the competence needed for the objectives of the study. Recommendations by Weiss (2003) and Shanteau (1988) on how to identify experts were followed. The participants in this study consist of experts within global audit, tax and advisory organizations. The experts were selected based on the following criteria: (i) survey participants from each organization were qualitatively selected by the head of each organization, (ii) survey participants had relevant experience working with ITG, and (iii) survey participants work frequently with ITG.

4.2 The survey

A face-to-face survey was carried out since all respondents were at the same geographical location (Blair, 2005). The survey consisted of four pages of which the first according to recommendation by (Blair, 2005) gave an introduction and described the aim of the survey. Further, the goals were described and a description of how to answer the questions was provided. The second page included four questions used to assess background information of the experts. The first question concerned years of ITG experience. The second question asked how frequently the respondent works with ITG. The third, asked if the respondent have acquired any certification relevant to ITG, and the final question concerned the industry the experts most regularly works in. The third and fourth page of the survey consisted of 7 questions per domain, thus in total 35 questions, utilized in order to gain expert opinions regarding the significance of the factors affecting its underlying target. All of the 35 questions included in the survey were taken directly from ISACA (2003) without any manipulation. For each of the 35 questions, the respondents were asked to assess the size of the corresponding degree of attainment related to its underlying goal. The question format was based on the widely applied metric Goal-centred judgment. The Goal-centred judgment is used for assessing effectiveness within the IS and strategic management domain (Venkatraman, 1987). It seeks to assess the degree of attainment in relation to targets which fits the scope of the paper well (Segars and Grover, 1998).

Likert scales, was used in the survey, as it allowed the respondents to specify their level of agreement with a statement related to a specific factor (Warner, 2008). The experts were asked to answer on a quantitative scale from 1 = not at all; 7 = to a great extent. In figure 1, the 7 questions related to factors affecting their underlying SA target are presented to provide information of the question format.
Figure 1. The question format

Please, ask yourself to what extent the following statements achieve the IT governance goal of (Scale: 1= not at all; 7= to a great extent):

<table>
<thead>
<tr>
<th>Strategic Alignment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 It is clear what IT is doing</td>
<td></td>
</tr>
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<td>1.2 IT projects deliver what they promised</td>
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<td></td>
</tr>
<tr>
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<tr>
<td>1.5 The enterprise and IT align their objectives</td>
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</tr>
<tr>
<td>1.7 IT is a regular item on the agenda of the board and is addressed in a structured manner</td>
<td></td>
</tr>
</tbody>
</table>

4.3 Method of data analysis

Four tools were utilized to analyse the results of the survey: box plots, tests for normality, statistical measurements, and ANOVA analysis combined with multiple comparisons.

Box plots (sometimes referred to as “box and whisker plots”) were first used to evaluate the results. Box plots were chosen to be used due to the favourable non-parametric distribution requirement by the tool (McGill, Tukey and Larsen, 1978).

Tests for normality were performed using QQ-plots (Warner, 2008). Outliers who did not meet the normality assumption were removed according to the recommendation by (Montgomery, 2005) in order to improve the overall data quality. The evaluation of the data set with box plots gave an understanding of the data before manipulation; therefore test for normality was performed after analysing the box plots.

Standard statistical measurements such as mean, standard deviation and confidence intervals were used to present the survey results. Descriptions of these measures can be found in (Montgomery, 2005).

ANOVA analysis and multiple comparisons were used to identify significant differences in factor means, i.e. degree of goal attainment. The dependent variable in this analysis was the assessed mean value, i.e. the extent, according to expert’s opinions; a factor achieves its related goal. Multiple comparisons were conducted to identify which of the factors that significantly was different.

5. Results

5.1 Demographics

Survey participants were chosen based on certain expert criteria’s, e.g. referrals by the head of the organization and years of experience working with ITG. The criteria: referrals by the head of the organization was met by letting executives at the four participating firms recommend 10 respondents that they considered to be
experts in ITG. In Table 3, information of the 40 survey participants is presented. In
general, the experts are experienced, work with ITG frequently, and have acquired
licenses relevant to ITG. Based on these data, the participants in this survey were
considered to be ITG experts, and therefore a representative sample set.

Table 3. Demographics of the survey sample

<table>
<thead>
<tr>
<th>Years of experience</th>
<th>Work with ITG</th>
<th>Acquired licenses</th>
<th>Industry experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 5 years: 37,5 %</td>
<td>On daily basis: 40%</td>
<td>CISA: 60%</td>
<td>Bank and Finance: 65%</td>
</tr>
<tr>
<td>1-5 years: 52,5%</td>
<td>On a weekly basis: 27,5%</td>
<td>CISM: 10%</td>
<td>Manufacturing: 40%</td>
</tr>
<tr>
<td>&lt;1 years: 10%</td>
<td>On a monthly basis: 27,5%</td>
<td>CGEIT: 10%</td>
<td>Insurance: 20%</td>
</tr>
<tr>
<td></td>
<td>On a yearly basis: 5%</td>
<td>CISSP: 2,5%</td>
<td>Commercial: 17,5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CRISC: 2,5%</td>
<td>Public Sector: 5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ITIL: 2,5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No license yet: 12,5%</td>
<td></td>
</tr>
</tbody>
</table>

5.2 Factor effectiveness levels by domain

For all domains, 1400 data points were collected. For each domain, 280 data
points were collected. This represent to what extent, according to expert’s
opinions, a factor achieves its related goal. The results are presented in a series
of box plots and tables describing their mean, standard deviation and confidence
intervals. The box plots depict numerical data representing the lowest observation,
lower quartile (Q1), median, upper quartile (Q3), and highest observation. The
interquartile range (IQR) represents the box and is calculated by subtracting Q1
from Q3. Any responses outside the “whiskers” are outliers that are shown as dots
on the plots. The length of the box can be considered a measure of the consensus
among the respondents. A relatively long box indicates a low consensus among
the respondents, i.e. a wider distribution of responses and a relatively short box
indicate high consensus among the respondents, i.e. a narrower distribution of
responses). In the remaining part of this section, the results will be discussed on a
domain-level.

Figure 2 illustrates data for factors affecting the SA goal. Factor 1.5-1.7 (“The
enterprise and IT align their objectives”, “The board articulates and communicates
the business direction to which IT should be aligned”, “IT is a regular item on the
agenda of the board and is addressed in a structured manner”) had the highest
medians and also mean values (Cf. Table 4). Factor 1.5 had the absolute highest
median and mean value, but the largest standard deviation and the longest box.
This indicates that the consensus among the experts regarding this factor was the
lowest among all factors. Factor 1.1 (“It is clear what IT is doing”) had the highest
consensus among all respondents, and Factor 1.4 (“The making of major IT-
decisions is time-efficient”) had the lowest median and mean value.

These results show that factors including board involvement are considered to be
important to many experts in achieving the SA goal. Second, the results indicate
that the respondent considers time-efficiency when making IT-decisions is less
important to achieve the SA goal. Thirdly, the box plot indicates that responses varied in five levels on the likert scale for 6 of 7 factors.

The ANOVA analysis revealed that there exist significant differences in factor means for at least two factors at \( p \leq 0.05 \), and by conducting multi comparisons factor 1.4 was identified to have significant lower mean value than all other factors in the SA domain. Factor 1.5-1.7 had also significant higher means than factor 1.2 (“IT projects deliver what they promised”) and factor 1.3 (“IT core competencies are maintained at a level to meet required enterprise strategic objectives”). The ANOVA table and multi comparisons can be found in the appendices.

**Figure 2.** Degree of goal attainment – SA domain

![Box plot showing the distribution of responses for the SA domain factors](image)

**Table 4.** Factor ranking – SA domain

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean Value</th>
<th>Std. Deviation</th>
<th>Lower Bound (95%)</th>
<th>Upper Bound (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>4.83</td>
<td>1.412</td>
<td>4.37</td>
<td>5.28</td>
</tr>
<tr>
<td>1.2</td>
<td>4.23</td>
<td>1.423</td>
<td>3.77</td>
<td>4.68</td>
</tr>
<tr>
<td>1.3</td>
<td>4.20</td>
<td>1.471</td>
<td>3.73</td>
<td>4.67</td>
</tr>
<tr>
<td>1.4</td>
<td>3.03</td>
<td>1.481</td>
<td>2.53</td>
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<tr>
<td>1.5</td>
<td>5.55</td>
<td>1.719</td>
<td>4.99</td>
<td>6.12</td>
</tr>
<tr>
<td>1.6</td>
<td>5.35</td>
<td>1.688</td>
<td>4.81</td>
<td>5.89</td>
</tr>
<tr>
<td>1.7</td>
<td>5.32</td>
<td>1.297</td>
<td>4.89</td>
<td>5.74</td>
</tr>
<tr>
<td>Mean</td>
<td>4.65</td>
<td>1.698</td>
<td>4.45</td>
<td>4.85</td>
</tr>
</tbody>
</table>

Figure 3 illustrates data for factors affecting the VD goal. Factor 2.4 (“IT meets business expectations to create competitive advantages”), 2.5 (“IT projects deliver what they promised”), and factor 2.7 (“The board has a clear view on the major IT
investments from a risk and return perspective”) had the highest medians. Factor 2.5 had the largest standard deviation and the longest box. This indicates that the consensus among the experts regarding this factor was the lowest among all factors. Factor 2.2 (“End users are satisfied with the quality of the IT service”) had the highest consensus among all respondents, and Factor 2.3 (“IT projects do not often go over budget”) had the lowest median and mean value (Cf. table 5).

These results show, again, that factors including board involvement are considered to be important to many experts in achieving an ITG goal. Second, the results indicate that the respondents consider IT project delivery as less important to achieve the VD goal. Thirdly, the box plot indicates that responses varied from the lowest to the highest levels on the likert scale for 4 of 7 factors.

The ANOVA analysis revealed that there exist significant differences in factor means for at least two factors at $p \leq 0.05$, and by conducting multi comparisons factor 2.4 (“IT meets business expectations to create competitive advantages”), 2.5 (“IT projects deliver what they promised”) and 2.7 (“The board has a clear view on the major IT investments from a risk and return perspective”) had significant higher mean value than factor 2.3 (“IT projects do not often go over budget”). The ANOVA table and multi comparisons can be found in the appendices.

**Figure 3.** Degree of goal attainment – VD domain
Table 5. Factor ranking – VD domain

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean Value</th>
<th>Std. Deviation</th>
<th>Lower Bound (95%)</th>
<th>Upper Bound (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>4.03</td>
<td>1.527</td>
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<td>4.51</td>
</tr>
<tr>
<td>2.2</td>
<td>4.18</td>
<td>1.299</td>
<td>3.76</td>
<td>4.59</td>
</tr>
<tr>
<td>2.3</td>
<td>3.38</td>
<td>1.844</td>
<td>2.79</td>
<td>3.98</td>
</tr>
<tr>
<td>2.4</td>
<td>4.97</td>
<td>1.500</td>
<td>4.47</td>
<td>5.47</td>
</tr>
<tr>
<td>2.5</td>
<td>4.65</td>
<td>1.424</td>
<td>4.19</td>
<td>5.11</td>
</tr>
<tr>
<td>2.6</td>
<td>4.08</td>
<td>1.913</td>
<td>3.46</td>
<td>4.69</td>
</tr>
<tr>
<td>2.7</td>
<td>5.08</td>
<td>1.579</td>
<td>4.57</td>
<td>5.59</td>
</tr>
<tr>
<td>Mean</td>
<td>4.33</td>
<td>1.673</td>
<td>4.13</td>
<td>4.53</td>
</tr>
</tbody>
</table>

Figure 4 illustrates data for factors affecting the RM goal. Factor 3.7 (“The board is regularly briefed on IT risks to which the enterprise is exposed, including compliance risks”) had the highest median, mean values (Cf. Table 6) and lowest standard deviation and shortest box. This indicates that the consensus among the experts regarding this factor was the highest among all factors. Factor 3.5 (“How risks can be avoided is clarified”) had the lowest consensus among all respondents, and this indicates that the spread of the responses varied to a large extent. This can also be seen in the large standard deviation and the long box in the boxplot.

Board involvement is yet again considered to be important to many experts in achieving an ITG goal, in this case the RM goal.

The ANOVA analysis revealed that there exist significant differences in factor means for at least two factors at $p \leq 0.05$, and by conducting multi comparisons factor 3.7 was identified to have significant higher mean value than half of the other factors (factor 3.4-3.6) in the RM domain. The ANOVA table and multi comparisons can be found in the appendices.
Figure 4. Degree of goal attainment – RM domain

![Boxplot showing the degree of goal attainment for different factors in the RM domain.](image)

Table 6. Factor ranking – RM domain

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean Value</th>
<th>Std. Deviation</th>
<th>Lower Bound (95%)</th>
<th>Upper Bound (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>5.03</td>
<td>1.568</td>
<td>4.51</td>
<td>5.54</td>
</tr>
<tr>
<td>3.2</td>
<td>4.80</td>
<td>1.728</td>
<td>4.25</td>
<td>5.35</td>
</tr>
<tr>
<td>3.3</td>
<td>4.89</td>
<td>1.573</td>
<td>4.38</td>
<td>5.41</td>
</tr>
<tr>
<td>3.4</td>
<td>3.95</td>
<td>1.701</td>
<td>3.40</td>
<td>4.50</td>
</tr>
<tr>
<td>3.5</td>
<td>4.00</td>
<td>1.850</td>
<td>3.40</td>
<td>4.60</td>
</tr>
<tr>
<td>3.6</td>
<td>3.95</td>
<td>1.959</td>
<td>3.31</td>
<td>4.58</td>
</tr>
<tr>
<td>3.7</td>
<td>5.50</td>
<td>1.414</td>
<td>5.05</td>
<td>5.95</td>
</tr>
<tr>
<td>Mean</td>
<td>4.59</td>
<td>1.772</td>
<td>4.38</td>
<td>4.80</td>
</tr>
</tbody>
</table>

Figure 5 illustrates data for factors affecting the ITREM goal. Factor 1.1 (“Management and support of IT systems is carried out by staff with appropriate and adequate skill”) had the highest medians but a quite long box and large standard deviation (Cf. Table 7). Besides factor 4.1, factor 4.5 (“Skilled IT resources are attracted to the organization successfully”), 4.6 (“The board is aware of the latest developments in IT from a business perspective”) and 4.7 (“The board is assured of the fact that suitable IT resources, infrastructures and skills are available (including external resourcing) to meet the required enterprise strategic objectives”) also had long boxes indicating that the consensus among the experts regarding these factors is low.

Outliers were identified in factor 3.4 and 3.5. These were removed in order to satisfy the assumption of normality. The ANOVA analysis revealed that significant differences in factor means for at least two factors at $p \leq 0.05$ did not exist.
Therefore a multi comparison was not necessary. The ANOVA table can be found in the appendices.

**Figure 5.** Degree of goal attainment – ITREM domain

![Box plot](image-url)

**Table 7.** Factor ranking – ITREM domain

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>4.20</td>
<td>1.924</td>
<td>3.58</td>
<td>4.82</td>
</tr>
<tr>
<td>4.2</td>
<td>3.95</td>
<td>1.648</td>
<td>3.42</td>
<td>4.48</td>
</tr>
<tr>
<td>4.3</td>
<td>3.63</td>
<td>1.213</td>
<td>3.24</td>
<td>4.01</td>
</tr>
<tr>
<td>4.4</td>
<td>3.75</td>
<td>1.532</td>
<td>3.26</td>
<td>4.24</td>
</tr>
<tr>
<td>4.5</td>
<td>4.33</td>
<td>1.542</td>
<td>3.83</td>
<td>4.82</td>
</tr>
<tr>
<td>4.6</td>
<td>3.58</td>
<td>1.767</td>
<td>3.01</td>
<td>4.14</td>
</tr>
<tr>
<td>4.7</td>
<td>4.28</td>
<td>1.948</td>
<td>3.65</td>
<td>4.90</td>
</tr>
<tr>
<td>Mean</td>
<td>3.96</td>
<td>1.678</td>
<td>3.76</td>
<td>4.15</td>
</tr>
</tbody>
</table>

Figure 6 illustrates data for factors affecting the PM goal. Factor 5.1 ("The current performance of IT is measured"), factor 5.6 ("The board obtains regular progress reports on major IT projects") and factor 5.7 ("The board obtains IT performance reports illustrating the value of IT from a business driver perspective (customer service, cost, agility, quality, etc.") had the highest medians but responses varied from the lowest to the highest value on the lickert scale. Outliers were identified in factor 5.3. These were removed in order to satisfy the assumption of normality.
The ANOVA analysis revealed that significant differences in factor means for at least two factors at $p \leq 0.05$ did not exist. Therefore a multi comparison was not necessary. The ANOVA table can be found in the appendices.

Even if no differences of factor means were identified the mean values were relatively high, ranging from 4.25 to 4.78. This indicates that the experts believe these factors are all important but cannot distinguish between their impact on attaining the specific PM goal.

**Figure 6.** Degree of goal attainment – PM domain

![Box plot of factor rankings](image)

**Table 8.** Factor ranking – PM domain

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>4.78</td>
<td>1.804</td>
<td>4.20</td>
<td>5.35</td>
</tr>
<tr>
<td>5.2</td>
<td>4.25</td>
<td>1.373</td>
<td>3.81</td>
<td>4.69</td>
</tr>
<tr>
<td>5.3</td>
<td>4.38</td>
<td>1.564</td>
<td>3.87</td>
<td>4.88</td>
</tr>
<tr>
<td>5.4</td>
<td>4.18</td>
<td>1.678</td>
<td>3.64</td>
<td>4.71</td>
</tr>
<tr>
<td>5.5</td>
<td>4.31</td>
<td>1.341</td>
<td>3.87</td>
<td>4.74</td>
</tr>
<tr>
<td>5.6</td>
<td>4.95</td>
<td>1.568</td>
<td>4.45</td>
<td>5.45</td>
</tr>
<tr>
<td>5.7</td>
<td>4.70</td>
<td>1.870</td>
<td>4.10</td>
<td>5.30</td>
</tr>
<tr>
<td>Mean</td>
<td>4.51</td>
<td>1.618</td>
<td>4.31</td>
<td>4.70</td>
</tr>
</tbody>
</table>
6. Discussion

In this study we have measured opinions on factors affecting their underlying goals by surveying 40 ITG experts. The result have been presented and analysed in the previous section and in this section the findings will be discussed. The section ends with some discussion regarding the validity and reliability of the study.

6.1 Evaluated factors

All of the studied ITG factors can positively affect the fulfilment of ITG targets, even those factors that are considered to be less effective. However, all factors can individually be a complement to another factor and together deliver more effectively. For instance, in the ITREM domain, a combination of factor 4.1 ("Management and support of IT systems is carried out by staff with appropriate and adequate skill") and 4.5 ("Skilled IT resources are attracted to the organization successfully") can yield more effectiveness than individually.

Factor 1.4 ("The making of major IT-decisions is time-efficient") resulted to be the least important factor to attain the goal of strategically align the business with IT. A reason for this can be that the aspect of being time-efficient is only a “hygienic factor” instead of being an effective factor to attain the SA target.

The majority of all survey respondents seemed to believe that factors concerning involvement of board-level executives attain targets more effectively. This is evident regardless of the domain factors belong to. This result is quite reasonable as ultimately it is the board that is responsible for the long term consequences for various stakeholders from the investment choices taken. The board is responsible for IT expenses and how IT investments should be managed to attain targets and support the achievement of strategic objectives. The board further controls the organisation and understands and knows what decisions concerning any ITG factor that are needed to be considered to achieve higher value, and also are those who are responsible for the overall IT management and operations.

The same line of reasoning is used by Kurtén (2009), Prasad, Heales and Green (2010), and Syaful and Green (2009). Kurtén (2009) argue that the core of the board’s responsibility is to make decisions on how to secure and build up the business value for stakeholders. This implies that the board needs to formulate the business long-term strategies for managing risks, deliver value, monitor the usage of IT resources, and measure the IT performance. Syaful and Green (2009) found correlations between involvement of senior management in IT and ITG effectiveness, and Prasad, Heales and Green (2010) identified that executive management driven IT governance initiatives exhibit higher levels of IT-related capabilities in their empirical analyses.

The results revealed an overlap in the confidence intervals; this indicates that the consensus among the experts regarding the impact of some factors on target attainment is low. Three explanations for the overlaps are possible:

(i) The respondents themselves have tried to prioritize the factors, but failed.
(ii) One single factor cannot be strong by itself
(iii) The answers are due to the structure and formulation of the survey.
Explanation (iii) is certainly the case to some extent. For example, the survey could have been programmed to force rankings from the respondents, rather than merely asking to what extent they agree with a certain statement. Nevertheless, explanations (i) are probably also present, indicating a lack of ability to prioritize among the proposed factors.

Explanation three is most probably present. A single factor cannot be strong to affect the attainment of a goal to a significantly larger extent. However as explained in the beginning of this section a combination of factors per domain can together be more effective in attaining targets, and thus more important.

In the ITREM and PM domain no significant differences of mean values were identified. One explanation can be that factors included in these domains in general are not regarded as strategic domains. In many ways, these factors are daily operational issues and considered as hygiene factors rather than factors to attain strategic goals, which the question explicitly asked. However, these goals are still important to attain. The PM goal, for instance, is needed to aid the fulfilment of overall strategic goals by monitoring actions to evaluate if the strategic goals have been realised. Further, a strategy cannot be realised if the resources in the organisation lack the skills needed relevant for their job function.

6.2 Discussions of validity reliability

*Content validity* is the degree to which items in an instrument reflect the content universe to which the instrument will be generalized (Boudreau, Gefen and Straub, 2001). E.g., if this study aimed to draw conclusions on factor effectiveness using only results from 2 factors in SA domain and 3 in the VD domain the content validity would be low. Furthermore, all survey questions are taken from (ISACA, 2003) without any manipulation. Finally, the survey was studied by two academic experts in the area who assessed the tool’s content validity as high (Boudreau, Gefen and Straub, 2001) (Reis and Judd, 2000)

*Construct validity* is the extent to which an operationalization measures the concepts that it purports to measure (Boudreau, Gefen and Straub, 2001). This implies whether the survey measures ITG factors in relation to attaining ITG targets. Firstly, neither the theoretical descriptions in (ISACA, 2003) nor prioritizations of its elements are abstract in such a manner that could cause significant problems with the construct validity. Secondly, the tool was tested (and discussed) by two academic experts and four respondents which were thought to be representative of the specified population. These pilot studies both hinted toward high construct validity.

Another important validation concept is *external validity*; the degree to which the results of a study can be generalized (Reis and Judd, 2000). The survey data was collected from a representative sample, and to achieve a high validity of the results, respondents with expert knowledge of the subject were selected to be surveyed.

A potential problem with the validity and reliability of the study is however that the factors are evaluated individually when there in fact could be correlation between
factors which provide the true significant impact on target attainment. Further, increased value of a factor state variable affects the states of other variables. Thus, increased target attainment is no doubt the result of the combination of many factor states and not just one, as is modelled in this study.

7. Conclusions

Research in the field of IT governance has traditionally investigated different ITG mechanisms functioning as enablers or inhibitors for IT success. However, for achieving IT success the fundamental goals of IT governance are needed to be fulfilled. The research presented in this article has therefore empirically examined IT governance factors in relation to attaining fundamental ITG targets by surveying 40 strategically chosen IT governance experts.

Clearly, the result of the survey data indicates that experts argue for the importance of having IT on the agenda of the board to achieve fundamental goals with IT governance. As previous research has demonstrated, using other constructs, board involvement impacts IT success. If IT is not on the board agenda, IT will not be prioritized and undermines the alignment to the business for achieving strategic business goals.

A natural continuation of the present line of research is to validate the results with case studies of actual ITG implementations. Since each of the studied factors can individually complement another factor and together deliver more strongly, the future study can be designed to enable use of other statistical methods such as multi regression analysis. Future research can aim at identify which factor combinations that explains variances in factor effectiveness, i.e. degree of attainment in relation to ITG targets. This quantitative data can then further be used to identify the single strongest predictor of effective IT governance in an organization.
References

Appendix

Table 9. ANOVA table for factors affecting the SA goal

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
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<td>181,414</td>
<td>6</td>
<td>30,236</td>
<td>13,342</td>
</tr>
<tr>
<td>Within Groups</td>
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<td>266</td>
<td>2,266</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>784,242</td>
<td>272</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10. Multi comparisons for factors affecting the SA goal

<table>
<thead>
<tr>
<th>(I) Factor</th>
<th>(J) Factor</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lower Bound</td>
<td>Upper Bound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>1.2</td>
<td>,600</td>
<td>,337</td>
<td>,561</td>
<td>,40</td>
</tr>
<tr>
<td>1.3</td>
<td>,625</td>
<td>,337</td>
<td>,511</td>
<td>,38</td>
<td>1,63</td>
</tr>
<tr>
<td>1.4</td>
<td>1,798*</td>
<td>,343</td>
<td>,000</td>
<td>,78</td>
<td>2,82</td>
</tr>
<tr>
<td>1.5</td>
<td>,728</td>
<td>,341</td>
<td>,336</td>
<td>,174</td>
<td>,29</td>
</tr>
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<td>,48</td>
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<td>,780</td>
<td>,50</td>
<td>,52</td>
</tr>
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### Table 11. ANOVA table for factors affecting the VD goal

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### Table 12. Multi comparisons for factors affecting the VD goal

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<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
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Table 13. ANOVA table for factors affecting the RM goal

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Table 14. Multi comparisons for factors affecting the RM goal

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<td>.356</td>
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<td>.239</td>
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<tr>
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<td>.383</td>
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<td>-1.09, 1.19</td>
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<td>.002</td>
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<td>.383</td>
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<tr>
<td>3.6</td>
<td>3.7</td>
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<td>.381</td>
<td>.001</td>
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<td>.42, 2.68</td>
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<tr>
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<td>1.500</td>
<td>.381</td>
<td>.002</td>
<td>.37, 2.63</td>
</tr>
<tr>
<td>3.7</td>
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<td>1.551</td>
<td>.381</td>
<td>.001</td>
<td>.42, 2.68</td>
</tr>
</tbody>
</table>
Table 15. ANOVA table for factors affecting the ITREM goal

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>23,786</td>
<td>6</td>
<td>3,964</td>
<td>1,421</td>
<td>.207</td>
</tr>
<tr>
<td>Within Groups</td>
<td>761,700</td>
<td>273</td>
<td>2,790</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>785,486</td>
<td>279</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 16. ANOVA table for factors affecting the PM goal

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>21,509</td>
<td>6</td>
<td>3,585</td>
<td>1,381</td>
<td>.222</td>
</tr>
<tr>
<td>Within Groups</td>
<td>706,233</td>
<td>272</td>
<td>2,596</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>727,742</td>
<td>278</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The effects of ERP-implementations on organizational benefits in small and medium-sized enterprises in the Netherlands

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Abstract

In this paper we try to assess the impact of ERP-implementations on the development of organizational benefits, as described by Shang and Seddon (2002) and Eckartz et al. (2009). We assess this impact for Dutch small and medium-sized enterprises, using a small but unique dataset. Several types of organizational benefits (concerning, among others, employee morale and the creation of a common vision among employees) are compared before and after the introduction of an ERP-system in a variety of organizations, taking into account a three-year period, and correcting/controlling for several possibly influential factors in the process (like organizational size, financial health and sectoral differences).

We conclude that by and large, organizational benefits did not increase significantly more for organizations that implemented an ERP-system in the last three years than for organizations that did not implement such a system. We can also conclude that organizations that recently implemented an ERP-system did not have significantly lower organizational benefits three years ago than organizations that did not implement such a system. Albeit limited to Dutch SMEs, these results contradict some of the views expressed in the ERP-related literature on the subject.

\textbf{Key words:} ERP systems, organizational performance, organizational benefits, SME, surveys
1. Introduction

“In essence, ERP deployment in itself saves nothing and does not improve anything, it’s the people and processes that create benefits” (Kumar et al., 2002, p. 170)

Ever since their introduction in the 1990s, Enterprise Resource Planning (ERP) systems have been widely used by organizations wishing to work with integrated information systems in the hopes to increase their market agility (Grabski and Leech, 2007; Keller, 1999). Many researchers have tried to assess the impact of the introduction of ERP systems on organizational conduct, often focusing on a system’s performance effects. Examples include Hunton et al. (2003), Kallunki et al. (2011), Liu et al. (2008), Poston and Grabski (2001), Nicolaou (2004) and Nicolaou and Bhattacharya (2006). One of the main questions in this type of research seems to be whether the (chiefly) financial performance of organizations adopting an ERP-system has deteriorated or improved during the post-implementation period.

In this study we define an ERP-system as a business support system that maintains the data needed for various business functions such as manufacturing, financials and supply chain management in a single database, so that transactions only need to be processed once (Kumar and van Hillegersberg, 2000).

The implementation of an ERP-system in an organization is often accompanied by substantial changes in organizational structure and ways of working (Bernroider, 2008; Grabski and Leech, 2007; Kallunki et al., 2011). Such implementations seem to be set apart by their complexity, and more specifically, by the difficulties involved in implementing large-scale changes in an organization together with a transition to new systems, whilst legacy systems may be in place (Kumar et al., 2002; Jones et al., 2006). Eckartz et al. (2009) even state that ERP-systems have a “(...) decisive impact on almost all aspects of an organization” (p. 2). Partly, the impact of these effects seems to be influenced by whether or not an ERP-system is tailored to fit an organization before it is actually implemented (Hong and Kim, 2002; Kumar et al., 2002).

In general, organizations (and consultancy firms alike) seem to think that the introduction of ERP-systems allows for more efficiency in organizational work, and therefore, for better (financial) performance vis-à-vis non-adopting organizations, because of the fact that best practices are embraced (Bernroider, 2008; Davenport, 1998; Sneller, 2010). It is also expected that in conjunction to this, ERP-implementations invoke more reliable information recording and exchanges in an organization (Shang and Seddon, 2002). However, is the situation always that simple?

Markus and Tanis (2000) developed a framework to describe the ‘typical’ phases involved in the adoption and implementation of ERP-systems. After a chartering phase, comprising the decisions leading to the approval of the implementation of a specific system, the communication in the organization about this, and the system’s funding, a project phase is entered, in which a system is set up and executed in one or more organizational (business) units, ultimately resulting in its rollout and start-up across the
organization (‘going live’). Thereafter, a shakedown phase is usually witnessed, which takes up the period of time between the aforementioned ‘go live’ date up until ‘normal operations’ have been achieved. In that case, user acceptance has occurred, bugs have been fixed, system training has been accommodated, and a system has been ‘finetuned’ to fit an organization. Finally, Markus and Tanis discern an onward and upward phase. This phase generally occurs between 1-3 years after a system’s ‘go live’ date, and entails the period from ‘normal operations’ until a system is replaced completely by another system or is upgraded. Alas, all of these phases are fraught with problems that can affect an organization’s productivity and profitability. For instance, Kumar et al. (2002) found that in many Canadian governmental organizations, project schedules tended to be revised as organizations underestimated the amount of work involved in implementing an ERP-system, inadequate training in the new system occurred, and difficulties in assuring the quality of the data entered in the system were paramount. Other studies have reported similar problems: implementation costs may rise exponentially, employees may refuse to work with the new system, and data integration processes between new and old (legacy) systems may be more troublesome than expected (Botta-Genoulaz and Millet, 2005; Hunton et al., 2003; Ross and Vitale, 2000; Nicolaou, 2004; Scott, 1999; Sneller, 2010). It may therefore not come as a surprise that more than 70% of ERP-introductions do not reach their intended effects, and may even be regarded as complete failures (Al-Mashari et al., 2006; Buckhout et al., 1999; Hong and Kim, 2002; Stefanou, 2001).

All of this suggests that ERP-implementations do not end when a system ‘goes live’, but can yield substantial performance gains and losses as a result of (discrete) changes that happen after the ‘go live’ date (Nicolaou and Bhattacharya, 2006). This paper wants to tap into some of these changes and effects. We look at organizations that have implemented an ERP-system between one to three years ago, and compare their self-assessed organizational benefits with a set of comparable organizations that did not implement such systems in the same period. The period of three years has been chosen for Nicolaou and Bhattacharya (ibid.) concluded that organizations adopting an ERP-system needed at least two years to generate positive financial performance. The authors term this the “(…) lag-led re-emergence of performance gains (…)” (ibid., p. 20) (also see Wah, 2000). Contrary to their research, however, we decide to look at non-financial performance (Shang and Seddon, 2002), this being an area where so far, little research seems to have been done (Eckartz et al., 2009). On top of this, we follow up on Esteves and Bohorquez’s (2007) call for more research on the benefits of ERP-implementations in small and medium-sized enterprises, this being the market where ERP-systems are nowadays implemented most often (Adam and O’Doherty, 2003). Our data stem from a unique dataset that we collected ourselves of nearly 100 Dutch organizations, many of them small and medium-sized enterprises, whose head(s) of finance or production were asked to fill in a lengthy questionnaire on the situation of their organization across a three year period. As ERP-systems as such have been said to have their roots in Europe (Pairat and Junghirapanich, 2005), and, apparently, few studies have been conducted in the Netherlands (Bernroider and Tang, 2003), the focus on this country is interesting as well.
This paper will proceed as follows. We start by setting out the types of benefits that may be expected from an ERP-system, working our way towards the organizational benefits we would like to focus on and the hypotheses we would like to test. Thereafter, our research approach and method will be discussed in detail and related to previous literature. The main results will be presented and discussed. Finally, a concluding section will put forward the conclusions that we think can be distilled from this research. We will also describe some of its drawbacks, and point out what we see as viable avenues for further research.

2. ERP benefits

Eckartz et al. (2009) present the results of an extensive literature review on ERP benefits. They aim to determine all potential benefits that may be achieved during and after an implementation, both tangible and intangible. Their intention is to come up with an integrative framework containing all of these benefits, focusing in particular on cross-organizational ERP-implementations, or ERP II-systems (Bond et al., 2000). A major problem they see in the literature is that studies sketching possible benefits often do not discuss how they may be realized, and vice versa. Their literature search, which is conducted according to guidelines set out by Webster and Watson (2002), and also includes concept mapping (Trochim, 1989), not only covers the ERP-related literature, but also literature stemming from logistics and organization theory on inter-company associations. They end up with 30 articles that help to create their integrative framework of ERP (II) benefits. They call the latter the ‘3-dimensional benefit framework’. It is largely based on the classification of ERP benefits of Shang and Seddon (2002), which the authors find the most comprehensive classification to date (at least, in 2009). The three dimensions Eckartz et al. (2009) distinguish are:

- Operational, managerial and strategic benefits (Anthony, 1965; Shang and Seddon, 2002);
- Process, customer, financial and innovation benefits, following the four perspectives of the balanced scorecard (Kaplan and Norton, 1993). Also included is a fifth perspective to assess employee resistance or willingness to change (Eckartz et al., 2009);
- Benefits falling into IT infrastructure and organizational categories (Shang and Seddon, 2002). These are often intangible and hard to identify (such as organizational learning and improvement in communications), and are, consequently, not researched very much (Eckartz et al., 2009).

Eckartz et al. explicate ask researchers to validate their framework in a variety of ways, among others by determining how the various dimensions and categories of ERP benefits impact on one another. Our own goal with their framework is, however, more modest. We wish to zoom in on organizational benefits in particular, and try to validate that aspect of their framework, as these benefits apparently have not been researched as often as more tangible ERP benefits like financial performance outcomes (Eckartz et al., ibid.; Hunton et al., 2003; Nicolaou and Bhattacharya, 2006).
Shang and Seddon (2002) argue that the organizational benefits of ERP-implementations evolve around the following six issues, which are all taken along in our analysis (see appendix 1 of their paper):

- Changing work patterns with shifted focus: the harmonization of interdepartmental processes and interdisciplinary matters
- Facilitating business learning and broadening of employee skills: greater possibilities to enhance employee learning
- Employee empowerment: more pro-active, perhaps even entrepreneurial, employee behavior and involvement in business management
- Building common visions: departments work as a unit, and not as separate entities, sustaining a shared image on organizational work across different levels of the organization
- Shifting work focus: concentration on core work
- Increased employee morale and satisfaction: increased work efficiency and (more) content users, who are provided with better quality service.

The authors also present a more extensive framework to assess the benefits that may be reaped in the years after the introduction of enterprise systems (ES) in an organization, with special attention to ERP-systems. They call this framework the ‘enterprise systems benefit framework’. It intends to help managers to make sound evaluations of the perceived success of an ERP-system some years after its ‘go live’ date (no specific time period is given though). After having answered seven questions on how to frame organizational effectiveness measurement in their particular setting (Cameron and Whetten, 1983), they apply a self-developed four-step procedure to conduct a literature and Internet search. They come up with five categories and 25 sub-dimensions of ERP benefits, organizational benefits being one of the five main categories. Organizational benefits “(...) arise when the use of an ES benefits an organization in terms of focus, cohesion, learning and execution of its chosen strategies” (Shang and Seddon, 2002, p. 279). Other categories include managerial and strategic benefits (just like the Eckartz et al. [2009] framework), while the various sub-dimensions pertain to issues like IT cost reduction, cycle time reduction, and the worldwide expansion of business activities. As stated, these categories and sub-dimensions partly overlap with the Eckartz et al. (2009) framework, which uses the Shang and Seddon (2002) framework as one of its cornerstones. The organizational benefits overlap completely.

There are many articles trying to assess the performance effects of ERP-system introductions in an organization (Hunton et al., 2003, Kallunki et al., 2011; Liu et al., 2008; Nicolaou, 2004; Nicolaou and Bhattacharya, 2006; Poston and Grabski, 2001). Although the focus of these papers is chiefly on financial performance effects (the Kallunki et al. [2011] paper being one of the few exceptions), the way most of these authors conceptualize their research is also followed here, even though we focus on specific non-financial benefits: the six dimensions of organizational benefits, as set out by Shang and Seddon (2002).
Nicolaou and Bhattacharya (2006) report on their analysis of the long-term financial performance effects of ERP-system revisions for ERP-adopters. They find that changes in ERP-systems often offset implementation issues that at first, negatively affect the financial performance of an organization. The sooner adaptations are made, the better organizational performance may become later. However, adapting a system too late may result in a deterioration of financial performance. Following Nicolaou (2004), they also find that taking into account an (at least) two year time lag may be useful to assess the performance impact of ERP-systems, as this lag seems to be necessary for positive differential financial performance in adopting vis-à-vis non-adopting organizations to start materializing.

Poston and Grabski (2001) examine the post-implementation financial performance of a small group of ERP-adopting firms over a period of three years after the system’s adoption, whilst controlling for pre-implementation performance. They note that organizations that have implemented an ERP-system seem to show efficiency gains in some areas, but increased costs elsewhere mostly counterbalance such gains. Perhaps consequently, they find no significant improvement in several financial measures of these organizations across a three year period.

The financial performance effects of ERP-implementations in Chinese chemical firms were assessed by Liu et al. (2008). They find no significant performance improvement during the implementation period and during the first three years after implementation. At first, a decline in performance is witnessed, which is in line with the Markus and Tanis (2000) framework and previous studies by Nicolaou and Bhattacharya (2006) among others. However, a slight performance improvement in the third year after implementation occurs, which may indicate that the financial benefits of ERP-implementations may only manifest themselves after more extensive ERP-use. This corroborates similar findings by Hunton et al. (2003) and Nicolaou and Bhattacharya (2006), and will be a valuable precondition for our own research as well (see below).

The impact of ERP-system adoption on the financial performance of over 60 organizations that were matched, on the basis of their 2-digit SIC-code as well as their size, with organizations that had not adopted such a system, was the focus of a study conducted by Hunton et al. (2003). Although the financial performance of ERP-adopting organizations was generally better over a three year period than for non-adopters, no improvement in the financial performance of adopting organizations could be witnessed before and after the implementation of a system. Nevertheless, the financial performance of non-adopters decreased over time.

Kallunki et al. (2011) explore the effects of ERP-implementations on both the financial and non-financial performance of 70 Finnish business-units. They try to assess the joint roles that ERP-systems and management control systems can play in potential performance improvements. Again, it is concluded that ERP-systems can improve both financial and non-financial performance (of, in this case, business-units), chiefly in the long run, and that using specific forms of management control may help to achieve this.
Esteves and Bohorquez (2007) have stressed the importance of more research on the benefits of ERP-implementations in small and medium-sized enterprises. This call is followed up on here. We will compare differences in organizational benefits as defined by Shang and Seddon (2002) in their enterprise system benefit framework, which are also contained in the 3-dimensional benefit framework prepared by Eckartz et al. (2009), before and after the implementation of an ERP-system in small and medium-sized enterprises in the Netherlands. Bernroider and Tang (2003), albeit indirectly, seem to suggest that although many studies have been conducted on ERP-system implementation effects in Europe, few studies have been conducted in the Netherlands. As ERP-systems as such have been said to have their roots in Europe (Pairat and Jungthirapanich, 2005), the lack of focus on this country is striking, and will be ‘redeemed’ here.

A period (lag time) of three years will be taken into account to assess the changes in organizational benefits, following the Hunton et al. (2003) and Liu et al. (2008) studies. We will control/correct our results for possible sectoral effects and effects related to organizational size. Like in Hunton et al. (2003), sectoral effects are taken into account by looking at an organization’s 2-digit SIC-code (see also Barber and Lyon, 1996), so as to create matched pairs of organizations whose organizational benefits can be compared. Size is expressed in this study as the natural logarithm of the sales of an organization, which is one of the ways in which Hunton et al. (2003) operationalized this item. In addition, we control/correct our results for the financial health of an organization through a self-assessment exercise (Berchet and Habchi, 2005, Hunton et al., 2003)¹, and for perceived environmental uncertainty (PEU), so as to include a measure for the turbulence in the surroundings of an organization (Vluggen, 2006). Finally, we take into account the ‘go live’ date of a system, as ERP benefits may only be reaped after a certain period of time when the aforementioned date has passed (Nicolaou and Bhattacharya, 2006; Wah, 2000). Regression analysis is used to accommodate the aforementioned corrections, after which several Wilcoxon paired-sample tests are carried out to assess the impact of ERP-implementations on the development of organizational benefits. More details on the actual methods used will be provided in the next section.

As this is one of the first studies examining the performance effects of ERP-implementations in terms of (the organizational benefits contained in) the Eckartz et al. (2009) and Shang and Seddon (2002) frameworks, we assert that it is mainly exploratory in nature (Smith, 2003). Nevertheless, in line with previous research on the financial performance of ERP-adopting organizations, we believe that the following two hypotheses may be put forward that are interesting to test in the current setting:

**H1:** Organizational benefits are significantly larger for organizations that have implemented an ERP-system in the last three years than for organizations that do not have such a system (for reference, see our description of the Hunton et al. [2003], Kallunki et al. [2011] and Liu et al. [2008] studies).

¹ Refer to the following section for more details about this self-assessment.
H2: Organizations that implemented an ERP-system in the last three years had significantly better organizational benefits three years ago than organizations that did not implement such a system (for reference, see our description of the Hunton et al. [2003] study).

We will now continue with our research approach. Our analysis protocol will be described subsequently, together with our research findings.

3. Research approach and results
There is little information available on ERP-implementations in SMEs (Esteves and Bohorquez, 2007), let alone that there are specific databases about this subject that can easily be accessed in the Netherlands (Bernroider and Tang, 2003).

The data used in this analysis have, therefore, been obtained via a self-developed survey that was almost entirely based on validated concepts taken from the ERP- (and related) literature (Bradley, 2008; Eckartz et al., 2009, Grabski and Leech, 2007; Hong and Kim, 2002; Shang and Seddon, 2002; Soja and Poliwoda-Pękisz, 2009; Vluggen, 2006). Through the survey, we wanted to assess the performance and circumstances in which a variety of Dutch organizations (many of them SMEs) operated in the period 2007-2009. Two surveys were developed: one for organizations that had implemented an ERP-system somewhere in the last three years (and had no such system before), and a highly similar survey for organizations that did not have an ERP-system - the main difference being that the latter survey came without the questions on ERP.

As part of the preparation for their master of science thesis, part-time master of science students in accountancy from Nyenrode Business University were asked to select and approach top-level managers who were knowledgeable about an organization’s primary processes (CFOs, CIOs, etc.) in four organizations: two organizations with and two organizations without an ERP-system. Preferably, these organizations had to come from the same sector (expressed in 2-digit SIC-codes) and from within their own network, in order to permit relatively easy data access and analysis. The data were collected in November and December 2010. Exactly 100 surveys were completed. The data were returned both on paper and in a pre-prepared Excel-sheet. As names and contact persons of the organizations that had been approached had to be handed in as well, this enabled us to check, in individual cases, whether the organizations in question had indeed been approached, and an appropriate interviewee had been selected. Also, several checks were carried out to safeguard that the data had been entered correctly in Excel (for instance, by checking several surveys in their entirety or by checking specific variables across surveys)². Examples of survey questions can be found in Appendix 1.

First, the SMEs in the dataset were set apart. The mean number of employees (expressed in FTEs) and mean annual turnover for the 2007-2009 period were

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² Both surveys can be obtained from the corresponding author on request.
calculated, so as to accommodate the definition of SMEs according to EC guideline 2003/361/EC\(^3\). Organizations that had, on average, between 10 and 249 employees, and a yearly turnover larger than 2 billion Euros, but less than or equal to 50 billion Euros, were labeled ‘SMEs’ in this study. As a consequence, the number of observations that could be used in the analysis decreased from 100 to 41.

At the time that the surveys were prepared, we had no access to previous operationalizations of the six dimensions of organizational benefits mentioned by Shang and Seddon (2002). Consequently, we had to operationalize them ourselves, and decided to use ten aspects that we believed captured what Shang and Seddon (2002) wanted to indicate by these dimensions. To assess the validity of our operationalization, Cronbach alpha analyses were carried out before further analysis was started (Nunnally, 1978). As can be inferred from Appendix 1, respondents were asked to indicate how they judged the performance of their organization on (among others) the abovementioned ten aspects, both currently and three years ago. A Likert 1-7 scale was employed to assess this (Grabski and LEECH, 2007). A low score indicated that they thought their organization performed poorly on a particular aspect, whereas a high score indicated very good performance.

Below it is shown how the six dimensions of organizational benefits distilled by Shang and Seddon (2002) can be linked with the ten aspects contained in our questionnaire (which are depicted in italics):

- Changing work patterns with shifted focus: the harmonization of interdepartmental processes and interdisciplinary matters\(^4\)
  - *Internal communication*
  - *Standardization of work processes*
  - *Quality of internal reports*

- Facilitating business learning and broadening of employee skills: greater possibilities to enhance employee learning
  - The size of budgets available for internal and external courses

- Employee empowerment: more pro-active, perhaps even entrepreneurial, employee behavior and involvement in business management
  - The degree to which work activities and decision power has been relegated to other employees than managers
  - Flexibility of work processes

- Building common visions: departments work as a unit, and not as separate entities, sustaining a shared image on organizational work across different levels of the organization


\(^4\) It may be argued that internal communication and the quality of internal reports, which have now been placed under the ‘changing work patterns with shifting focus’ header, could also have been placed under ‘increased employee morale and satisfaction’, given the latter’s definition. However, since we are studying organizational benefits *in toto*, the exact dissection of these benefits in subcategories is not important to us.
Building a common, organization-wide vision

- Shifting work focus: concentration on core work
  
  Focus on core tasks

- Increased employee morale and satisfaction: increased work efficiency and (more) content users, who are provided with better quality service.
  
  Employee satisfaction

  Mutual behavior of employees

As it turned out, all ten aspects could be grouped under the same header – in this particular case, ‘organizational benefits’. The Cronbach alpha values were over 0.70, both in case the current data and the data stemming from three years ago were used (Nunnally, 1978). For the current data, the Cronbach alpha value was 0.77, for the data stemming from three years ago it was 0.84. This validated our conception of organizational benefits, in both situations.

The main part of the analysis then proceeded as follows. To accommodate both H1 and H2, we first ran the following regression for every organization that had implemented an ERP-system in the last three years:

\[
\log \text{MSALES} = \beta_0 + \beta_1 \text{FINHEALTH}_t + \beta_2 \text{PEU}_t + \beta_3 \text{GOLIVE} + \epsilon_t
\]

where:

\[
\text{LOGMSALES} = \text{the natural logarithm of the mean of organizational sales for the 2007-2009 period (our size measure)}
\]
\[
\text{FINHEALTH} = \text{financial health of an organization}
\]
\[
\text{PEU} = \text{perceived environmental uncertainty}
\]
\[
\text{GOLIVE} = \text{dummy indicating whether the ‘go live’ date of a system occurred in 2007 (‘0’), 2008 (‘1’), or 2009 (‘2’)}^5.
\]

We ran a regression, for contrary to previous studies like Hunton et al. (2003), we believe that organizational size is dependent on a number of factors, the influence of which has to be purged before matching can occur. We chose to correct our measure of organizational size for effects occurring both in- and outside organizations. The reason for including the ‘go live’ date of a system has already been set out in the previous section: it generally takes time before the fruits of an ERP-implementation can be reaped (Markus and Tanis, 2000; Nicolaou and Bhattacharya, 2006).

The PEU variable has been incorporated to accommodate effects occurring in the environment of an organization. It has been taken from Vluggen (2006). He uses six items, on a Likert scale ranging from 1-6 (where ‘1’ indicates ‘high stability’ and ‘6’ ‘high instability’), to assess the turbulence of the surroundings an organization operates in. The six items cover issues like the predictability of consumer tastes, the rate of change

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5 One organization had a ‘go live’ date that occurred in 2010. Since the size variable had been calculated as a mean for the 2007-2009 period, we removed this observation from the dataset, so that we ended up with 40 observations instead of the previously mentioned 41 to be used.
in the portfolio of products and services offered, the rate of change in production technologies, etc. Also here, a Cronbach alpha analysis was carried out to see whether the six items could be grouped under the 'PEU' header. Alas, the Cronbach alpha value was only 0.58, but could be increased to 0.65 by deleting an item on the speed with which an organization generally responded to market changes. Although below the commonly used 0.70 threshold, the value of 0.65 is still deemed acceptable in exploratory studies like this (Nunnally, 1978). Thus, the scores for the five remaining items Vluggen (2006) distinguishes were added to come up with the value of the PEU-variable used in the regression analyses.

The financial health variable, taken from a single question on the survey measured on a Likert scale ranging from 1-6 (where ‘1’ indicates ‘completely disagree’ and ‘6’ ‘completely agree’), tried to put the respondent’s view on whether he or she thinks their organization is in a healthy financial state. This can affect the benefits ultimately obtained from an ERP-system, as has previously been indicated by Berchet and Habchi (2005) and Hunton et al. (2003) among others. On top of this, we feel that the recent financial crisis, which occurred in the period of study, exacerbated the relevance to include this variable in our analysis.

The standardized residuals of the abovementioned regression were used to facilitate the matching of organizations whose organizational benefits are to be compared to one another. A similar regression was run for organizations without an ERP-system, albeit without the ‘go live’ variable.

By and large, the regression results were not impressive. The regression for ERP-related organizations had an $R^2$ of 0.074 (with 21 observations), with no statistically significant variables at either the 5% or 10% significance level except for the constant term (although both LOGMSALES and the standardized residuals of the regression were normally distributed according to a Kolmogorov-Smirnov test at both of the aforementioned levels of significance, with $p$-values equal to 0.877 and 0.851 respectively) (Hair et al., 2010). Roughly the same conclusion held for the regression within the group of non-ERP adopting organizations (with 19 observations), which yielded an $R^2$ of 0.043 and similarly statistically insignificant and normally distributed variables ($p$-values of the Kolmogorov-Smirnov test for the LOGMSALES variable and the standardized residuals were now 0.612 and 0.789 respectively).

Thereafter, we tried to match organizations based on their 2-digit SIC-code (Barber and Lyon, 1996; Hunton et al., 2003) and the standardized residuals from the two regressions. In Table 1 it can be seen in which sectors the sample organizations with and without an ERP-system primarily operated.

---

6 In both regressions, the residuals were homoscedastic according to the (visual inspection) procedures described by Hair et al. (2010).
7 As the regression results were largely unimpressive, one may wonder what would have happened if we had used the LOGMSALES variable besides the 2-digit SIC-codes in our matching procedure, instead of standardized residuals. As it turns out, two different matches would have been made, but the overall results would have remained the same.
Table 1: Sample overview by sector and ERP- and non-ERP adopting organizations (as indicated by the number of standardized regression residuals). Stars (‘*’*) signify the maximum of number of matches possible per sector using 2-digit SIC-codes. Crosses (‘+’) indicate further matches possible for 1-digit SIC-codes. Also see the text below.

<table>
<thead>
<tr>
<th>SIC-code</th>
<th>Number of ERP-adopting organizations</th>
<th>Number of non-ERP adopting organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>25*</td>
<td>1*</td>
<td>1</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>28</td>
<td>5</td>
<td>2*</td>
</tr>
<tr>
<td>29*</td>
<td>1*</td>
<td>1</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>45*</td>
<td>1*</td>
<td>4</td>
</tr>
<tr>
<td>50</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>52</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>60</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>65*</td>
<td>2</td>
<td>1*</td>
</tr>
<tr>
<td>70*</td>
<td>0</td>
<td>3*</td>
</tr>
<tr>
<td>71</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>72*</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>74*</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>85</td>
<td>1*</td>
<td>1</td>
</tr>
<tr>
<td>93</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>19</td>
</tr>
</tbody>
</table>

From Table 1, it is immediately clear that we could not match all organizations for the presence of a sometimes dissimilar number of observations (standardized residuals) per sector. For instance, there were five organizations in the dataset with SIC-code 28 (producers of metal products) among the organizations with an ERP-system, but only two among the non-adopting organizations. Therefore, at best, two organizations could be matched for this particular sector. On top of this, there were several sectors that had at least one ERP-adopting firm, but none non-adopting firm, and vice versa (for example the sectors with SIC-code 35 and 52). In the end, we could match only 7 of the 20 organizations, in a total of 6 sectors (spread among SIC-code 25 to 85). These are indicated by a star (‘*’) in Table 1.

This number we deemed too low to conduct any further statistical analysis. However, when we look at the 1-digit SIC-codes in Table 1, we see that three other organizations may be matched within SIC-code 7, as there are 6 observations in SIC-codes 71, 72 and 74 of ERP-adopting firms, and 3 observations, all in SIC-code 70, among non-adopting firms. This we indicated by a cross (‘+’) in Table 1. We decided to add these matches to our sample, yielding a total of 10 matched pairs of organizations.

As a consequence of the relatively low number of observations left after the matching had been done, we decided to apply a Wilcoxon paired-sample test, this being a non-parametric counterpart of the perhaps more commonly used independent sample t-test.
(Hair et al., 2010). This happens to be the same test that has been used in similar studies on the subject (see, for instance, Hunton et al., 2003), and it can accommodate samples sizes less than ten and still yield sufficient statistical power (Noether, 1987).

Two Wilcoxon paired-sample tests were carried out, for H1 and H2. In both cases, we could not reject the null hypotheses that differences in organizational benefits were present between our pairs of ERP and non-ERP adopting firms (p-values were 0.61 and 0.65 respectively). Thus, organizational benefits were not significantly larger for organizations that implemented an ERP-system in the last three years than for organizations that did not have such a system. On top of this, organizations that implemented an ERP-system in the last three years did not have significantly better organizational benefits three years ago than organizations that did not implement such a system. We believe that the relatively small number of observations in our final sample cannot be ‘blamed’ for this outcome, as the Wilcoxon tests had sufficient power (Noether, ibid.).

Given the abovementioned results, one might wonder whether the ERP and non-ERP firms have undergone statistically significant increases or decreases in organizational benefits in the last three years themselves. This was checked by two other Wilcoxon paired-sample tests, using the entire sample of 21 ERP-adopting and 19 non-ERP adopting firms. In both cases, we could reject the null hypothesis that no changes in organizational benefits occurred in the 2007-2009 period (p-values were 0.01 and 0.02 respectively). Thus, both adopting and non-adopting firms had seen significant changes in organizational benefits in three years’ time, the changes being positive in both cases (average organizational benefits increased from 44 to 50 for ERP-adopting firms and from 42 to 48 for non-ERP adopting firms). Although organizational benefits, both three years ago and now, were slightly less for non-ERP adopting firms than for adopting firms, they both seem to have increased by roughly the same amount in the intervening period (at least, on average). This suggests that the presence of an ERP-system in Dutch SMEs does not invoke significant performance increases for adopting firms vis-à-vis non-adopting firms (in terms of their non-financial performance), but that other reasons that affect both adopting and non-adopting organizations may be the culprit for the changes that are witnessed.

4. Conclusions and discussion

We started this paper with a quote taken from Kumar et al. (2002), stating that there is nothing really special to be expected (in terms of outcomes) of adopting an ERP-system. The adoption does not guarantee anything by itself (better performance, smoother business processes, highly motivated personnel, etc.). More or less, we can substantiate the authors’ quote with this study. Organizational benefits, which are typically non-financial in nature (Shang and Seddon, 2002; Eckartz et al., 2009), are not suddenly on the rise when ERP-systems are implemented. Although this conclusion by itself is not new (Grabski and Leech, 2007), it is new in the context of Dutch SMEs. We assert that in this type of organization, in terms of organizational benefits, nothing extraordinary changes for ERP-adopting firms vis-à-vis non-adopting firms over a three
year period. This contradicts previous literature like Hunton et al. (2003), Kallunki et al. (2011) and Liu et al. (2008), albeit these authors tended to emphasize the financial performance of organizations, most of them not being SMEs.

Of course, it may be claimed that our final sample was relatively small, and/or that the period of three years that we have taken into account for the “(...) lag-led re-emergence of performance gains (...)” (Nicolaou and Bhattacharya, 2006, p. 20) to start materializing, was not large enough for SMEs. Although we might concur with the latter remark, as the effects of ERP-implementations in SMEs may impact organizational conduct to an extreme extent and they may therefore need more time to recuperate (Sneller, 2010)\(^8\), we decline the former, as we did find significant differences in statistical terms when applying some Wilcoxon paired-sample tests on our allegedly small sample (also see Noether, 1987).

The value added of this paper, in our opinion, lies in the fact that as of yet, not much empirically supported research seems to be available for Dutch SMEs (Bernroider and Tang, 2003). Given the exploratory nature of the research (Smith, 2003), we admit that generalizable results cannot be claimed, but still, valuable insights into some of the effects that ERP-implementations might (not) realize in specific settings, focusing on non-financial benefits, have been generated. Further research, using larger samples, and also, perhaps, taking into account the presence of specific integrating mechanisms that might help in realizing the alleged integration benefits of ERP-systems (Grabski and Leech, 2007; Kallunki et al., 2011; Kumar et al., 2002), could yield further important insights into an, in our view, under-researched area in the ERP-related literature.

References


\(^8\) On the other hand, Shang and Seddon (2002), in table 8 of their paper, seem to suggest that it only takes a year for organizational benefits to be reaped as a consequence of ES-implementations, in all types of organizations. This would contradict the view presented here.


Appendix 1: Examples of survey questions

I. [Based on Eckartz et al., 2009; Shang and Seddon, 2002]
Could you tell us how your organization currently performs on the following aspects? Please use the scale below.10

(1= very low; 2= low; 3= somewhat below expectations; 4= as expected; 5= somewhat better than expected; 6= high; 7= very high; 8= don’t know)

<table>
<thead>
<tr>
<th>Current performance</th>
<th>Very Low</th>
<th>Very High</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Employee productivity</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Quality of products and services offered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Amount of new work processes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The degree to which work activities and decision power have been relegated to other employees than managers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Flexibility of work processes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Order times</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

II. [Based on Grabski and Leech, 2007; Hong and Kim, 2002]
When you look back at the situation in your organization immediately after the implementation of the ERP-system, when all employees could work with the system for the first time, how far do you do you agree with the following statements?

(1= completely disagree; 2= highly disagree; 3= disagree somewhat; 4= don’t agree/don’t disagree; 5= agree somewhat; 6= highly agree; 7= completely agree; 8= don’t know)

<table>
<thead>
<tr>
<th>Statements</th>
<th>Completely disagree</th>
<th>Completely agree</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The ERP-system is clearly connected to the ways things are done around the organization</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The costs of the ERP-implementation remained with budget</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The functionality of the ERP-system corresponded with the functionality it purportedly had to have when it was decided to start the implementation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9 For reasons of space, only parts of the actual questions used are shown.
10 This question was repeated to assess the situation in an organization three years ago. The underlying items form the main part of the analysis, as far as they pertain to what Shang and Seddon (2002) have called ‘organizational benefits’.
III. [Based on Soja and Poliwoda-Pękosz, 2009]
Which role, or combination of roles, did you have during the implementation phase of the ERP-system? Please indicate this in the boxes below.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. User of the ERP-system</td>
<td>yes/no</td>
</tr>
<tr>
<td>2. Tester of the system</td>
<td>yes/no</td>
</tr>
<tr>
<td>3. Project team member that was responsible for the ERP-implementation</td>
<td>yes/no</td>
</tr>
<tr>
<td>4. Other role, namely ...... ...... ......</td>
<td>yes/no</td>
</tr>
<tr>
<td>5. No role</td>
<td>yes/no</td>
</tr>
</tbody>
</table>
A Literature Review on the Impact of Enterprise Systems on Management Accounting

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Abstract

This paper provides a comprehensive review of previous research at the interface of enterprise systems (i.e. enterprise resource planning (ERP), business intelligence (BI) systems) and management accounting. To date, research has focused mainly on ERP systems with the exception of one study which also investigated BI systems. Studies are reviewed under three categories: those that have employed a positivist approach, an interpretivist approach, and a combination of both approaches. The findings of the literature review suggest that the majority of previous empirical studies has tended to focus on describing changes in management accounting practice and in the role of the management accountant resulting from ERP implementations rather than focusing on analyzing and understanding these changes. The paper presents a research agenda which aims to help academics and practitioners achieve a better understanding of the impact that enterprise systems may have on management accounting.

Keywords: enterprise systems, enterprise resource planning, business intelligence, management accounting, management accountant, literature review
1. Introduction

In light of recent dramatic changes in the corporate world, namely globalisation and severe competition, the contribution of management accounting to business control and planning has increased considerably. Recent advancements in the corporate use of information technology (IT), commonly known as enterprise systems (ES), appear to have the potential to enhance this contribution (see, for example, Nicolaou, 2008; Kallunki et al., 2011). The term ES is widely used in the literature (see, for example, Davenport, 1998, 2000; Shang and Seddon, 2002; Brown and Vessey, 2003; Davenport et al., 2004; Moller, 2005; Alvarez, 2008; Schubert and William, 2009), and refers to business information systems that are implemented in order to integrate information flow across the entire organisation. Enterprise resource planning (ERP) systems, the primary ES form (Sutton, 2006), succeeded manufacturing resource planning (MRPII) systems in the mid-1990s. In comparison to their predecessors, ERP systems are expanded both functionally and technologically (David et al., 1999; Olhager and Selldin, 2003). While MRPII systems were designed for materials management and production planning purposes, ERP systems are, according to Sadagopan (2003), capable of addressing the needs of several additional business functions such as finance, cost, sales, quality management, plant maintenance, service management, and human resources. To attain integration between the abovementioned functional areas, ERP systems exploit a centralised database which collects and stores data within the organisation in real-time.

Although ERP systems are generally designed and introduced by non-accountants, they are closely connected with the accounting processes (Chapman, 2005). As indicated by Sadagopan (2003), some of the most ordinary accounting processes, which are incorporated in an ERP system, include: general ledger, accounts receivable, accounts payable, financial control, asset management, funds flow, cost centers, profit centers, profitability analysis, order and project accounting, product cost accounting, and performance analysis. Accordingly, ERP systems should have implications for all areas of accounting (Hunton, 2002; Sutton, 2006).

The deployment of ERP systems generally results in significant reductions in the routine tasks of management accountants (Lowe, 2004; Arnold and Sutton, 2007; Drury, 2008) and the subsequent a transition in their role from one of information gatherer or transaction-orientated role, to one of information analyst or business-orientated role (Granlund and Lukka, 1998; Hunton, 2002) or more simply from the back office to the front office (Holtzman, 2004). Furthermore, management accounting practices, whether traditional or modern, may become more efficient and effective when supported with ERP systems (see, for example, Edwards, 2001; Baxendale and Jama, 2003; Lea and Min, 2003; Scapens and Jazayeri, 2003; He, 2007; Lea, 2007). This is possible through greater information integration, greater flexibility in information access, and superior functionality (Booth et al., 2000). More recently, the enrichment of ERP systems with new ES, such as business intelligence (BI) systems, appears to have had a significant boost to the role of management accounting. BI systems normally sit on top of ERP systems, and are intended to bridge transactional efficiency with strategic planning (see figure 1). BI comprise a set of tools used for data analysis, query and reporting (Elbashir et al., 2008) and supporting strategic decision-making (Fahy, 2001; Bucher et al., 2009; Mikroyannidis and Theodoulidis, 2010) by providing managers with insights into their business
BI systems are composed of three complementary and interrelated tools, namely data warehousing, online analytical processing (OLAP), and data mining. As Theorey et al. (2006) describe, data warehousing deals with the storage, maintenance and retrieval of historical data; OLAP provides quick answers to *ad hoc* queries; and data mining is a collection of algorithms which find patterns in the data and return valuable user information.

Since the early 2000s, the interaction between ES and management accounting has constituted a research topic of particular interest, and there is a growing body of literature in this area. The first and extensive detailed works in this line of research surfaced as a consequence of the large scale adoption of ERP systems (see, for example, Booth et al., 2000; Granlund and Malmi, 2002; Caglio, 2003; Hyvonen, 2003; Scapens and Jazayeri, 2003). To date, researchers have shown interest in ERP systems, with the exception of Rom and Rohde (2006) who have also paid attention to BI systems.

Despite the fact that considerable research has been devoted to the impact that ERP systems have upon both management accounting practice and role of the management accountant, no clear conclusions on these issues can be drawn. This is due to the fact that, up to now, most research has tended to focus on describing changes in management accounting resulting from ERP implementations rather than focus on analyzing and understanding them. In other words, whilst researchers have indicated how ERP systems may have an impact on management accounting practice and on the management accountant’s role, they have largely neglected to consider the explanatory variables of these impacts. These variables exert influence...
on the extent of change in management accounting practice and in the management accountant’s role resulting from ERP implementations. More specifically, looking into the extant relevant empirical findings, there are a number of companies which have experienced minor changes in management accounting post ERP implementations, several which have experienced moderate changes, and a small number which have experienced significant changes. Yet, no research has attempted to provide a sufficient explanation of why such differences among ERP adopting firms with regard to these changes exist.

As a result, Sutton (2006) argues that the extant empirical findings have been a poor guide to those interested in ES and management accounting. At the same time, it is increasingly important to understand the impact of ES on management accounting (Sutton, 2000, 2005, 2006; Granlund and Mouritsen, 2003; Rom and Rohde, 2006, 2007; Granlund, 2011) for the following two reasons. Firstly, such systems appear to have the potential to facilitate practitioners’ endeavors to advance management accounting practice in order to improve control and planning within their businesses; thus, practitioners need to know whether and how these systems can meet expectations. Secondly, such systems drive semantic changes in the occupational identity of management accountants; thus, they need to know what skills they should add to their portfolio in order to respond to the demands of their new roles, and, in the long run, remain indispensable in their businesses.

The present study addresses the above issues and has the following objectives:

- To provide a comprehensive review of previous empirical research within the area of ES and management accounting in order to obtain an initial understanding of this area; and
- To identify gaps in the literature and give directions for future research in order to help academics and practitioners to achieve a better understanding of the relationship between ES and management accounting.

The remainder of this paper is structured as follows. In the next section the search approach adopted to undertake the literature review is outlined. This is followed with a review of previous empirical research at the interface of ES and management accounting. The next section summarises and discusses the findings of the literature review. Finally, some concluding remarks and areas of further research are outlined in the concluding section.

2. Literature Search

In order to carry out a comprehensive literature search, the following search strategy was adopted for the period 1995 to 2011.

- Review of academic databases (ABI/Inform Global; Business Source Premier; Emerald; Informaworld; Ingentaconnect; ScienceDirect; Social Science Research Network, and Swetswise);
- Review of the accounting journals listed in Harvey et al. (2010);
- Review of the information systems journals listed in Harvey et al. (2010); and

The review of academic databases (ABI/Inform Global; Business Source Premier; Emerald; Informaworld; Ingentaconnect; ScienceDirect; Social Science Research Network, and Swetswise) was undertaken using a combination of keywords (e.g. “enterprise resource planning” and “accounting” / “accountant”; “ERP system” and “accounting” / “accountant”; “business intelligence” and “accounting” / “accountant”). All articles retrieved as a result of this search were subject to further analysis by reviewing the title, abstract and keywords to ascertain their applicability for inclusion in the literature review. The full text of all articles retrieved from the detailed search of the accounting and information system journals reviewed by Harvey et al. (2010) and the accounting information systems journals were subject to examination in order to identify their appropriateness for inclusion.

3. Literature Review

To date, a number of empirical studies have investigated the relationship between ES and management accounting. Using methodological criteria, these studies can generally be grouped into three categories: those which have employed a positivist approach, an interpretivist approach, and a combination of both approaches. The differences between the two research paradigms (i.e. positivism and interpretivism) lie in the selection of the research method (Weber, 2004). Positivist researchers usually carry out surveys or experiments, while interpretivist researchers typically conduct case studies. On the basis of the above three categories, a review of the literature is now conducted.

3.1. Empirical Studies Employing a Positivist Approach

Table 1 provides a summary of previous research within the area of ES and management accounting which has adopted a positivist paradigm. A review of these studies indicates that the survey method has been used extensively.
Table 1 Empirical research within the area of ES and management accounting which has employed a positivist approach

<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>Country</th>
<th>Type of survey</th>
<th>Sample (usable responses)</th>
<th>Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>Booth et al.</td>
<td>Australia</td>
<td>Postal</td>
<td>55 firms</td>
<td>Chief financial officers</td>
</tr>
<tr>
<td>2003</td>
<td>Hyvonen</td>
<td>Finland</td>
<td>Postal</td>
<td>86 firms</td>
<td>Accounting personnel, Chief financial officers</td>
</tr>
<tr>
<td>2003</td>
<td>Spathis &amp; Constantinides</td>
<td>Greece</td>
<td>Postal, fax, e-mail</td>
<td>45 firms</td>
<td>Accounting personnel, Accounting information systems personnel, Administration, Information technology personnel</td>
</tr>
<tr>
<td>2004</td>
<td>Doran &amp; Walsh</td>
<td>Ireland</td>
<td>Postal</td>
<td>68 firms</td>
<td>Financial controllers</td>
</tr>
<tr>
<td>2004</td>
<td>Spathis &amp; Constantinides</td>
<td>Greece</td>
<td>Postal</td>
<td>26 firms</td>
<td>Information department staff</td>
</tr>
<tr>
<td>2005</td>
<td>Spathis &amp; Ananiadis</td>
<td>Greece</td>
<td>–</td>
<td>1 University, 43 employees</td>
<td>ERP users from the accounting and other financial departments</td>
</tr>
<tr>
<td>2005</td>
<td>Spraakman</td>
<td>Canada</td>
<td>Postal, telephone</td>
<td>28 firms</td>
<td>Business controllers</td>
</tr>
<tr>
<td>2006</td>
<td>Jackling &amp; Spraakman</td>
<td>Australia</td>
<td>Postal, web, telephone</td>
<td>35 firms</td>
<td>Chief financial officers</td>
</tr>
<tr>
<td>2006</td>
<td>Rom &amp; Rohde</td>
<td>Denmark</td>
<td>–</td>
<td>349 firms</td>
<td>Chief financial officers</td>
</tr>
<tr>
<td>2006</td>
<td>Spathis</td>
<td>Greece</td>
<td>Postal, fax, e-mail</td>
<td>73 firms</td>
<td>Accounting personnel, Accounting information systems personnel, Administration, Information technology personnel</td>
</tr>
<tr>
<td>2009</td>
<td>Jean-Baptiste</td>
<td>–</td>
<td>E-mail</td>
<td>212 IMA members/Certified Public Accountants</td>
<td>Management accountants</td>
</tr>
<tr>
<td>2009</td>
<td>Sangster et al.</td>
<td>U.K.</td>
<td>Postal</td>
<td>62 CIMA members</td>
<td>Management accountants</td>
</tr>
</tbody>
</table>

– : not acknowledged; IMA: Institute of Management Accountants; CIMA: Chartered Institute of Management Accountants
At this point, it is useful to note that the majority of surveys have been designed to examine the impact of ERP systems on management accounting practice. In this context, some studies have focused on identifying changes only with regard to the transactional aspects of management accounting (e.g. changes in information processing), while other studies have also paid attention to the strategic aspect of management accounting by viewing ERP systems as enablers of sophisticated accounting techniques (e.g. activity based costing (ABC), benchmarking, balanced scorecard (BSC)). Some research has also been conducted which has explored the interaction between the ERP system and the management accountant.

Booth et al.’s (2000) study represents the first systematic attempt to examine the impact of ERP systems on management accounting practice. The study attempted to assess whether organisations with ERP systems experience higher levels of information integration, improvements in terms of reporting and decision-making, and a greater use of sophisticated accounting techniques. Using a survey which was distributed to the top 800 companies in Australia, seventy four responses were received (giving a 9.3% response rate). However, since the authors wanted to compare ERP and non-ERP users, any company who had an ERP project under consideration or an ERP implementation in progress was excluded from the analysis. The final sample therefore consisted of 55 firms, representing 32 non-ERP and 23 ERP users. Booth et al.’s findings indicated that ERP systems are effective in supporting information processing but less so for reporting and decision-making support. Rather surprisingly, there was no noteworthy difference between ERP and non-ERP users regarding the level of information integration with a possible explanation being that most ERP implementations were at an early stage of development. Since ERP systems often need years to ‘bed in’ (Adhikari et al., 2004), the majority of benefits are expected to be extracted from these systems when they are in their maturity phase. Booth et al. (2000) also indicated that ERP systems have a minor impact on the adoption of sophisticated accounting techniques. In particular, no statistically significant difference in the utilisation of such techniques between ERP and non-ERP users was determined. For this reason, Booth et al. (2000) deduced that ERP systems do not constitute an incentive for the adoption of sophisticated accounting techniques.

In a similar vein, Hyvonen (2003) conducted a comparison between ERP and best of breed (BoB) systems in respect of their impact on management accounting practice. BoB systems are stand-alone applications designed to support a single or small number of functional areas rather than the entire organisation (Engle, 2008). As illustrated by Rom and Rohde (2006), BoB systems are normally installed to assist practitioners in dealing with activities such as consolidation, budgeting, costing and performance measurement. A questionnaire was distributed to 300 large and medium-sized businesses in Finland with 99 responses received (response rate of 33%). Their findings indicate that ERP systems were used by 53% of the respondents, while the remainder used BoB systems. Based on 86 usable responses (13 enterprises which had not updated their information systems during the 1990s were excluded from the final sample), Hyvonen (2003) argued that ERP and BoB systems exert almost the same influence on management accounting practice, as no statistically significant differences between these information systems were found. Explicitly, both had a small impact on the introduction of sophisticated accounting techniques. However, it is worth noting that in most cases where such techniques
were adopted, companies had an ERP system. Furthermore, Hyvonen (2003) reports that BoB systems surpass ERP systems in terms of solving management accounting problems related to budgeting, cost control and flexibility, accuracy and reliability of reporting activities. In summary, the findings of this study corroborate earlier evidence provided by Booth et al. (2000) that ERP systems are not sufficient in terms of reporting and do not motivate the utilisation of sophisticated accounting techniques.

Spathis and Constantinides (2003) also explore how ERP systems have influenced the management of accounting information. Using telephone contacts from a random sample of 98 large and medium-sized Greek companies, the researchers report on the practices of 45 organisations (response rate of 45.9%). The most highly rated ERP perceived accounting benefits found by the researchers were increased flexibility in information generation, improved quality of reports and increased integration of applications. No significant improvements were experienced by the surveyed firms with regard to the time required for issuing reports and the decision-making process. The findings of Spathis and Constantinides (2003) are therefore much in line with those of Booth et al. (2000) which suggested that ERP systems are effective in supporting information processing, but not as effective in terms of reporting and decision-making support.

One year later, Doran and Walsh (2004) reported the results of a survey which was designed to examine the impact that ERP systems have upon both management accounting practice and the role of the management accountant. Using a survey, Doran and Walsh (2004) received 70 responses from Irish companies (representing a response rate of 45.8%). In comparison with the findings of Booth et al. (2000) and Hyvonen (2003), Doran and Walsh (2004) found a stronger relationship between ERP systems and management accounting. In particular, while the former indicated that ERP implementations are not significantly associated with the adoption of sophisticated accounting techniques, the latter revealed that several companies utilised such techniques alongside ERP systems. The findings also suggest that ERP systems increase the use of numerous traditional management accounting practices, (e.g. variance analysis, standard costing, marginal costing, breakeven analysis). Finally, the findings suggest that ERP systems advance the role of the management accountant. For example, following the implementation of ERP systems, more comprehensive information is automatically provided to managers which consequently free the management accountant from manual tasks and facilitate more time for information analysis to support key decision makers.

In a similar fashion, Spathis and Constantinides (2004) attempted to identify what changes to management accounting practice have come about as a result of ERP implementations. Extending their earlier study which investigated the impact that ERP systems have on the management of accounting information, they examined whether ERP implementations in the Greek business context are associated with the adoption of sophisticated accounting techniques. Again using a random sample of telephone contacts of 98 large and medium-sized companies, Spathis and Constantinides (2004) report on 26 companies which participated in the study (response rate of 26.5%). The findings of this study are in line with those of Doran and Walsh (2004) and suggest that after the implementation of ERP systems, sophisticated accounting techniques, such as ABC and target costing are
implemented. Furthermore, the evidence provided by Spathis and Constantinides (2004) adds support to the results of the studies of Booth et al. (2000) and Spathis and Constantinides (2003), indicating that ERP systems are more effective in terms of information processing (e.g. increased flexibility in information generation) and less effective in terms of reporting and decision-making.

Another study by Spathis and Ananiadis (2005) investigated how the implementation of an ERP system influenced the management of accounting information, thereby replicating that of Spathis and Constantinides (2003). What differentiates these two studies is that Spathis and Constantinides (2003) conducted a survey of 45 firms, whereas Spathis and Ananiadis (2005) carried out a survey of ERP users in the context of a single case study, namely a large Greek public university. The researchers used structured questionnaires in two phases to collect data, one month before and one year after the implementation of the ERP system. Questionnaires were sent to a random sample of 61 ERP users (University staff), of whom 43 participated in the survey, giving a 70.5% response rate. The most highly rated ERP perceived accounting benefits were improved follow-up of assets, increased flexibility in information provision, improved cash control, and less time required for end of year procedures. Improved quality of reports and less time for issuing reports were among the lowest rated benefits of the ERP system. These findings suggest that ERP systems support tasks of information processing better than reporting activities, and, therefore, reinforce the findings of Booth et al. (2000) and Spathis and Constantinides (2003, 2004).

In the same year, research by Spraakman (2005) examined how ERP systems changed management accounting practice and in particular capital budgeting activities. The survey was administered to 71 large Canadian companies with 35 responses received (response rate of 43.7%). With respect to capital budgeting, the changes occurred were noted as follows: more rigorous use of detailed and accurate data (e.g. organisation of data by type and start date), more realistic process, on-line submissions, reviews and approvals of data used in capital budgeting, increased linkages to strategy, greater ability to track projects such as construction plan, monetary expenditures and fixed asset ledgers and decentralisation of smaller projects. Furthermore, Spraakman (2005) indicates that ERP systems have a moderate impact on other management accounting practices, such as budgeting, operating statements, forecasting, performance measurement and costing. Some of the most frequent changes regarding these practices, which were observed after the implementation of ERP systems, were:

- **Budgeting**: more automated, more detailed, more accurate, easier to use, easier for consolidations, and improved overview capacity.
- **Operating statements**: more automated, more detailed and quicker generation.
- **Forecasting**: longer term, more frequent, rolling and not merely fixed period, more accurate, more integrated, and more detailed.
- **Performance measurement**: expanded, more detailed, more focused on operations, more flexible reports, greater use of benchmarking.
- **Costing**: more detailed, more focused, more accurate, more flexible reports.

Overall, it can be concluded from Spraakman’s (2005) findings that ERP implementations mainly improve the use of existing traditional management
accounting practices rather than enabling the use of sophisticated accounting techniques.

The research of Spraakman (2005) was replicated by Jackling and Spraakman (2006) in an Australian context. Using a questionnaire which was distributed to 90 large companies, 35 responses were received (response rate of 38.9%). The most significant changes in capital budgeting arising from the implementation of ERP systems were increased use of analytical or measurement tools, such as risk adjustments, return on investment, weighted average cost of capital, discounted cash flow, internal rate of return and payback; and increased formalisation and rigour in the overall process, principally expressed through the development of an investment management committee. With respect to the impact of ERP systems on other management accounting practices, such as costing, performance measurement, forecasting, operating statements and budgeting, Spraakman (2005) find that ERP systems render these practices to be more detailed, accurate and flexible.

In later work, Rom and Rhode (2006) attempted to trace the differences between ERP systems and BI systems with respect to their impact on management accounting practice. A questionnaire was sent to 3,000 Danish large and medium-sized firms and 401 responses were received (response rate of 13.4%), of which 349 were suitable for analysis. The authors indicate that ERP systems are effective in terms of collecting data and organising management accounting tasks. These systems also support and improve the use of some traditional management accounting practices. These findings are largely consistent with those of Spraakman (2005) and Jackling and Spraakman (2006). Rom and Rhode (2006) also report that ERP systems are not significantly associated with improvements in information reporting and analysis, confirming earlier studies. As for BI systems, the research findings show that they further improve data collection and facilitate and advance reporting, analysis and budgeting tasks. However, a limitation of this particular study is that the authors did not investigate whether any sophisticated accounting techniques were utilized post-BI implementation. Nevertheless, based on their findings, the researchers inferred that BI systems seem to be able to support such techniques. Rom and Rhode (2006) also argued that there is an independent variable called “sophistication of management” which is likely to affect the extent of change in management accounting due to ES implementations. According to the authors, this variable is concerned with the extent to which management focuses on and applies appropriate management techniques and should influence both the comprehensiveness of ES and management accounting.

In the same year, research conducted by Spathis (2006) examined what accounting benefits were achieved via ERP implementations. Spathis’s (2006) study attempted to identify the independent variables which affect the number of perceived accounting benefits from using ERP systems. Drawing on the responses of 73 Greek large and medium-sized organizations, Spathis (2006) reports the most highly rated accounting benefits, deriving from the implementation of ERP systems, as follows: increased flexibility in information generation, increased integration of applications, improved quality of reports, quicker issuing of reports, improved decisions based on timely and reliable accounting information, and speedier end of year accounting procedures. In comparison with earlier studies, the study found a significant relationship between ERP systems, reporting and decision-making. Nevertheless, Spathis (2006) also
indicates that ERP systems support tasks of information processing better than reporting and decision-making activities. Interestingly, Spathis (2006) also measured the correlation between the number of ERP perceived accounting benefits and a number of independent variables: number of implemented ERP modules, number of reasons for ERP implementation, cost of ERP implementation (as a percentage of sales) and company size (total assets). He found that there is a positive correlation between the independent variables (with the exception of the cost of ERP implementation) and the number of accounting benefits. Conversely, a negative correlation was found between the cost of ERP implementation and the number of accounting benefits. The most influential independent variable found in the study was the number of implemented ERP modules.

In a more recent study, Jean-Baptiste (2009) evaluated the contribution of management accountants to the deployment of ERP systems. The research methodology adopted included the distribution of a questionnaire in 2005 to approximately 50,000 members of the Institute of Management Accountants (IMA). Three years later, the same survey was also sent to 45 certified public accountants outside of the IMA group. The questionnaire was completed only by management accountants with ERP experience. In total, 219 responses were received, of which 212 were suitable for analysis. The researcher reports the existence of a significant positive relationship between the participation of management accountants in an ERP implementation and its level of success. Jean-Baptiste (2009) also found that when management accountants are equipped with high IT skills, they are more likely to become members of ERP groups in both the implementation and maintenance phases of ERP systems. The author also stresses that during the implementation of an ERP system, management accountants need enhanced financial, knowledge sharing and IT skills. These same skills are also required in the post implementation phase. Interestingly, report writing abilities were found to be an additional skill required by management accountants after the implementation of an ERP system. This finding seems to corroborate evidence provided by earlier research that ERP systems are not sufficient in terms of information reporting and decision-making. As a consequence, management accountants are often forced to develop additional reports via the use of spreadsheets in order to present relevant information to decision makers.

In the most recent study to adopt a positive perspective, Sangster et al. (2009) examined the relationship between ERP systems and management accounting, paying particular attention to the impact these systems have upon the role of the management accountant. The ultimate objective of this study was to detect whether there is a relationship between the level of success of ERP implementations and the extent of change in the role of the management accountant. Sangster et al.’s (2009) survey instrument was designed by drawing heavily on the research of Grabski et al. (2009) and other related literature. Grabski et al (2009) found that the more successful an ERP implementation is, the more significant the changes which take place in the role of the management accountant. Sangster et al.’s sample consisted of 668 members of the Chartered Institute of Management Accountants (CIMA) who were employed in large UK organisations. Ninety two questionnaires were completed, representing a 13.8% response rate. Of these, only 62 were used for analysis, representing management accountants who were employed for an ERP adopting organisation. The findings of Sangster et al.’s study suggest that the level
of success of an ERP implementation is not significantly related to the extent of change in management accounting practice, as successfully implemented ERP systems merely automate data collection and improve information quality. This finding strengthens the results of prior research which indicated that ERP systems are effective mainly in terms of information processing. Sangster et al. (2009) also report that there is a significant correlation between the level of success of an ERP implementation and the extent of change in the role of the management accountant. Explicitly, they observed that successfully implemented ERP systems result in dramatic changes in the work of management accountants, as many of their previous tasks (e.g. information gathering and provision) are executed by the ERP system. As a consequence, management accountants can concentrate on value-adding activities such as information analysis. Conversely, they indicate that poorly implemented ERP systems limit the role of management accountants, since the latter continue to carry out the same tasks but in a more complex work setting. The authors also considered the skills which are required by management accountants when they work in ERP adopting firms. Their findings suggest that the key skills which management accountants should possess in this context include IT competencies, cross functional working relationships and analytical and consulting abilities, which concur with the findings of Jean-Baptiste (2009).

3.2. Summary of Positivist Empirical Research

A number of conclusions can be drawn from the above review. First, ERP systems appear to be associated with transaction-oriented changes in management accounting. There is strong evidence that after the implementation of an ERP system, accounting information is not only more comprehensive and reliable, but is also generated and provided to decision makers more flexibly. As a result, management accountants are free from routine tasks such as information gathering and provision, hence saving time to concentrate on value-adding activities in order to support decision-making. In particular, tasks such as information reporting and analysis, which cannot effectively be carried out by the ERP system, may be added to the tasks of the management accountant. Post ERP implementation, management accountants may also deal with the management of the ERP system. A second conclusion is that ERP systems appear to be weak in driving strategic-oriented changes in management accounting practices. More precisely, ERP systems tend to reinforce the use of traditional management accounting practices such as variance analysis, standard costing, marginal costing, and breakeven analysis, rather than enabling the use of sophisticated accounting techniques. Despite this, there is some limited evidence that techniques such as ABC, target costing, BSC and benchmarking have been introduced post ERP implementation. The above review of positivist studies has provided an understanding of the changes that may be driven in management accounting post ERP implementation. However, more research is needed to understand under what conditions these changes take place. In other words, which independent variables affect the impact that ERP systems have on management accounting practices? Two potential independent variables, namely use of a BI system as ERP superstructure and level of sophistication of management have been identified through the above review. Rom and Rohde (2006) assume that ERP systems when combined with BI systems are enablers of significant changes in management accounting, such as improvements in the way management accounting
tasks are performed and greater adoption of sophisticated accounting techniques. This assumption seems logical, since a BI system is implemented as an ERP extension in order to provide management with enhanced analytical abilities (Elbashir et al., 2008). Furthermore, Rom and Rohde (2006) characterise the extent to which management focuses on and applies sophisticated accounting techniques as an independent variable, which may influence the extent of change in management accounting due to ERP systems. This independent variable also seems relevant, as the decisions of managers around the ERP system are critical to the type and magnitude of the benefits that can be extracted from the system (Staehr, 2010).

3.3. Empirical Studies Employing an Interpretivist Approach

In addition to the studies reviewed in the previous section, a number of researchers have employed an interpretivist perspective to investigate the interplay between ES and management accounting practices and the role of the management accountant. These are summarised in Table 2. In one of the earliest of these studies, Granlund and Malmi (2002) explored the impact that ERP systems have on management accounting practice and the role of the management accountant. Drawing on extended interviews with ten large Finish companies, Granlund and Malmi (2002) report that ERP systems have little impact on management accounting practices and that some techniques, such as ABC and BSC, used in the organizations investigated were not supported by the ERP system. With respect to the role of the management accountant, Granlund and Malmi (2002) find that ERP systems have reduced the amount of routine work related to transaction handling towards more analytical value-added activities related to managerial control and decision-making.

In later research, Caglio (2003) reported the findings of a case study which investigated the impact of ERP systems on the role of the management accountant. Drawing on in-depth interviews with practitioners who were intimately involved in the implementation of the ERP system at Pharmacom, an Italian medium-sized pharmaceutical firm, and documentary evidence, Caglio (2003) find that the chief financial officer (CFO), played an influential role in decisions around the implementation of the ERP system. The ERP system enabled widespread changes to take place to the management accountant’s role with the ERP system playing a major role in information gathering and generating information. As a consequence, management accountants have lost some control over their traditional tasks and are now more focused on analyzing the information coming out of the ERP system in terms of supporting the decision-making process.
### Table 2: Empirical research within the area of ES and management accounting which has employed an interpretivist approach

<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>Country</th>
<th>No. of cases</th>
<th>No. of interviews</th>
<th>Duration of interviews</th>
<th>Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>Granlund &amp; Malmi</td>
<td>Finland</td>
<td>10</td>
<td>16</td>
<td>≈ 1-2½h (each)</td>
<td>Chief financial officers, Controllers, Information technology managers, Project managers</td>
</tr>
<tr>
<td>2003</td>
<td>Caglio</td>
<td>Italy</td>
<td>1</td>
<td>–</td>
<td>&gt; 33h (in total)</td>
<td>Accounting personnel, ERP users, Information technology personnel, Management</td>
</tr>
<tr>
<td>2003</td>
<td>Scapens &amp; Jazayeri</td>
<td>U.K.</td>
<td>1</td>
<td>–</td>
<td>≈ 1½h (each)</td>
<td>Accounting and non-accounting personnel</td>
</tr>
<tr>
<td>2005</td>
<td>Dechow &amp; Mouritsen</td>
<td>Denmark</td>
<td>2</td>
<td>34</td>
<td>–</td>
<td>Accounting personnel, ERP users</td>
</tr>
<tr>
<td>2005</td>
<td>Quattrone &amp; Hopper</td>
<td>U.K., Japan, Belgium, U.S.A.</td>
<td>2</td>
<td>36</td>
<td>≥ 1½h (each)</td>
<td>ERP project managers</td>
</tr>
<tr>
<td>2006</td>
<td>Rikhardsson &amp; Kraemmergaard</td>
<td>Denmark</td>
<td>6</td>
<td>–</td>
<td>–</td>
<td>Chief financial officers, Chief information officers, Chief production managers</td>
</tr>
<tr>
<td>2006</td>
<td>Sayed</td>
<td>Egypt</td>
<td>1</td>
<td>23</td>
<td>≈ 1-3h (each)</td>
<td>Accounting personnel, Chief information officer, ERP implementers, Senior financial officer</td>
</tr>
<tr>
<td>2007</td>
<td>Granlund</td>
<td>–</td>
<td>–</td>
<td>21</td>
<td>–</td>
<td>Chief financial officers, Chief information officers, Controllers, Production &amp; Logistics managers, Software consultants</td>
</tr>
<tr>
<td>2007</td>
<td>Kholeif et al.</td>
<td>Egypt</td>
<td>1</td>
<td>–</td>
<td>&gt; 2h (each)</td>
<td>Accounting personnel, Information technology personnel, Management</td>
</tr>
<tr>
<td>2008</td>
<td>Jack &amp; Kholeif</td>
<td>Egypt</td>
<td>1</td>
<td>–</td>
<td>&gt; 2h (each)</td>
<td>Financial controller, Management accountants, Management</td>
</tr>
<tr>
<td>2008</td>
<td>O’Mahony &amp; Doran</td>
<td>–</td>
<td>1</td>
<td>≥ 5</td>
<td>–</td>
<td>Management accountants</td>
</tr>
<tr>
<td>2009</td>
<td>Colmenares</td>
<td>Venezuela</td>
<td>1</td>
<td>≥ 6</td>
<td>&gt; 2h (each)</td>
<td>Senior managers</td>
</tr>
<tr>
<td>2009</td>
<td>Grabski et al.</td>
<td>U.K.</td>
<td>7</td>
<td>≥ 12</td>
<td>–</td>
<td>Management accountants, Management consultants, Information technology managers, Senior Managers</td>
</tr>
</tbody>
</table>

– : not acknowledged
In the same year, Scapens and Jazayeri (2003) investigated how the implementation of an ERP system changed management accounting practice as well as the role of management accountants in a large US-based manufacturer of building materials, referred to as BM by the researchers. Interviews were conducted with practitioners involved in the implementation phase of the ERP system and with employees most affected by its deployment. Scapens and Jazayeri (2003) observe that the ERP system had a moderate impact on management accounting practice. Specifically, it increased information visibility, thus making accounting information more readily available to decision-makers. It also enabled BM to carry out more frequent and efficient forecasts, and improved the conditions under which standard costing and actual costing were performed (e.g. input automation). In contrast, the ERP system was unable to provide all the reports required by BM’s management, and, as a consequence, spreadsheets were often used by management accountants to organise and report the information produced by the ERP system. The impact of the ERP system on the role of management accountants was important, as a number of positive changes in the tasks of these professionals are reported by the researchers. Most of the routine tasks of management accountants are now completed by the ERP system or non-accountants, and management accountants are now more concerned with interpreting the information generated by the ERP system. This change in emphasis has, however, resulted in the loss of some traditional skills. These findings largely confirm those reported by Granlund and Malmi (2002) and Caglio (2003).

In later work, Dechow and Mouritsen (2005) analysed how two large Danish multinational manufacturing firms attempted to improve management control by adopting an ERP system. In both firms, the researchers observed that post ERP implementation, the financial statements were generated more frequently, were more complete and reliable due to the automated and continuous data reconciliation afforded by the ERP system. One of the two firms tried to utilise benchmarking techniques in the ERP environment. However, the ERP system could not effectively support the measurement of divisional performance. Additionally, management accounting data could not be properly collected and aggregated due to the complexity of the ERP system. This finding is in line with that of Granlund and Malmi (2002) that ERP systems do not effectively support the utilisation of sophisticated accounting techniques because of the complexity of their architecture. This led Dechow and Mouritsen (2005) to conclude that the accounting benefits achieved via the deployment of the ERP system were limited to the consolidation of data.

Quattrone and Hopper (2005) also investigated how two large multinational manufacturing organizations attempted to improve management control by adopting an ERP system. Managers who were closely involved in the ERP implementation were interviewed and relevant documentation was analyzed. The findings of the case studies show that ERP systems increase information visibility. Prior to ERP implementation, management accountants were responsible for gathering and providing information to managers. Post implementation, the ERP system carries out these tasks. The researchers also indicate that post ERP implementation, tasks, which were formerly performed by management accountants (e.g. books of subsidiaries), are now performed by non-accountants through the ERP system. Quattrone and Hopper (2005) also report that post ERP implementation, management accountants wanted to utilize benchmarking techniques. However, this
was impossible due to the complexity of the ERP system. With respect to management accounting practice, the ERP system merely automated information processing confirming the findings of earlier studies (Granlund and Malmi, 2002; Scapens and Jazayeri, 2003; Dechow and Mouritsen, 2005).

In a later study, Sayed (2006) investigated the impact of ERP systems on the role of management accountants in a large Egyptian manufacturing company. Drawing on interviews with key practitioners, Sayed (2006) report that the lack of qualified IT specialists during the implementation phase of the ERP system affected its functionality which in turn affected the way the system was used. For example, a senior accountant within the company commented that accounting personnel relied on the help menu in order to understand how to perform their tasks in the new environment. Additionally, during the ERP implementation, there was a high level of antagonism between the accounting and production personnel regarding control of the system. The factory manager wanted to have control over the ERP system in order to improve production control while the accountant function argued that the ERP system should be under the control of the accounting department as financial statements are the final output of the system. To overcome this disagreement, the firm’s management accountants attempted, and, eventually, succeeded in adapting the ERP system to meet the needs of both the production and accounting staff. Sayed’s (2006) findings demonstrate that due to the lack of personnel equipped with appropriate IT skills, management accountants were required to enhance their technological expertise, and, in the long run, to represent themselves as experts in extracting the benefits from the ERP system. The author concludes that in a business environment, where some routine accounting tasks are accomplished by the ERP system and others are carried out by non-accounting staff, management accountants should redefine themselves and acquire new skills (e.g. communication skills, teamwork skills, IT skills, strategic thinking) so that they remain indispensable.

Using a similar methodology to that of Granlund and Malmi (2002), Rikhardsson and Kraemmergaard (2006) explored the organisational effects of ERP implementations in five large Danish manufacturing companies and the municipality of Copenhagen. Drawing on interviews and case descriptions which were written by those interviewed, the findings of the study suggest that ERP systems promote better coordination of processes. Specifically, they automated information processing, and, in the long run, reduced the need for manual inputs by management accountants. Prior to ERP implementation, management accountants were the ‘gate keepers’ of accounting information and were responsible for gathering and providing this information to decision makers. Post ERP implementation, accounting information is more freely available to managers. In order to support decision-making, management accountants now perform value-adding tasks, such as information analysis, scenario building and information assurance and presentation.

In a later piece of work, Granlund (2007) investigated the impact that ERP systems have on management accounting practice. Emerging from a comprehensive review of the related literature, the researcher performed a number of interviews with specialists operating in the relevant field. Interviews were supported with additional sources of information such as informal discussions with key practitioners and written material (e.g. software product descriptions). Granlund (2007) find that ERP systems are effective in supporting information processing and, as a result, change to some
extent the tasks of management accountants. To remain indispensable in their businesses, management accountants carry out new tasks, such as analysis of information produced by the ERP system, information system design, software implementation and maintenance of the ERP system. Furthermore, ERP systems were not able to support effectively the utilization of sophisticated accounting techniques because of the complexity of their architecture. As one interviewee described, his organization had attempted to develop ABC into the ERP system for two years, but the company finally abandoned the project because substantial amounts of time and money were required whilst the outcome was uncertain. Granlund (2007) argues that the changes in the structure of ERP systems, which have to take place for the support of sophisticated accounting techniques, may cause serious problems in business processes such as managerial reporting.

In the same year, Kholeif et al. (2007) investigated the failure of an ERP project in an Egyptian company, called AML. Interviews, site visits, and documentary evidence were used to collect data. Since AML is a state-owned enterprise, they had applied the Uniform Accounting System introduced in 1966 by the Egyptian control authorities for preparation of the National Plan. In terms of this system, “accounts are classified in homogeneous classes in a manner that assists in preparing national accounts, as well as satisfying the needs of the traditional financial and cost accounting” (Kholeif et al., 2007, p.9). In order to modernize its information systems, AML decided to invest in an ERP system. The ERP system was customized to be compliant with the Uniform Accounting System. However, it was not possible to achieve complete conformity with the existing organizational system. Two of those interviewed characterized the ERP system as a highly complex information system which could not be adapted to the specific needs of the organization. As a result, neither management accounting practices or the role of management accountants changed as a result of the ERP implementation.

In later research, Jack and Kholeif (2008) examined the effects of a failed ERP implementation on the role of management accountants in an Egyptian company, IMC. The company was in charge of a programme sponsored by the European Union (EU) which aimed to promote the economic transition of Egypt from a central planning to a market oriented economy. To overcome the constraints of their existing system, IMC decided to implement an ERP system with the finance and distribution modules initially installed. Under the EU order, a controller and an IT manager at IMC undertook to build a web-based custom system for managing the budget. The system was designed to trace requisitions and contracts and automatically adjust budget lines using the intranet. Both practitioners left IMC before completing the development of the new system. As a consequence, the interaction between the web-based custom system and the ERP system was poor because of the low level of integration between the two systems. This issue was addressed by customizing the ERP system so it was in alignment with the needs of the organization. However, this resulted in the development of a conventional accounting information system. As a result, Jack and Kholeif (2008) found the neither management accounting practices or the role of management accountants changed as a result of the ERP systems.

O’ Mahony and Doran (2008), in later research, appraised the impact of an ERP implementation on the role of management accountants in a large multinational manufacturing company. The researchers conducted interviews with five
management accountants, a senior budget analyst, a senior financial analyst, a senior manufacturing analyst, a budget analyst and an accounting analyst. Similar to earlier research, they report that the ERP system enabled the management accountants to be relieved to a large extent from information processing activities and become more focused on information analysis to support decision-making. O’Mahony and Doran (2008) also attempted to assess whether ERP systems provide an accounting role to non-accountants. Similar to earlier studies (Scapens and Jazayeri, 2003; Quattrone and Hopper, 2005; Sayed, 2006), the researchers found that traditional accounting tasks, such as reporting and journal bookings, are now performed by non-accountants.

Replicating Spathis and Constantinides’s (2003) study, Colmenares (2009) examined how the implementation of an ERP system influenced the management of accounting information in a large Venezuelan firm. Colmenares’s (2009) findings concur with those of Spathis and Constantinides (2003) which suggest that ERP systems facilitate the integration of accounting applications, increase the flexibility of information generation, improve the quality of financial reports and aid decision makers through provision of timely and reliable accounting information.

In the most recent interpretivist research, Grabski et al. (2009) investigated the relationship between ERP systems and management accountants in seven large UK organizations. The main objective of their research was to ascertain whether there is an association between the level of success of ERP implementations and the extent of change in the role of management accountants. The case study organizations comprised those who had experienced successful and unsuccessful ERP implementations. A number of findings were reported. First, the more successful an ERP implementation, the more considerable the changes that take place to the role of the management accountant. For example, in a successful ERP environment, management accountants focus on information analysis and interpretation in order to aid decision-making. Secondly, the participation of management accountants in the implementation of an ERP system is critical to its success. As the researchers point out, in the three organisations which experienced a very successful ERP implementation, the management accountants had been involved in all phases of ERP implementation. In the two companies which had a less successful ERP adoption, the participation of management accountants had been limited to the final phase of implementation only. Finally, in a similar vein to Sayed’s (2006) study, Grabski et al. (2009) suggests that management accountants need to acquire new skills, including IT, interpersonal, leadership, decision-making, analytical and planning skills in order to meet the requirements of their new roles.

3.4. Summary of Interpretivist Empirical Research

The review of interpretivist research supports the first conclusion drawn from the review of positivist empirical studies, namely that ERP systems appear to have predominantly driven transaction-oriented changes in management accounting such as automation in information processing. As a result, management accountants may lose some control over their traditional tasks. The review of interpretivist research also corroborates the second conclusion drawn from the review of positivist research that ERP systems appear to be weak in driving strategic-oriented changes in
management accounting. Specifically, there is evidence that ERP systems reinforce the use of traditional accounting practices rather than enabling the introduction of sophisticated accounting techniques. The review of interpretivist research also finds that ERP systems are not sufficient in terms of enhancing reporting (e.g. development of cost reports), and, as a consequence, spreadsheets are often used by management accountants in order to report relevant information to decision makers.

The review of interpretivist research identifies independent variables which may further explain the relationship between ERP systems and management accounting, and have not been tested in large research samples. For example, Grabski et al. (2009) find a positive relationship between the participation of management accountants in ERP implementation and the extent of change in their role. Furthermore, Caglio (2003) reported the important role of the CFO in ERP implementations. This suggests that control of an ERP implementation may be regarded as an independent variable which influences the extent of management accounting change. Some further support for this is provided by the findings of Dechow and Mouritsen (2005) and Sayed’s (2006). A further explanatory variable which may influence the impact of ERP systems have on management accounting practices and the role of management accountant is the level of IT skills of management accountants. In the case study conducted by Caglio (2003), management accountants focused not only on the analysis of the information generated from the system post ERP implementation, but also on its maintenance and development. Caglio (2003) suggested that management accountants should enhance their IT competencies in order to carry out these tasks effectively. Sayed (2006) also shows that with the acquisition of IT skills, management accountants were able to represent themselves as experts in terms of achieving the benefits of an ERP implementation. Finally, the review of research studies suggests that the level of complexity of an ERP system should also be a relevant independent variable. In interpretivist works (e.g. Granlund and Malmi, 2002; Dechow and Mouritsen, 2005; Quattrone and Hopper, 2005; Kholeif et al., 2007; Granlund, 2007), where ERP systems were deemed by the interviewees to be very complex information systems, the management accounting benefits were limited to the transactional level. Although there were endeavors to utilise sophisticated accounting techniques, these techniques could not be supported effectively by the ERP system because of the complexity of its architecture.

3.5. Empirical Research Combining Positivism and Interpretivism

To date, only one study within the research area of ES and management accounting has combined positivist and interpretivist research methods, namely a survey and case study method. Newman and Westrup (2005) conducted a survey of UK CIMA management accountants and a series of case studies involving 34 interviews in manufacturing firms (seven in the UK and two in Italy) in an attempt to understand the implications that ERP systems have for management accountants. Using 122 responses, the majority of the respondents (83%) indicated that the management accountants experienced positive changes as a result of the advent of an ERP system. The findings also suggest that post ERP implementations management accountants focus on the analysis of information produced by the ERP system in
order to support decision-making (Doran and Walsh, 2004; Jean-Baptiste, 2009; Sangster et al., 2009; Newman and Westrup, 2005). Hence, they conclude that ERP systems may transform management accountants into business advisers. Newman and Westrup (2005) also report that management accountants lose some control over their traditional tasks as a result of ERP implementation. In addition, management accountants were able to retain overall control over the ERP system. This finding reinforces the possible influence of the independent variable “control of ERP implementation” which was identified through the review of interpretivist studies.

The findings of the case studies undertaken by Newman and Westrup (2005) largely corroborate the results of their survey. These indicate that when an ERP system has been implemented, management accountants are free from routine tasks enabling them to focus on information analysis and interpretation in order to advise decision makers. In other words, management accountants acquire the role of business advisers. The authors also suggest that enhanced IT skills are one of the main abilities required by management accountants in an ERP environment. Finally, the findings of their case studies lead Newman and Westrup (2005) to confirm the findings from earlier studies (Granlund and Malmi (2002) and Scapens and Jazayeri (2003)) that ERP systems are unable to facilitate the development of reports in an appropriate manner because of their immense complexity. As a consequence, management accountants often use separate systems in the form of spreadsheets to present the information produced by the ERP system.

4. Discussion and Conclusions

At a general level, what can be inferred from the review of the extant empirical research on ES as it interrelates with management accounting is that ERP systems appear to exert a significant influence on the transactional aspect of management accounting, but appear to have a rather moderate impact at a strategic level. This perception is in line with that of Brignall and Ballantine (2004) that ERP systems have benefited their adopters more with respect to transactional efficiency, and less so with respect to strategic planning.

The first major finding to emerge from the literature review is that ERP systems can make accounting information more comprehensive and reliable, and can increase flexibility of its generation and provision. The second major finding is that post ERP implementation, management accountants may lose some control over their traditional activities, as tasks such as information gathering and provision may be carried out by the ERP system and non-accountants. As a result of ERP implementation, management accountants are more likely to be involved in value-adding activities, such as information analysis and interpretation and management of the ERP system. Therefore, it can be inferred that ERP implementations have the potential to upgrade the role of the management accountant to that of business adviser.

The literature review also suggests that due to their transactional efficiency, ERP systems have generally reinforced the use of traditional management accounting practices and made them more integrated, detailed, accurate, automated and timely.
Conversely, it may be deduced that ERP systems do not effectively support the utilisation of sophisticated accounting techniques within organizations. Although the results of several surveys suggest that post ERP implementations, management accounting techniques such as ABC, target costing, quality costing, the BSC and benchmarking, were introduced, the overwhelming majority of these techniques were adopted by only a small number of ERP adopting organisations. A general finding arising out of the review of interpretivist studies is that ERP systems do not enable the utilisation of sophisticated accounting techniques because of the immense complexity of their architecture. For the same reason, ERP systems often provide insufficient information to facilitate the development of managerial reports (e.g. cost reports), and, as a result, management accountants are forced to use other systems such as spreadsheets in order to present the information produced by the ERP system to decision makers.

The literature review has provided a picture of the changes that may occur to management accounting practices and the role of the management accountant post ERP implementation. However, it can be argued that the relationship between ERP systems and management accounting is still obscure. Indeed it has been suggested that research on ES as it interrelates with management accounting is at an early stage of development (Arnold, 2006; Stefanou, 2006; Berry et al., 2009; Granlund, 2011). As a result, Sutton (2006) argues that “we really need to move to the next stage with the development of more generalized theories that help us to understand the phenomena in a more generalized fashion” (p.3). As the literature review indicates, in order to proceed to the next stage we need to understand better under what conditions ERP-related changes in management accounting take place and what the independent variables are in relation to this. As noted in the beginning of this paper, these are variables which exert influence on the extent of change in management accounting practice and on the role of the management accountant resulting from ERP implementations.

In an earlier review of the related literature, Rom and Rohde (2007) concluded that ERP systems cannot alone drive revolutionary changes in management accounting, such as strategic-oriented changes including greater adoption of sophisticated accounting techniques. Rather, ERP systems can simply facilitate such changes. The current literature review has identified the following five independent variables which may drive management accounting change: control of ERP implementation, level of complexity of ERP system, level of IT skills of management accountants, level of sophistication of management, and use of a BI system as ERP superstructure. Additional independent variables, which do not result directly from the literature review, but may exert influence on the extent of change in management accounting practice and in the role of the management accountant resulting from ERP implementations, are: cost of ERP implementation, length of the time the system has been operational, brand of ERP system, number of implemented ERP modules, number of implemented BI modules, implementation of BI financial module, implementation of a customer relationship management system, implementation of a supply chain management system, company size and sector of economic activity. Given that limited previous research has investigated the impact of these variables, accounting researchers should focus on these issues in order to enhance our understanding of the relationship between ES and management accounting.
The present review suggests that previous empirical research at the interface of ES and management accounting has tended to focus on describing changes in management accounting practice and in the role of the management accountant resulting from ERP implementations rather than focusing on carefully analyzing and understanding these changes. Whilst researchers have indicated how ERP systems may impact on management accounting practice and on the role of the management accountant, they have largely neglected to consider the explanatory variables of these impacts. To date, there is a lack of research which has attempted to provide a sufficient explanation for the differences among ERP adopting firms with regard to the perceived management accounting changes of ERP implementations. Although recent studies (e.g. Spathis, 2006; Grabski et al., 2009; Sangster et al., 2009) have increased our understanding of the relationship between ERP systems and management accounting, substantially more research is needed in order to draw valid conclusions on this subject.

In this paper, a number of independent variables which may exert influence on the extent of change in management accounting practice (i.e. first dependent variable) and in the role of the management accountant (i.e. second dependent variable) resulting from ERP implementations have been proposed. It is believed that the investigation of the relationship between pertinent variables will help academics and practitioners to achieve a better understanding of the impact that ES have upon management accounting. In order to gain more valuable insights into this issue, future research might adopt existing information systems theories (e.g. diffusion of innovations theory, flow theory, technology acceptance model, theory of planned behavior) as the principle theoretical lens through which to investigate the phenomena under consideration. However, caution should be applied in theory selection, as there are information systems theories (e.g. contingency theory, agency theory, transaction cost economics) which “while providing some valuable insights into the area, they seem to push research into questions and problems that are many times far from the everyday practice of accountants…” (Granlund, 2011, p.6). Future work should seek to develop a research model which will integrate the variables (independent and dependent) identified in this paper with mediating variables used in existing information systems theories.
References


Teaching Enterprise Systems in Higher Education: The Learning Context Triangle

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Abstract

We have iteratively developed curricula in two enterprise systems courses in higher education for information systems (IS) students. Enterprise systems embed technical complexity and imply organizational challenges when implemented in organizations. Therefore, teaching good ES classes are pedagogically challenging for faculty, and ES curricula are difficult for students. To cope with these challenges we gradually designed, implemented and rebuilt curricula and teaching framework from 2003 to 2010. We extended the use of various pedagogical principles and pedagogical means to stimulate deep-level learning processes. We propose a generic three-dimensional teaching framework comprising learning contexts of traditional classroom, laboratory, and organizational settings. We argue that an integrated teaching approach that includes practice-based learning loops facilitate and enrich a collaborative learning environment.

Keywords: Teaching framework, enterprise systems, pedagogical means, diverse learning context, practice-based learning, collaborative learning, design research

1. Introduction

Scholars have recently paid attention to enterprise systems (ES) in higher education program (Ask et al. 2008; Hawking et al. 2004; Watson & Schneider 1999). These systems are integrated software solutions in the form of standardized, ‘best practice’, off-the-shelf packages from different vendors (Davenport 1998). The software is used to manage organizational resources by integrating information flows across departments and functions into a single computer system to serve the needs across different departments. Organizations seek to increase efficiency, improve communication across the enterprise, and to reduce costs and data redundancy by overcoming the limitations of fragmented, incompatible “silos” of legacy systems (e.g. Robey et al. 2002). ES, however, embed technical complexity and imply organizational challenges when implemented in organizations (Markus & Tanis 2000). Furthermore, the organizational and human consequences and the requirements for changes in business processes are often underestimated (Volkoff et al. 2007).

Despite challenges and implementation costs, ES of several types have become increasingly popular in organizations, and are widely implemented in both small
and large enterprises. To follow these contemporary trends in the business environments, academic institutions have started to integrate ES classes in higher education programs. Universities are also implementing ES software into PC labs to generate hands-on experiences for students (Watson & Schneider 1999). ES are complex systems, and ES classes are pedagogically challenging to teach for faculty, and difficult to understand for students.

Despite a growing interest for utilizing ES in education, there are few studies reporting on how universities combine innovative technologies with other pedagogical means to enhance learning in ES classes. Our research seeks to bridge this gap, and a longitudinal experimental study was performed at a Norwegian university which implemented two ES courses designed for IS graduate students in 2003. The purpose was to develop an appropriate teaching framework over time by implementing improvements based upon iterative experience circles. The research has followed an overall abductive approach (Dubois & Gadde 2002), by systematic combining existing theories (e.g. pedagogy, learning theories, ES issues) and empirical data based upon own teaching experiences and students’ evaluations and feedback. The final framework suggests that ES curricula should implement different pedagogical principles and pedagogical means into three learning contexts to trigger deep level learning processes. The study has utilized design research principles (Hevner et al. 2004), in this longitudinal development process.

The following research question has guided our research:

How can faculty create an effective learning environment while teaching ES classes for IS graduates?

The aim has been to educate IS professionals to become “reflective practitioners” (Schön 1983), with appropriate ES skills to handle complex ES implementations and related issues. IS graduates who start to work in ES projects would benefit from having a broad understanding of the implementation process and related challenges. ES classes would benefit from having curricula that provide an overview of different aspects of ES through books, academic articles and empirical case studies. In addition, IS graduates need to understand different roles in a ES project since they are likely to get roles representing the customer part (e.g. CIO, ES project leader), or the vendor part (e.g. IS consultant).

The paper is organized as follows. Firstly, we present theoretical background and previous research. Then we present the research setting and our methodological approach. After that, we report the design and evaluation processes for developing curricula, and present our proposed teaching framework. Finally, we provide a discussion and conclusion.
2. Theoretical Background and Related Research

This section provides a brief overview of previous research focusing on ES in higher education. In addition, a review of different pedagogical principles and perspectives of learning is presented.

2.1 Previous Research of ES in Education

Today, many organizations are dependent upon IS professionals with appropriate ES skills to handle complex implementation of different kinds of ES. Consequently, universities try responding to the increasing requirements for ES skill by incorporating ES classes into their education programs (Mohamed & McLaren 2009). One categories of ES, ERP-systems, have in particular become popular in both small and large enterprises and across a diversity of business domains (Robey et al. 2002). Both business schools and education programs in information systems and informatics, are increasingly establishing ES classes implementing ERP software in PC-labs to ensure hands-on experiences with ERP-systems (Ask et al. 2008; Rosemann & Maurizio 2005; Watson et al. 1999; Winkelmann & Leyh 2010). Several of the major ERP vendors (e.g. SAP, Microsoft, Oracle) have developed university alliance programs, and universities have focused on collaboration by establishing ES teaching partnership with ES vendors and consultant companies (Ask et al. 2008; Klose et al. 2004; Rosemann & Maurizio 2005). Studies report, however, that integrating ES software into curriculum is resource intensive and challenging for teachers as well as for students (Fedorowicz et al. 2004; Seethamraju 2007). The lack of ERP skills of academic staff has been an important challenge (Hawking et al. 2004). Accordingly, launching hands-on modules require expensive training of lecturers, and development of appropriate lab assignments, in addition to continuously upgrading and maintaining of the implemented software. These expenses may discourage hands-on ES courses (Bradford et al. 2003; Seethamraju 2007).

Despite of establishment of ES education programs, there are still shortages of ERP consultants who have sufficient ERP skills to handle complex ES implementations. Technical competency and hands-on experiences of ES software, is obviously not the most important competence needed to cope with ES implementations. Research studies report that IS graduates need to have an array of different ES skills to cope with complex ES implementations (Boyle & Strong 2006; Mohamed & McLaren 2009).

Boyle and Strong (2006) compiled a list of ERP skills that organizations expect from IS graduates. They found that the most important skills were related to business functional knowledge, and in particular the ability to understand the business environment. The second most important set of skills were technology management knowledge – knowledge of ERP concepts and the ability to learn new technology and understand the strategic impact of ES on the organization. The third and fourth set of skills was interpersonal and team skills and knowledge. The ability to work cooperatively in a team environment to accomplish assignments was highly valued. These “soft skills” are also emphasized and further elaborated in a
study conducted by Mohamed and McLaren (2009). The authors compare the research stream of ERP education with the stream of ERP implementation success factors. They found that several “soft skills” that are associated with ERP success such as change management, organizational and employee resistance, and performance incentive schemes are not sufficiently emphasized in ES education programs. Their study has implications for the design of ERP classes comprising issues worth paying more attention to.

2.2 Pedagogical Principles and Perspectives on Learning

This section presents a summary of pedagogical principles and perspectives of learning. This literature provided us with important knowledge while planning and organizing ES classes for IS graduates. We utilize perspectives and principles from both educational and organizational literature. We elaborate on instructivism, cognitive learning, constructivism, experimental learning and socio-cultural pedagogy.

The traditional classroom approach to learning or instructivism builds upon pedagogical theory and learning principles of “behaviourism” (Skinner 1954). This approach is mostly based upon one-way communication events between teacher and students. Dynamic interactions and dialogues between classmates and between students and teacher are rather seldom. The content of the course is usually broken into small units and presented in a controlled way through verbal and graphical instructions (Mckenna & Laycock 2004). Instructivism is often associated with cognitive learning in which knowledge is possessed in the heads of individuals. A cognitive learning approach ranks individual knowledge higher than collective knowledge assuming that the individual thinker is the repository of what is known (Cook & Brown 1999). Cognitive learning is defined as the acquisition of knowledge and skills by mental or cognitive processes while individuals apply procedures to manipulate information “in their heads” (Jones & Idol 1990). Cognitive processes include creating mental representations of physical objects and events, and other forms of information processing. Students as learners in the classroom may build declarative knowledge in terms of “knowing what” (facts, concepts, theories) (Brown & Duguid 2001), however, building procedural knowledge or “knowing how” is more challenging in a class-room context.

Instructivism and traditional teaching approaches, have been criticized for generating passive students in contrast to active learners (Dewey 1986; Lave & Wenger 1991; Vygotsky & Cole 1978). Dewey (1986), who introduced experiential education, argued that traditional education was authoritarian not taking the students’ actual learning processes through experience into account. Lave & Wenger (1991) who introduced situated learning (supporting socio-cultural pedagogy) did also criticize the traditional classroom model and cognitive learning for being too mechanistic focusing on transmission between teacher and students. In addition, instructivism is blamed for only stimulating surface learning (e.g. Atherton 2009). In contrast to the instructivism approach, constructivism, experiential approaches and socio-cultural pedagogy promote learning contexts that make students more engaged as active learners. The role of the teacher is more facilitating than authoritarian; the learning environment is less hierarchically
designed and allows for increased flexibility and collaboration between teacher and students. Learning therefore becomes a reciprocal experience for both students and teacher (e.g. Vygotsky & Cole 1978).

The teacher according to constructivism, should not provide fixed answers, but guide the students to be active learners that search independently for learning resources. Scaffolding is a pedagogical means that stimulates active learning processes by extending students’ understanding by pushing them beyond their current abilities and level of understanding (Hammons & Gibbons 2001). By gradually reducing scaffolding (e.g. reducing extensive support and fixed answers) the teacher entrusts the students to learn more independently.

In socio-cultural pedagogy the situated learning model has got much attention since it focuses on collective learning and accordingly it is in contrast to cognitive learning focusing on individual learning. In contrast, situated learning takes place in communities of practice through socialization processes, peripheral participation an active involvement in practice (Lave & Wenger 1991; Brown & Duguid 1991).

Because of several existing and sometimes competing pedagogical approaches and perspectives of learning as described in the above, it is important for educators in general and educators teaching ES in particular, to have a broad understanding of different learning models, pedagogical principles and knowledge perspectives to organize a suitable learning context. To some extent we favor a socio-cultural learning model (Lave & Wenger 1991). The educational literature, however, does also emphasize that teachers do not necessarily need to choose one learning model over another. For instance, Sfard (1998) maps cognitive learning – the acquisition metaphor with socio-cultural learning – the participation metaphor. The process of “knowing” is a process that is established based upon acquisition, that provide the students with “knowing what” through having, possessing, in combination with active participation and communication in student teams/communities.

If we turn to organizational literature, we notice that socio-cultural pedagogy also has some analogies to sensemaking, which highlights action, activity, in which meanings are interpreted, rejected and reinterpreted in ongoing processes (Weick 1995). Sensemaking in organizations is a social process where the cognitive and the social are intertwined to a network of inter-subjectively shared meanings that are sustained through the development and use of common language and everyday social interaction. It also illustrates a combination of both acquisition (the cognitive) and participation (the socio-cultural/practice-based) approaches.

Sensemaking is also related to concept of the reflective practitioner, highlighting that our knowing is in our action (Schön 1983). Schön (1983) proposed a cycle of four learning activities: experiencing, reflecting, interpreting and taking action as an umbrella theory to understand different learning processes. Reflection is a key activity since it enables an individual to uncover and make experiences explicit.
3. Research Setting and Method

The paper reports from teaching activities performed in ES classes for IS graduates at a Norwegian University. The study builds upon seven years (2003-2010) of teaching experiences. Through an overall abductive approach, our teaching framework has gradually emerged through interaction between existing theory and empirical data. The framework was built, implemented and evaluated through iterative design processes over time.

3.1 Research Setting

The Faculty of economics and social sciences at this university has more than 2000 students, whereof the majority is in Business Administration. The Faculty also gives education in Information Systems, Management, Development Management, Political Science and Social Science. The Centre for ES started its operations in January 2007 to promote the teaching of ES at the faculty. The raison d'être for centre was that hands-on experiences of ES are highly appreciated by employers of graduates.

From the outset, the primary focus was developing lab modules for business administration courses to provide students with hands-on experiences from ERP accounting systems and CRM systems. The strategy was to get ERP software embedded as natural ingredients of different business administration courses. Moreover, the aim was to illustrate how theoretical ideas and concepts describing these systems in the literature, also fitted with these systems in practice. For example, how marketing, business intelligence, decision-making and managerial coordination may benefit from utilizing CRM systems, and how ERP may support and decrease amount of manual work in accounting and finance.

Moreover, ES courses already taught at the IS graduate program (2003-2007), changed their curriculums from being mainly conceptual courses towards a combined multi-modular approach comprising both theoretical and practical modules. By emphasizing the practical modules in these courses, project work assignments and lab exercises become important parts of these courses' curricula. The purpose of the lab module is to achieve learning by getting hands-on experiences on specific ES software packages. The aim is to understand usability of the system, configuration issues and customization opportunities, and furthermore to reflect on potential consequences of customizing an ES.

The centre runs Visma Global, Microsoft Dynamics AX 3.0 and Microsoft Dynamics NAV 5.0, provides the ARIS modeling tool and utilizes Microstrategy BI from Teradata. The Software-as-a-Service (SaaS) system, “Xledger”, became up and running at the end of 2009. Microsoft provides educational licenses for all Dynamics products free of charge. The centre continuously considers new ES and has ongoing dialogues with different ES vendors.
3.2 Research Methods

Firstly, this study has followed an overall abductive approach by systematic combining existing theory and empirical findings (Dubois & Gadde 2002). Theoretically, we have utilized pedagogical principles, learning perspectives and ES literature and combined these with empirical data consisting of teaching experiences and students’ evaluations.

Secondly, this study has utilized design research principles (Hevner et al. 2004; Sein et al. 2011). In IS research, design research creates and evaluates IT artifacts to solve organizational problems (Blakey et al. 2008). Moreover, March and Smith (1995) have categorized IT artifacts into constructs (e.g. vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices) and instantiations (implemented and prototype systems). We have applied these principles and set of activities described in the design research literature (e.g. build and evaluate) (Hevner et al. 2004) while developing ES curricula, and our product (artifact) is the emerging teaching framework. The research process took place in iterative circles repeating the set of activities (build, evaluate) over time.

Thirdly, this abductive design process was also a sensemaking process for the actors involved (Klein & Myers 1999). During these design loops, we interpreted, reflected and developed theoretical interpretations of the learning context emerging over time. In addition to teaching experiences, empirical data consisted of results from three sources based upon dialogues with students, ES colleagues, and CIOs from local businesses.

4. The Design Process

This chapter describes the iterative design of the ES courses. By contrasting our teaching experiences and learning outcomes with literature, we implemented gradually and extended the use of different pedagogical principles and pedagogical means to stimulate learning processes among students.

4.1 The Introductory Course in Enterprise Systems in 2003 – 2006

The introductory course in Enterprises systems (ES I) was first given in the fall semester 2003. It was a compulsory course in the first semester in the master program in IS, and was an overview course that encompassed a variety of ES topics. ES and in particular ERP had received increased attention in the 1990s and had been widely adopted among businesses. It was therefore very timely that the master program in IS put more explicit emphasis on ES. The topic is, however, very complex and places high requirements on faculty competence.

The aim of this course has not changed much over time; the main goal is to provide the students with an understanding of different concepts of ES. It is the organizing and the use of pedagogical means which has been undergoing changes over time. The course provides an overview of various IT-based systems that support enterprise-wide functions and processes. The students get a fundamental
insight into the critical factors and challenges for planning, implementing and using of such IS, as well as which role the applications will play in an integrated IS architecture. The course also focuses on possibilities and constraints of the various systems, as well as the factors that influence implementation and use.

The course initially consisted of two sub-modules; a theoretical module introducing concepts of ES through books and articles, and a project assignment conducted in groups (2-4 students per group). In the project assignment the students should either discuss an actual issue within the ES domain, or conduct a small study in an organization that already had an ES installed, was planning to implement an ES or was in the middle of an ES implementation process.

The course was organized as weekly sessions which mainly focused on traditional classroom teaching with lectures given by faculty. In parallel with lectures and readings, students carried out their project work and completed this with a report and an oral presentation.

Two faculty members were in charge of the course in 2003. One had long experience as a CIO from various businesses, and had just joined the faculty. He had a wide experience that significantly complemented the academic faculty. It was therefore possible to assemble an appropriate course curriculum, with important input from practice. He was involved in the course from 2003 to 2006. The other person in charge of the course was an associate professor that primarily had academic background. In addition, they involved three of the other faculty members that supplied modules on topics such as data warehousing, knowledge management and ERP systems. There was also one guest lecture from a CIO in a large company that had implemented SAP and won an award in 2003 for their Data Warehouse application.

The students generally found the course topics quite challenging and the readings quite abstract. It was quite difficult to comprehend the implementation issues and the related challenges. On the other hand, they indicated that guest lecturers were very valuable. One students commented: “The course is too theoretical oriented, we do not understand what ES really are about … Why can’t you take us to a company so that we can see these kinds of systems, see how they work in practice?”

The course was also given in the fall semester in 2004. Based on the experience from teaching the course in 2003, and the input from students, it was decided to integrate more input from industry. It was decided to have two guest lectures and a visit to a local company. The number of other faculty that contributed was also increased to five. Otherwise the curriculum was similar to the one from 2003. The number of industry guest lecturers was increased even further in 2005 and 2006, and now comprised five quite different industries such as food and beverages, health, consulting, software development and oil and gas exploration. In addition, there was a demo of an ES for Small and medium sized enterprises.
To provide more practical and applied business cases, the teaching team contacted local industry, and organized a visit to a company. The company operates in the food and beverage sector and has five SAP modules installed (implemented in 2002). One of the employees organized a round trip inside the factory to provide the students with an overview of the business processes and logistics that were supported by the system. Processes such as ordering, production, packing, inventory and shipment were emphasized. In addition, the students got a demonstration of the system. The students were quite satisfied with this round trip and demonstration, and the session was repeated in the following years.

The rest of the curriculum remained stable, and still comprised a variety of ES topics. Two of the faculty members were responsible of the course, and three other faculty members contributed with specific modules such as content management, knowledge management and in-depth ERP. This format was also run in 2006.

It became apparent that there were some serious challenges to provide a quality ES course, which would give students adequate ES skills. Feedback from students indicated that the course was very abstract and that theory and concepts were hard to grasp. Students also expressed a desire for a more applied and hands-on approach.

4.2 The Enterprise Systems Courses in 2007-2008

In 2006, several of the faculty raised the issue of creating a hands-on lab with ES systems. Other institutions had recently taken steps to provide such lab facilities. The faculty started a dialogue with the University of Gothenburg, who one year earlier had established a center for ES. The major purpose of this center was to provide hands-on ES lab in business courses. Based on these experiences, it was decided that we would apply for external funding for establishing a center for ES. The goal of this center would be to provide hands-on ES course modules in business and IS courses. In addition, the center should become a competency resource for local businesses on ES implementation issues. We were able to get backing from the Faculty as well as external funding from a local competency foundation.

The increased focus on ES did also lead to a more deliberate process among the key faculty to further develop the ES curricula. This led to some changes in the master program. The introductory course was moved from first semester to the second semester, and was therefore next given in the spring semester of 2008. Furthermore, an advanced course in ES was established as an elective (ES II). This course was first given in the fall semester of 2007, which was the third semester of the master program. This purpose of this course was to focus on advanced topics in ES, and it has in 2007-2010 concentrated on ERP implementation issues. It was decided that this course would combine theoretical issues with hands-on lab exercises and student projects. One of the faculty devoted significant time to create a lab module in Microsoft Dynamics AX for this course.
The introductory course (ES I) was given again in the spring semester of 2008. The lab module in Microsoft Axapta was included, as well as a content management and a knowledge management lab. There were guest lectures from three companies, and a visit to one company. In addition, there were guest lecturers from two vendors of ES. The course topics were similar to previous years, with the emphasis on the variety of ES systems.

In the fall semester of 2008, ES II expanded the lab exercises to weekly sessions. Microsoft Dynamics NAV 5.0 was used, and we utilized teaching resources from Microsoft’s website “CustomerSource” that provides e-learning packages and training materials for academic institutions. We focused on assignments to understand logistics (purchase, sale, inventory, and finance modules).

Another important implication of the center was that we began to discuss the pedagogical principles for teaching ES. We had iteratively created curricula in the ES courses that now consisted of three learning arenas: classroom, ES lab and projects in organizations. We now needed to reflect further on providing a learning environment that integrated these contexts. We conjectured that we would gradually and iteratively develop the pedagogical framework further. This would be done by refining the framework and curricula each semester, as depicted in figure 1. We would discuss the experiences, student feedback and assess the learning outcomes. The yearly evaluation process is further elaborated in chapter 5.

The experiences would be input for the further discussion of the underlying pedagogical principles and the pedagogical framework. We therefore reviewed various perspectives on learning and pedagogical principles from both educational and organizational literature. The revision of the pedagogical framework led to yearly revisions of the curriculum and course activities.

We analyzed and contrasted our ES teaching experiences with learning theory and the findings about ERP skill requirements in Boyle and Strong (2006). The most important skill set in Boyle and Strong (2006) related to business function knowledge. The IS students are taught some business functions in the bachelor program. Our ES courses build on a course in IT and business development in the first semester. Students get some exposure to business processes in this course, through term projects in local businesses. The students do interviews with managers and study process descriptions, and map various business processes in the process modeling tool ARIS. We conjectures that we should extend the focus on business processes in the ES courses, and emphasize the significance of modeling and understanding the business processes as a requirement for ES implementation. In this way, the students get a good exposure to business functions and processes.

The second most important skill set in Boyle and Strong (2006) is technology management knowledge. We felt that the students get adequate technology management training in the courses in the master program. The third and fourth most important skill sets are interpersonal and team skills and knowledge. These sets emphasize such skills as abilities to accomplish assignments, deal with
uncertainty, being proactive and to work cooperatively in a team environment. These are “soft” skills that normally are not emphasized in an IT program. We conjectured that we needed to create a cooperative learning environment that would stimulate students to develop these soft skills. Furthermore, we decided that we should emulate the organizational learning processes involved. We therefore decided that the student teams would integrate issues from theory with hands-on laboratory exercises and projects in organizations. This requires that the major part of the learning activities should take place within student teams.

We argue that inter-subjective sensemaking (Weick 1995) is necessary to make sense of ambiguous situations, characterized by application of tacit knowledge and/or insufficient formal knowledge frameworks. This entails a collective sensemaking to share interpretations and explore meanings. Students also need to apply codified (articulated) knowledge to make sense of ambiguous situations, generically subjective sensemaking (Weick 1995). Collaborative learning consists of practice-based learning, and we utilize situated learning theory (Lave 1988), to understand learning processes that occur in student teams (in the project organization and in the lab). Lave (1988) argues that learning as it normally occurs is a function of the activity, context and culture in which it take places, thus it is situated. Moreover, collaborative social interaction is a critical component of situated learning which leads to the social construction of knowledge (Brown et al. 2001). Project work in organizations and laboratory assignments are important pedagogical means that enhance collaborative learning. We surmised that traditional classroom would not be well suited for ES courses, and that we should put more emphasis on student activity. This implied that we would define our role as facilitators, and guide the students to be active learners, and not provide them with fixed answers. We also adopted the concept of “reflective practitioners” (Schön, 1983) and the cycle of four learning activities (experiencing, reflecting, interpreting and taking action) as a guiding principle. We would see our mission as to develop reflective practitioners, with the ability to reflect and integrate complex ES issues. We would stimulate students’ reflection through assignments and projects.

4.3 The Enterprise Systems Courses in 2009

For the ES I course in 2009, we decided that we would introduce our pedagogical approach to the students. By being explicit about our pedagogical approach, we could make students reason and learn about their learning processes. We would thereby attempt to create a meta-level of learning. We emphasized our pedagogical approach and our framework in the introductory lecture, and several times through the semester. We presented the pedagogical framework consisting of the three learning contexts and the significance of group interactions for learning. We strongly encouraged the students to work in teams throughout the semester. We organized group projects that included several group presentations. We arranged labs with Microsoft Dynamics NAV and Microstrategy Business Intelligence (BI), and run demos of a knowledge management system (AskMe) and a Software-as-a-Service (SaaS) system (Xledger.net).
The ES II course was run in a similar fashion in the fall semester of 2009. The focus within lectures and class activities was on ERP implementation, while the focus in lab was on installing and configuring Microsoft Dynamics NAV and two open source systems, Sugar CRM and Dolibar (ERP system). Students were required to work in groups on lab assignments and case assignments.

We found that the focus on the pedagogical approach increased student motivation and heightened the student awareness about the interplay between the learning contexts, and the rationale behind our teaching approach. There were an increased activity among the students, and more students demonstrated good understanding of different ES topics. However, we were not fully satisfied with the student participation in class. Approximately one third of the students would seldom contribute to discussions in class. The exam results corroborated this view. Discussions with the student representatives after the semester indicated that we could increase the extent of group assignments.

4.4 The Enterprise Systems Courses in 2010

Primarily, our intention was to further increase the student self-learning activities. We reduced the number of lectures in ES I in the spring semester, and used lectures mainly to introduce to new concepts and topics. We continued the strong emphasis on team work from the previous semester. We emphasized that they should view the professors as facilitators, and their peers as valuable resources. In that way, the scaffolding was reduced gradually (Hammons & Gibbons 2001), and the sessions became more student centric over time. We required the students to prepare presentations of 1) various research papers, 2) selected system vendors, 3) various emerging technologies and current issues and 4) the term projects. They were also supposed to discuss case exercises in the groups. The students would present their term projects at several stages, and two groups would be responsible for providing feedback for each group. In this fashion we were able to make the students more accountable for the course progress.

There were just minor changes with respect to topics and lab exercises. We added three guest lecturers from ERP vendors.

In ES II, we decided to offer lab with several ERP software packages from different vendors. This would allow us to expose the students to a wider set of ES applications. We continued to use Microsoft Dynamic NAV 5.0, and provided a lab in a SaaS system (Xledger.net), SAP and an open source ERP (Dolibar).

There has been an increased focus on cloud computing and SaaS ERP systems. We therefore decided to use the Xledger ERP solution. SaaS principles are especially appropriate for small companies that usually have limited resources. Investing in ERP packages, expensive hardware and architecture solutions may be difficult to handle in small companies. In SaaS solutions, the customer has online access to the software and works on the vendor’s server, only paying for the transactions. In Norway, most of the companies belong to the small and medium sized enterprises (SME) category, and it is therefore important for Norwegian students to know systems made for these organizations. A consultant from Xledger
supported the teaching of the software and offered training material and assignments. These assignments focused mainly on accounting and project management. From a teaching perspective, this ERP solution was easier to maintain and upgrade, but still required significant training.

We provided a SAP mini course by hiring external expertise. Assignments were focusing on basic logistic functions (mainly purchase, inventory and sales modules). Finally, we also installed and used the open source solution, Dollibar, mostly for demo purposes.

We experienced an increased student motivation and class participation through 2009 and 2010. The students thrived on the increased extent of mandatory group assignments, and increased responsibility for making contributions during the sessions. A collaborative and competitive atmosphere did emerge; students provided feedback for each other within and across the groups. On the other hand, groups and students competed to make the best presentations and projects.

Students were quite satisfied with both courses. The regular master students were particularly satisfied with the lab exercises, getting hands-on experience to complement the classroom learning. Two German exchange students had previous lab experience with SAP. In their evaluations, they emphasized the benefits of integrating the theoretical issues from the classroom with the lab assignments. They were also satisfied with the lower learning curve of our ES lab (e.g. Microsoft assignments) compared to the SAP lab.

One significant effect was that the advanced ES course became the most popular elective. The department board had decided early in 2010 that it would only run the course every second year. Because of its popularity among student, this decision was overturned.

5. The Evaluation Process

The design of curricula and the teaching framework for ES classes went through evaluation processes every year. We describe this process of evaluation through an interpretive lens focusing on ongoing dialogues that made influences on our sensemaking process (Klein & Myers 1999). These dialogues took place between 1) teachers within the teaching team responsible for the ES courses, 2) the teaching team and the students participating in ES classes, and 3) the teaching team and participants (CIOs) from local business sector. The following section designates of how these dialogues came up.

5.1 Dialogue between Instructors Teaching ES Classes

In the period between 2003 and 2006, the responsibility for the sessions of a class was divided among several instructors, and there was limited exchange of experiences between the involved instructors. The introductory course was a bit fragmented, and there was a need for more integration of the content within the course. From 2007 and further on, normally two instructors were responsible and
practiced team-based teaching. During sessions, one of the teachers is responsible for the main lecturing, while the other teacher supplies and supports his/her colleague with examples and relevant questions to stimulate the discussion among the students in the class. The responsible teachers have continuously dialogues regarding their experiences, reflections, and suggestions for improvements of ES classes.

5.2 Dialogue between Faculty Staff and Students

There has been an ongoing dialogue between the students and the instructors who teach ES classes. Students’ feedback is not limited to centralized evaluation schemes and surveys posted by the university administration. In fact, the evaluation schemes are not very popular among the students, and few students respond. Results from these surveys are often difficult to follow up from the teachers. Thus, a central aim for the teaching team has been to establish constructive and regular dialogues with students throughout the semester. For instance, at the end of a session, the teachers ask students about the learning outcome, what the most difficult issues were, what seemed unimportant topics, and what would benefit the session more. This democratic routine might be easier for a Scandinavian university to establish compared to elsewhere in Europe or US. The university culture of Scandinavia has the characteristic of being quite egalitarian with an informal atmosphere among students and teachers. Based upon these feedback and dialogues with the students, teachers discuss and reflect on their experiences, and make decisions on how and what to improve. These dialogues become an iterative and ongoing process to make final decisions of improvements and actions to take in existing class and/or in forthcoming classes.

5.3 Dialogue between Teaching Team and Externals

The instructors teaching ES classes have over time established research contacts with firms and CIOs that are acquiring, implementing, using or supplying ES of different kinds. The CIOs share important competencies and suggest practice-based assignments for the project module within the ES classes. They also arrange contacts through their company networks and suggest other firms that students may collaborate with to do their projects. Furthermore, the teaching team gets advices for improving lab assignments.

In addition to these dialogues, the teaching team participates at different ES seminars to keep track of emerging technologies and new market trends, and for establishing new contacts with actual ES vendors and CIOs.

5.4 The Research Process as a Sensemaking Process

Analysis of these dialogues transpired iteratively between activities of 1) reflection, interpretation and evaluation of past dialogues, and 2) participating in new ones, and 3) development of preliminary theoretical constructs. This process followed the ideas of Klein and Myers’ (1999) third principle: “The principle of interaction between the researcher and the subjects; Critical reflection on how the research materials (or “data”) were socially constructed through the interaction between the
researchers and the participants” (ibid., p. 72). The themes emerged through interplay between the actors consisting of students, the teaching team and the participants from the local business sector. It was advantageous to be two researchers (both members of the teaching team) in the process of theorizing around a pedagogical approach since we had the possibility to question each other’s assumptions of learning.

Figure 1 summarizes the research process as a context of sensemaking. The figure presents the actors (industry partners, students, and teachers) and artifacts involved (curriculum, theory, and prior empirical studies of teaching ES classes). Furthermore, it presents the hermeneutic circle in terms of different sensemaking processes that occur iteratively in terms of experiencing, participating in dialogues, reflecting, interpreting, and taking action such as implementing changes in the course program.

While theorizing around our experiences from teaching ES classes, different learning theories and prior empirical studies reporting from teaching ES classes informed and guided our research process. According to the principle of dialogical reasoning, the researcher’s frame of reference may include inevitable prejudice (principle 5, Klein and Myers 1999). However, our readings of research studies and theories influenced the analysis in a critical manner. Besides, interpretive research allows for flexible use of established theories during the research process (Walsham 2006). Reflections of new theoretical frames happened gradually as the analytical process proceeded. For instance, while cognitive learning models dominated in the beginning of teaching ES classes, a more integrative and collaborative learning approach emerged over time.

Through an ongoing process from preliminary understandings of the parts, through an emerging understanding of the whole, and then back to a reinterpretation of the parts, the final product of the research process became accomplished. The final product comprises a complete puzzle of interpretations of the infrastructure of the course structure in terms of the learning contexts, the pedagogical means and the learning processes.

In this hermeneutic process of sense making, each iterative circle of statements and interpretations from participants represents the parts, while the evolving teaching framework, the learning context triangle, constitutes the whole.
6. The Pedagogical Framework

We iteratively developed our pedagogical framework through teaching the ES courses. In this section, we summarize the design process and present our final artifact which is our teaching framework, the learning context triangle.

Several research studies have documented that ES implementations in organizations represent complex phenomena. These are challenging topics to teach in universities. We conjectured that to create a learning environment that stimulates students’ knowing processes, we need to integrate real-life ES implementation issues. Further, we decided that we should emulate the organizational learning processes involved. We therefore decided to integrate issues from theory with hands-on laboratory exercises and projects in organizations. This requires multiple teaching contexts and levels of learning, and the major part of the learning activities should take place within student teams. The learning environment should integrate learning processes about the ES and the organizational context in addition to the traditional classroom learning.

We organized our framework into a graphical model to depict the interaction of the various contexts. Figure 2 depicts our three-dimensional teaching framework, “the learning context triangle”. The teaching framework comprises a combination of different learning contexts, pedagogical means, and illustrates how this integrative teaching approach initiates various learning processes.

By combining the learning contexts, we attempt to bridge the epistemologies of possession and practice to induce the “generative” dance (Cook and Brown 1999) between knowledge (cognitive learning) and knowing (practice-based learning).
The laboratory context would stimulate learning through experimenting (also based upon Dewey’s innovative and experimental teaching approaches and Kolb’s continuation in an organizational context, as well as practice-based learning, depicted in figure 2). The project assignments would expose the students to organizational settings and implementation issues (organizational project-based learning, figure 2). Both contexts require students to integrate theoretical knowledge from the classroom (codified knowledge, figure 2). Students are required to work in teams to promote collaborative learning dynamics. By gradually reducing scaffolding, the students were pushed across the boundaries of their knowledge, and became able to internalize new knowledge and integrate it with their existing knowledge.

![Diagram of the learning context triangle]

Figure 2. The learning context triangle

7. Conclusion

We have developed the learning context triangle artifact to guide the teaching of ES courses. It was developed through iteratively designing graduate courses in ES from 2003 to 2010 in a Norwegian university. Altogether, our pedagogical approach resulted in an integrative approach to ensure a learning environment that provided a diversity of ES skills for IS graduates. By combining different pedagogical principles, the aim was to stimulate deeper learning processes that
enhanced collaboration, creativity, analytical abilities, as well as reflection and sensemaking processes among the students. Teaching ES implies pedagogical challenges for the educators. We illustrate how we approached the pedagogical challenges related to providing this learning environment. Our goal is to teach students the skills needed to be proficient ES implementers and reflective practitioners. Complex learning processes take place when organizations implement ES. Therefore, we need to prepare students for these complex organizational processes, and the organizational learning processes involved.

We presented and utilized the learning context triangle in the lectures in ES in 2009 and 2010. We have referred to the triangle through the semesters. The triangle was well received in class, and we maintained a very good class atmosphere, and students were well motivated to work with complex and challenging assignments. We believe that it created a meta-level of learning. It made students reason and learn about their learning processes. This made students actively involved in shaping the learning arena, and understanding the significance of the group projects. We believe that it increased student motivation and heightened the student awareness about the interplay between the learning contexts, and the rationale behind our teaching model.

We propose that other programs teaching ES can adopt our framework. Future research should empirically test and extend our framework. This model has been developed based on teaching experiences in one setting, and therefore should be tested and further developed in other universities. We propose that its applicability to other courses should also be tested, in IS as well as other studies.

In the future, we will extend the lab with other ES. We are presently looking more into Software-as-a-Service (SaaS) systems, issues related to Service-oriented-Architecture (SOA) and open source ERP systems. Moreover, we are in the process of creating a virtual company context that can be integrated into most courses at the master program in IS. This development is being done in cooperation with a local company.

References


From research-led teaching to teaching-led research in accounting

Jan Bots, Ivo De Loo, Fred de Koning

Abstract

Accountants are researchers by nature: it is, among others, their task to judge if material weaknesses are present in financial statements of organizations. More than a thousand students are currently following a part-time Master of Science curriculum in accounting at the Nyenrode School of Accounting & Controlling. They already work in practice, either as chartered accountant-to-be or as management accountant-to-be. We have recently developed four courses that the students are obliged to follow near the end of their studies, following the concept of teaching-led research. Students have to choose one out of these four courses. All of them focus on conducting research hands-on. So far, we have experienced quite a lot of advantages of the new courses: (1) it is a good training exercise for students to prepare their master’s thesis; (2) using their professional network, it is relatively easy for part-time students to approach organizations to participate in the research projects; (3) this way of working provides us with a unique database which faculty and/or students can use for publications in peer-reviewed journals; (4) the courses are stimulating: both students and faculty feel that they are delivering a useful contribution. A possible disadvantage is the reduced freedom of choice for students in choosing the research projects they want to participate in.

1. Professionals and professional accounting education

Accountants, both management accountants and CPAs, are professionals, just like doctors, engineers, lawyers, and nurses (Wilkerson 2010). Education for professionals needs to bridge theory and practice. The relationship between theory and practice in professional education, and how the links between the two can be established, is a topic still open for discussion (Wilkerson 2010; O’Sullivan et al. 2010).

In health care education, Regehr (2009) sees many dilemmas surrounding the place and value of applied vis-à-vis more theoretical research in curricula. When discussing Business Schools and management education, O’Brien et al. (2010) ask whether research really adds value for students. Burke & Rau (2010) believe that a stronger link between research and teaching is critical in enhancing students to be lifelong consumers of management research.


Accountants are researchers by nature. It is their duty to look behind financial figures; to determine whether the figures reflect the ‘real’ financial status of an organization. As professional doubt, curiosity and the need to keep on questioning oneself and others are important characteristics of research behavior (Blumberg et al. 2008), one may
expect accountants to exhibit such characteristics as well. Quite a number of accountants do not seem to realize that they are partly failing to take into account other elements than just the reliability of financial information when judging an organization's state of financial affairs, probably because of a lack of research orientation in their mindset (Carnegie & Napier 2010).

At the Nyenrode School of Accounting & Controlling, we therefore aim to implant and strengthen such a 'research mindset' in students. We want them to be more receptive to research, and more oriented towards (scientifically founded) doubt, skepticism and curiosity in their professional activities. We have developed four teaching-led research courses for Master of Science students in accounting and controlling. In this way, we hope to deliver more broadly skilled accountants. We are convinced that a better understanding of research will help students, and later on alumni, in their professional life.

2. Objective: a teaching-led research course in an MSc in accounting program

More than 1000 students are currently following a part-time Master of Science in accounting program at Nyenrode School of Accounting & Controlling. Only part-time students participate in the program. This is from a research perspective both an advantage (they understand the accounting problems from their own experience; they have business contacts) and a disadvantage (their research orientation is perhaps less developed as compared to that of full-time students).

The concept of a teaching-led research course was originally developed in the Master of Science program in controlling some eight years ago. Following and extending this concept there have now been developed three teaching-led research courses in the Master of Science in Accountancy program: (1) a survey based course in Accounting Information Systems (AIS); (2) a course based on experiments in Auditing; and (3) a course based on archival data analysis in Financial Accounting. All Master of Science students in Accountancy have to choose one of these three courses.

This paper intends to describe the structure, content, and evaluation of the AIS course.

3. Methodology: design considerations

Closely supervised by faculty members, students work ingroups in the AIS course in order to go through a research process, which ends with the writing of a research paper (a ‘mini thesis’). By doing so, students have to set all the steps generally involved in developing a thesis, from its planning phase to the actual writing-up of the thesis (Blumberg et al. 2008). In this way the course is a good preparation for the ‘real’ master thesis which they have to writethereafter.

The course consists of nine steps, with a possible tenth step useful for faculty members. (1) Reading, presenting and discussing research articles on a variety of AIS-related topics (like information quality, information systems, data management, etc.). (2) A written examination about these articles. (3) Developing a (‘mini thesis’) research design. (4) Receiving an extensive survey instrument developed by faculty members; this year the general topic of the AIS course was Enterprise Research Planning (ERP) systems in SME, an apparent gap in current research (Esteves and
Bohorquez, 2007). The survey instrument consists of existing, validated survey instruments. The ERP-related research topics contained in the survey are: past and current firm performance (using both financial and non-financial measures), decision-making about implementing the ERP-system, the role of the respondent (financial director, CFO, controller) in the ERP implementation phase, the perceived success of the implementation phase of the system, the data processes that are supported by the system, the considerations made by management to implement the system, the actions taken to advance the project during the implementation phase, and some general organizational characteristics, like its sales and number of full-time employees. (5) Developing a research proposal by each group of students, within the boundaries of the survey instrument mentioned before. (6) Approaching and interviewing a CFO / financial director / controller of an organization within their network, using the survey instrument. Each respondent should fill in the whole questionnaire, not only the part the interviewee is interested in. Each student should interview four people, generating 108 completed questionnaires with 27 students. (7) Assembling all data in pre-prepared datasheets, which are subsequently assembled by faculty members and spread among students, so that each group receives the data on the topics they need, according to their research proposal. Each group receives the (according to them) necessary data of all respondents, not only from the respondents they have interviewed themselves. (8) Analyzing the research questions which have been raised in the research proposal. (9) Writing a research paper (a ‘mini thesis’) which has to be presented to, and subsequently assessed and graded by faculty members. (10) If possible, a paper is written by faculty members on the basis of the assembled dataset that may be submitted for publication in a peer-reviewed journal.

4. Initial findings

There are several main findings, which actually extend to all the courses in the Accountancy curriculum, not just the AIS course. (1) The courses appear to be a good training exercise for students to prepare their master’s thesis afterwards. (2) Using their professional network, it is possible for students to approach respondents to participate in the various research projects quite easily. (3) This way of working provides us with a unique database that is gradually enlarged as the courses are repeated. (4) Faculty, sometimes in cooperation with students, can use the database for publications in peer-reviewed journals. (5) Students evaluated the course very favorably; scores were above average compared to evaluations from similar, earlier courses. Perhaps the most important finding in this context is that students and faculty feel that they are delivering a useful contribution during the course. Evaluations indicate that they experienced research as an ‘insight-giving’ activity and as a real ‘pleasure’.

A possible disadvantage is the reduced freedom of choice for research projects for students compared to the past - when more or less everything was possible. And, it is less easy to switch between courses: if someone has followed the AIS course, it takes substantial extra time if he or she wants to prepare his or her master’s thesis in, say, Financial Accounting.

5. Discussion

We want to contribute to the discussion about the professionalization of accountants and to the discussion about the contribution of accounting education to this (St.Pierre
et al. 2010). The concept of teaching-led research looks promising in enhancing the research mindset of accountants, and may be seen as an interesting alternative to other, similarly interesting, developments (Hoque 2002; Paisey & Paisey 2005; Jalbert 2008). By and large, the preliminary results of the AIS course seem to support our expectations.

**Literature**


Factors Affecting Accountants’ Job Satisfaction and Turnover Intentions: A Structural Equation Model

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Abstract

The present research attempts to examine accountants’ job satisfaction focusing on specific job and organizational related factors, such as organizational and professional commitment, work motivation and job characteristics, which seem to affect job satisfaction and intention to leave (turnover).

A structured questionnaire has been used to collect data from 213 accountants working for different organisations located in the region of East Macedonia, Greece. The proposed model has been tested using the structural equation modelling.

The analysis of the model confirms the majority of the initial hypotheses. These results provide strong evidence and highlight the need for specific action from accounting office/department managers to improve working conditions and strengthen employees commitment and, thus, to enhance their performance and weaken their turnover intention.

Keywords: Job Characteristics, Work Motivation, Commitment, Job Satisfaction, Turnover

1. Introduction

Job satisfaction and the concepts related to it, such as organizational and professional commitment, have attracted the interest of many researchers. A great amount of theories have been developed regarding those organizational issues because of their practical and theoretical importance.

The main target of all organizations is to improve their productivity and, consequently, their performance and, thus, to become more competitive and gain a larger market share. HRM departments or managers of accounting organizations, despite the size of the company or the volume of activities, should be seriously concerned about their employees’ needs and work towards establishing satisfactory working conditions to enhance satisfaction.

Early studies on job satisfaction date back to 1924, when Elton Mayo found that novel changes in working conditions can increase productivity. Focusing on
accountant’s job satisfaction, Strawser et al. (1969) were among the first to examine the impact of job satisfaction on the productivity level within this profession.

Job satisfaction reflects employees’ feelings regarding their work and has been found to affect many operations within the organization. If the level of satisfaction is low, the impact on the organization may be negative and vice versa. On the other hand, when employees’ level of satisfaction is high, they are willing to exert considerable effort on behalf of the organization, feel that the level of internal work motivation is high, organizational and professional commitment is strong, while the management observes significant decreases of turnovers (Boles et al., 1997).

In the current ongoing competitive environment, the degree of job satisfaction is a critical factor affecting the consistency and continuity of an accounting firm. The advantages of examining employee satisfaction in accounting firms are very significant. The role of the accounting profession has been developed through the years. Their main duties used to be only to gather and report company’s past activities. However, accountants now are not restricted only to bookkeeping but they are involved in different managerial levels, analyze past, examine and evaluate present conditions and make financial decisions for future investments. Given the above, accounting organizations should not disregard the human contribution which is critical for the success.

The purpose of this study is to explore Greek accountants’ perceptions of their working environment and their effect on job satisfaction and turnover intention. In more detail, the study examines the possible effects of job characteristics, internal work motivation, and commitment (professional and organizational) on accountants’ job satisfaction and turnover intention. A new conceptual framework is developed incorporating all these factors, which are then tested using the structural equation modelling (SEM).

2. Literature Review

2.1 The Nature and Consequences of Job Satisfaction

Although a widely accepted definition of job satisfaction has not yet been established, job satisfaction generally describes the degree to which somebody is pleased or not with his/her job. Locke (1976, p. 1300) defines job satisfaction as “pleasurable or positive emotional state resulting from the appraisal of ones job or job experiences”. According to Spector (1997), job satisfaction is an emotional reaction to work and the different facets of work nature. This reaction can be positive or negative as it stems from the congruence between personal and work values.

Job satisfaction is a complex concept that according to Rose (2001) can be divided into intrinsic and extrinsic satisfaction. Intrinsic satisfaction is associated with the content of one’s job, such as autonomy, degree of responsibility, variety of skills, supervision etc. In general, intrinsic sources of satisfaction comprise the qualitative attributes of a job. On the other hand, extrinsic satisfaction is associated with one’s work environment (working conditions), such as working hours, safety, promotion opportunities, tangible rewards and other bonuses. It is necessary, therefore, to adopt a more detailed measurement of satisfaction, where both intrinsic and extrinsic characteristics are taken into account.

Apart from the impact of satisfaction on performance and intention to leave, the former also serves as an indicator of cost saving. In organisations with high rates of turnover, other kinds of costs are expected to be increased. These expenses
include the cost of hiring and training the new personnel. Also, for low levels of satisfaction, the effort each employee contributes to the achievement of the organisational goals is decreased and, consequently, leading to a decrease of organisational performance (Silverthorne, 2005).

2.2 Factors Affecting Job Satisfaction

There are numerous theories that are trying to explain the antecedents and consequences of job satisfaction. Much of the research on satisfaction is based on the motivation theories. Motivation refers to the forces that are responsible for the direction and the level of the efforts an individual puts into his work. Work motivation theories, associated with job satisfaction, are divided into two main frameworks; content theories, which focus on the importance of the work (Maslow’s Need Hierarchy theory, Aldefer-ERG, Herzberg’s Two Factor Theory, McClelland’s Need Theory), and process theories, which deal with the explanation of how professional characteristics interact with variables such as expectancies, needs and values of the employees that need to be satisfied (Vroom’s Expectancy Theory, Locke’s Goal-Setting Theory, Hackman and Oldham’s Job Characteristics Model etc). With respect to the effects of job satisfaction, it has been found to be associated such factors as, commitment, performance, turnover, absenteeism, well-being and general life satisfaction.

In the past, many researches have investigated the factors that are associated with employee satisfaction (Spector, 2008). These include demographic variables, such as age and gender (Moyes et al., 2006; DeVaney and Chen, 2003; Smith, et al, 1998; Spector, 1997; Benton and Halloran, 1991; Jewel and Siegall, 1990; Kacmar and Ferris, 1989; Kaufman and Fetters, 1989) and personal factors, as for instance, personality, previous experience and tenure (Spector, 1997; Benton and Halloran, 1991).

Except for the demographics and the various personality factors, it is important to consider some other aspects which are related to work and its attributes. These attributes are grouped into the following two categories (Arnold and Feldman, 1986).

- Reward structure, which consists of monetary remuneration and promotion
- Working environment, which is associated with the work itself, the relation with co-workers and supervisors etc.

2.2.1 Job Characteristics

Job characteristics include all the aspects that identify the nature of the work itself, working conditions and the relationships with colleagues and supervisors. Kovach (1995) attempted to define the attributes of job satisfaction indicating that employees ranked the degree of interest as the primary factor contributing to satisfaction, while good salary was the fifth. Conversely, managers thought that the first thing employees wanted to achieve was a good salary while they ranked interesting working environment as fifth. Indeed, employees are attracted by interesting and challenging tasks. The use of their skills and abilities to accomplish tasks with high demands influences job satisfaction. It has been observed that when the tasks are monotonous, without variety, and the employees are not given the chance to exercise fully their abilities, the level of satisfaction decreases.

2.2.2 Organizational Commitment
Organizational commitment is a concept that is strongly linked to job satisfaction (Silverthorne, 2005). It has attracted the attention of the researchers because it is a critical issue associated with the management of human resource. There are many definitions for organizational commitment; however, a lot of them include the concepts of psychological and emotional attachment to the organization. Organizational commitment can be defined as the relative strength of an individual’s identification with a particular organization and his/her involvement in it (Porter et al., 1974; Mowday et al., 1979).

2.2.3 Professional Commitment

Commitment to one’s profession can be defined as the dedication or devotion of a person to his/her profession (Bartol, 1979). High levels of professional commitment are linked to positive effects, such as greater satisfaction and reduced employee turnover (Elias, 2006).

However, comparing the effects of the two commitment forms, Sorensen and Sorensen (1974) found that organizational had a greater impact of job satisfaction compared to professional commitment. Additionally, results indicated that when working climate was satisfying, according to accountants’ values, there was also a positive relationship between organizational and professional commitment and this resulted to a positive correlation with satisfaction.

2.2.4 Internal Work motivation

People are stimulated to take action so as to achieve a specific task (Luthans, 1998). Through motivation they become committed to their jobs and, consequently, more satisfied. There is a positive correlation between satisfaction and motivation (Peerbhai, 2006).

2.2.5 Turnover Intention

Employee turnover is defined as the intention to exit an organization voluntarily (Nazim, 2008). The job satisfaction and intention to quit are inversely related. Intention to leave is strong when total job satisfaction is low, while when satisfaction remains at a high level, employee turnover is low (Vecchio, 2000). Nevertheless, it must be stressed that this relationship is not necessary observed in all circumstances. Some people remain in their jobs although they do not feel satisfied. This is mainly observed in situations where unemployment rate is high, few job are available and, consequently, the cost of quitting for the individual is high (Peerbhai, 2006).

2.3 Accountants’ Job Satisfaction

With respect to the relation between job performance and satisfaction, there are two contradictory views. According to the first argument, high satisfaction leads to increased performance, that is employees who feel happy with their work exert are more effort compared to the ones that are dissatisfied. According to the second point of view, performance impacts on job satisfaction. People who achieve high performance accept rewards resulting to an increase in satisfaction (Spector, 1997).

Spathis (1999) examined the job satisfaction of independent accountants in Greece, combined with employment, personal and social characteristics. Their
research results indicated that independent accountants are highly satisfied with their profession, which they have chosen because its characteristics are in congruence with their personality. Following accountant’s profession, they are able to achieve a successful career, work recognition and economic rewards.

Dole and Schroeder (2001) examined the relationship between personality, job satisfaction and turnover intention. No significant relationship between personality and satisfaction or turnover intention was found, although the inverse relationship between satisfaction and turnover was indicated by the results. Finally, gender and ethnicity did not moderate the relationship among the aforementioned variables.

As for the years of employment and the career stages, Adler and Aranya (1984) found that it creates differences among professionals as far as their attitudes, job satisfaction and commitment are concerned. Accountants in the pre-retirement stage appeared to be less satisfied than the younger ones. However, the level of organizational and professional commitment was higher for the older ones.

Norris and Niebuhr (1984) examined the relationship between professionalism, organizational commitment and job satisfaction; both found to be strongly related with job satisfaction. Employees appeared to be particularly satisfied with their work and their supervision and, at a lower degree, satisfied with their fees, promotion opportunity and co-workers. Finally, results indicated strong positive correlation between professionalism and organizational commitment.

Professional commitment in relation to organizational commitment, income, satisfaction and organizational level has been examined by Aranya et al. (1981). Organizational commitment was the strongest predictor of accountants’ professional commitment, while satisfaction with income also influences professional commitment.

Reed et al. (1994) examined accountant’s satisfaction with their current positions, their commitment to the organization and their turnover intention in United States. In their survey, there were differences in the result between males and females and the employees who were perceived as “Internals” and “Externals”. Internals were those who look forward to rewards, resulting from their own actions, while externals are those who believe that the outcome of the events is not determined by their actions but by unpredictable forces. “Internals” expressed greater satisfaction with their jobs than “Externals”. As for organizational commitment, the results were the same for all accountants. However, turnover intention was higher in externally–oriented women. As far as the length of employment is concerned, the results were different when gender was considered. A positive association between short tenure in a given job and job satisfaction with women and, also, a positive association between short tenure and organizational commitment with men were observed. In contrast, the association between lengthy tenure and organizational commitment was positive for male accountants.

Organizational commitment in the accounting environment was also examined by Stallworth (2004), focusing on the antecedents and the consequences of organization commitment and turnover intention. Results suggest that organizational commitment, especially affective commitment, is the best predictor of turnover.

Lui et al. (2001) studied the effect of inter-role conflict on accountants’ job satisfaction and propensity to leave work in Hong Kong. Inter-role conflict is defined as the conflict that arises from incompatible role requirements between two or more work-related roles. It was found that inter-role conflict is negatively associated with job satisfaction and positively with the propensity to leave. Similar results were obtained by the study of Lombardi Bullen and Flamholtz (1985), as job satisfaction was found to be negatively correlated with the probability to quit.
Aranya et al. (1982) studied job satisfaction of Canadian accountants, examining the influences between professional and organizational commitment, job satisfaction and migration. Their sample was divided in three groups; partners or sole practitioners, employees in accounting firms and employees in bureaucratic organizations. It was concluded that in all three settings accountants’ job satisfaction is influenced by organizational and professional commitment. As for the intention to migrate, it was not affected by their perception about the occupation or organization.

3. Research Model and Hypotheses

This research will focus on the relationship between job satisfaction and other personal and organisational factors, such as organisational and professional commitment, turnover intention, work motivation and job characteristics. Based on the evidence found in the literature, which has been presented earlier, the following research model (Figure 1) and hypotheses (Table 1) are proposed and empirically tested:

**Figure 1. The Proposed Research Model**
Table 1. Summary of the Research Hypotheses

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Statement</th>
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<td>H1</td>
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</tr>
<tr>
<td>H2</td>
<td>Job characteristics positively affect professional commitment</td>
</tr>
<tr>
<td>H3</td>
<td>Job characteristics positively affect organisational commitment</td>
</tr>
<tr>
<td>H4</td>
<td>Organizational and professional commitment are positively correlated</td>
</tr>
<tr>
<td>H5</td>
<td>Internal work motivation positively affects organisational commitment</td>
</tr>
<tr>
<td>H6</td>
<td>Internal work motivation positively affects professional commitment</td>
</tr>
<tr>
<td>H7</td>
<td>Internal work motivation positively affects job satisfaction</td>
</tr>
<tr>
<td>H8</td>
<td>Organisational commitment positively affects job satisfaction</td>
</tr>
<tr>
<td>H9</td>
<td>Professional commitment positively affects job satisfaction</td>
</tr>
<tr>
<td>H10</td>
<td>Job satisfaction negatively affects turnover intention</td>
</tr>
<tr>
<td>H11</td>
<td>Organizational commitment negatively affects turnover intention</td>
</tr>
<tr>
<td>H12</td>
<td>Internal work motivation negatively affects turnover intention</td>
</tr>
<tr>
<td>H13</td>
<td>Job characteristics positively affect job satisfaction</td>
</tr>
<tr>
<td>H14</td>
<td>Job characteristics negatively affect turnover intention</td>
</tr>
</tbody>
</table>

3. Research Methodology

3.1 Sampling and Data Collection

Accountants are employed in several organisations, both private and public, or as independent professionals (consultants); hence, accountant population mainly consists of:
1. Accountants who are employees of bureaucratic organisations (working in their accounting departments)
2. Accountants who are employees of accounting firms
3. Accountants who own (or they are partners of) an accounting firm
4. Accountants who work as sole practitioners (freelancers).

However, the target population of this research consists of accountants from categories 1 and 2 (from the list above), since the other types of accountants own the firm (or they are partners) and, thus, their opinion, as far as the working environment is concerned, would be significantly biased. Moreover, freelancers cannot participate since they are working for many different organizations and, thus, they would not be able to focus their answers to a specific one.

A combination of the cluster and random sampling approach was adopted to form the target sample of this research. First, it has been limited into the geographical area of East Macedonia (Greece). The main sources of information were the local departments of the chamber of commerce & industry and chamber of economics, located in the capital city of each prefecture of the region. From the chambers of commerce and industry 200 organisations with independent accounting departments were selected, while from the chambers of economics 200 registered accounting firms were also chosen. The main criterion for both sub-samples was the number of people (accountants, assistant accountants) working for these organisations/ accounting firms (minimum 2, excluding the head/ owner).

The questionnaire was delivered to the participants either through a personal contact (most of them) or via emails. For the second case, an appropriate electronic form of the questionnaire was developed (along with its own web site) where
participants could directly submit their responses. Appropriate guidelines concerning the way each question should be answered were provided to all participants. The actual time needed for the participants to complete the questionnaire was less than 10 minutes. The collection process started in June 2010 and was completed in September 2010.

The final sample consists of 213 usable questionnaires, of which 142 were completed by individuals working for 71 accounting firms, while the remainder by individuals working in the accounting department of various organisations (response rate 35.5%). In order to reduce the biases caused by the fact that some accounting firms were represented in the sample by more than one person, the average score for each question per organization was calculated and entered into the data set. Thus, the final data set consists of 142 observations.

3.2 The Data Collection Instrument

The research instrument used to collect primary data was a structured questionnaire, divided into seven sections. The first part (section A) includes questions about the demographic characteristics of the participants and, especially, gender, age, level of education, working experience as accountant (experience), tenure in the organisation and type of employment.

The rest of the questionnaire comprises of questions-statements, and respondents were asked to comment whether they agree or disagree with each statement. All the questions are using the five-point Likert scale (1= Strongly Disagree, 2= Disagree, 3=Undecided, 4= Agree, 5= Strongly Agree). More specifically:

- Section B consists of questions measuring job characteristics. Five factors, namely skill variety, task identity, task significance, autonomy, feedback are used to assess job characteristics and based on the Job Diagnostic Survey (Hackman and Oldham, 1975).
- Section C is designed to measure accountants’ job satisfaction taking into account five different facets of satisfaction, according to Smith et al.’s (1969) Job Descriptive Index. The facets are: work, pay, promotion, supervision and co-workers.
- Section D assesses the degree to which accountants are self-motivated to perform effectively on their job. Internal work motivation dimension comprises 4 items, adopted by Hackman and Oldham (1975).
- Section E examines accountants’ intention to quit from the organisation. Three items measuring turnover intention were adopted by the Michigan Organisational Assessment Questionnaire (Cammann et al., 1983).
- Section F measures accountants’ organizational commitment. using the short version (9 out of the 15 items) of the Organizational Commitment Questionnaire (OCQ) developed by Mowday et al. (1979).
- Finally, in section G, professional commitment is measured, using a 9-item adapted version of the OCQ; were the word “organisation” is replaced by the word “profession” and other minor wording modifications (Aranya et al., 1981).
3.3 Data Analysis Methodology

After the data collection process had been completed the next step was to analyze the data collected. The Statistical Package for Social Sciences, known as SPSS (version 17.0.0. for windows) and AMOS software were used to perform all the necessary statistical analyses. The responses were recorded in SPSS data format using the predefined 5-point Liker scale. Using factor analysis the main factors included in the model were tested for validity and reliability, while the hypotheses were tested using path analysis. Various fit indices were used to assess the overall fit of the model.

4. Data Analysis

4.1 Sample Characteristics

The sample consists of 66 (46.5%) men and 76 women (53.5%), 26-55 years old (88%). Most of them (73.2%) hold a relevant degree, while the rest have attended official vocational training programs. These people cannot be registered as accountants but they can work in accounting firms or accounting departments as assistant accountants. In addition, graduates from Technical Educational Institutes (35.2) prefer to work in accounting departments of various organisations rather than sole practitioners or in accounting firms.

The participants could be considered as quite experienced since 40.1% of them have more than 13 years of experience as an accountant/assistant accountant. Further, it was not surprising to find that most of them (70.5%) stay with a firm/organisation for more than 4 years (μ = 7 years). Actually, this result is in line with the working behaviour (work force mobility) of most professionals in Greece, who usually stay (or want to stay) with the same firm/organization all their working life. Cross tabulation analysis and the chi square test support this claim.

4.2 Descriptive Analysis

From the five different elements (10 items) of Job Characteristics examined here, those with the highest mean score were skill variety (μ = 4.05), task significance (μ = 3.99) and feedback (μ = 3.93). No significant statistical difference is found between the mean scores of these three elements. On the other hand, the two with the lowest score were task identity (μ = 3.80) and autonomy (μ = 3.60). The overall mean score for Job Characteristics is quite satisfactory (μ = 3.88).

Examining Organizational Commitment (9 items), it is found that its overall mean score is 3.69, which can be considered as satisfactory. Respondents declared that “they care about the fate of the organization they are currently working for” (μ = 4.12) and this is why “they are willing to put great effort, beyond the expected so as to contribute in the success of this organization” (μ = 4.11). However, they are underlying that “they are not willing to accept any type of work so as to continue working for this organization” (μ = 3.31 – the lowest mean score among the 9 items used to measure this factor).

The results are similar when Professional Commitment (9 items) is considered. Although the overall mean score is lower (μ = 3.56) than this of
Organizational Commitment, the two statements with the highest scores are the same (with lower mean scores – 3.96 and 3.85, respectively).

Further, the mean score of Internal Work Motivation (4 items) is 3.86, with “sense of personal satisfaction when the work is performed well” being the item with the highest mean score (4.29) and the lowest standard deviation score (0.637).

As far as Job Satisfaction is concerned, five dimensions (25 items) were examined. From these, the one with the highest score is collaboration with colleagues ($\mu = 3.76$), followed by the work itself ($\mu = 3.62$) and the promotion prospects ($\mu = 3.55$). The dimensions with the lowest mean score are quality of supervision ($\mu = 3.17$) and salaries/rewards ($\mu = 3.04$). The overall mean score for Job Satisfaction is 3.43.

Finally, examining Turnover Intention (3 items), the results reveal that it is rather low ($\mu = 2.37$). This can be partly explained by the overall mean scores of the other factors but, probably mainly, from the fact that the recent financial crisis has drastically increased the unemployment rates (officially as high as 13%, unofficially up to 18%) even for educated people and, therefore, the chances of someone getting a better job are dramatically decreased.

4.3 Factor Analysis

Confirmatory factor analysis has been performed; the factors were extracted using the Varimax rotation method and their number has been further reduced. In order to determine the number of factors, the criterion of Eigenvalue has been used. Factors whose Eigenvalue is over than one have been selected. Additionally, factor loadings exceeded the 0.5 cut-off value, proposed by Straub (1989) and 0.6 proposed by Hair et al. (1989).

Reliability is one of the major criteria for evaluating research instruments. Reliability measures the internal consistency of the model. In this research, Cronbach’s alpha has been used to test the reliability of the measures.

The value of Cronbach’s alpha coefficient should be higher than the minimum cut-off score of 0.60 (Nunnally, 1978). However, Fornell and Larcker (1981) supported that the index of the reliability should be greater than the benchmark of 0.70 to be considered adequate. Table 2 shows that all the factors have an alpha score higher than 0.70, except for “Internal Work Motivation” with alpha scores of 0.583, which is still marginally accepted. Generally, observing these indicators it is concluded that the degree of internal consistency is adequate.

Kaiser-Meyer-Olkin (KMO) test of sampling adequacy and Bartlett’s test of Sphericity, are necessary to be conducted so as to determine if the sample is appropriate for factor analysis (Andersen and Herbertsson, 2003). KMO is an index which tests whether the partial correlations among variables are small. Small prices of KMO index show that the factor analysis is inappropriate, because the correlations among pairs of variables cannot be explained by the rest of the variables. According to Kaiser (1974), the minimum accepted KMO value is 0.50.

Bartlett’s test of sphericity is used to test whether the variables in the population of correlation matrix are uncorrelated. Since the observed significance level of all factors is 0.00 (less than 0.005), the initial hypotheses is rejected. Consequently it can be concluded that the correlation matrix is not an identity matrix and the relationship among the variables is strong.
Total Variance Explained (TVE) for each factor is also provided. The minimum accepted rate for TVE values is 0.50. TVE scores exceed the minimum threshold set and, as a result, the factors are considered meaningful.

In order to test the significance of the items to the creation of the factors their loadings have also been examined. Factors loadings indicate the relative importance of each item to each factor and they are considered as the correlations coefficient for the variables and the factors. For a sample of more than a hundred observations, a loading of more than 0.5 is considered adequate.

All these tests have support the reliable and adequate measurement of the factors and, thus, they can safely be used in the next stage of our analysis.

Table 2. Factor Analysis

<table>
<thead>
<tr>
<th>(Hyper-) Construct</th>
<th>Construct</th>
<th>Factor Loading</th>
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<th>Sign. Of Bartlett Test</th>
<th>Cronbach α</th>
<th>TVE</th>
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KMO = Kaiser-Meyer-Olkin Measure of Sampling Adequacy; TVE = Total Variance Explained; Cronbach α = Internal Consistency Coefficient.
4.4 Path Analysis – Hypothesis Testing Results

The results of the path analysis, schematically presented in Figure 2, indicate that 10 out of the 14 proposed hypotheses are accepted (see also Table 5). Moreover, fit indices suggest that the model fits the data well (see Table 3), while the model can explain a noteworthy amount of variance ($R^2$) of the model’s endogenous constructs (see also Table 4).

In more detail, job characteristics have a significant positive direct effect on both commitment forms, as well as on internal work motivation. However, job characteristics affect job satisfaction and turnover intention only indirectly (see Table 4). Internal work motivation also has a positive direct effect on professional and organizational commitment, and as was the case with job characteristics, influences turnover intentions only indirectly.

On the other hand, organizational commitment has a fairly strong positive effect on job satisfaction, which is stronger than that of professional commitment on that construct. Organizational commitment also influences turnover intention directly, while professional commitment only has a weak indirect effect on intention to quit. Moreover, the two commitment forms have been found to be strongly and positively correlated as initially hypothesized. Finally, job satisfaction has a fairly strong negative effect on turnover intention, confirming the initial hypothesis. Overall, the model can explain 28% and 41% of the variance in job satisfaction and turnover intention, respectively.

Figure 2: The Final Model
Table 3. Overall Model Fit

<table>
<thead>
<tr>
<th>Model-fit Index</th>
<th>Score</th>
<th>Recommended Cut-Off Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-square/ Degree of Freedom ($\chi^2$ / d.f.)</td>
<td>1.955</td>
<td>&gt;3 Straub (1989)</td>
</tr>
<tr>
<td>Goodness-of-fit Index (GFI)</td>
<td>.978</td>
<td>&gt;0.9 (Bentler and Bonett, 1980)</td>
</tr>
<tr>
<td>Comparative Fit Index (CFI)</td>
<td>.981</td>
<td>&gt;0.9 (Bentler and Bonett, 1980)</td>
</tr>
<tr>
<td>Tucker Lewis Index (TLI)</td>
<td>.944</td>
<td>&lt;0.95 (Hu and Bentler, 1999)</td>
</tr>
<tr>
<td>Normed Fit Index (NFI)</td>
<td>.964</td>
<td>&gt;0.9</td>
</tr>
<tr>
<td>Root Mean Square Error of Approximation (RMSEA)</td>
<td>.022</td>
<td>&lt;0.08 (Browne and Cudeck, 1993)</td>
</tr>
<tr>
<td>Root Mean Square Residual (RMR)</td>
<td>.082</td>
<td>&lt;0.05 (Marsh et al., 1988)</td>
</tr>
</tbody>
</table>

Table 4. Direct, Indirect and Total Effects and Variance Explained

<table>
<thead>
<tr>
<th>R²</th>
<th>Path Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Job Characteristics</td>
</tr>
<tr>
<td>Internal Work Motivation</td>
<td>.05</td>
</tr>
<tr>
<td>D</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>.230</td>
</tr>
<tr>
<td>Organizational Commitment</td>
<td>.33</td>
</tr>
<tr>
<td>D</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>.341</td>
</tr>
<tr>
<td>Professional Commitment</td>
<td>.19</td>
</tr>
<tr>
<td>D</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>.374</td>
</tr>
<tr>
<td>Job Satisfaction</td>
<td>.28</td>
</tr>
<tr>
<td>D</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>-.417</td>
</tr>
<tr>
<td>Turnover Intention</td>
<td>.41</td>
</tr>
<tr>
<td>D</td>
<td>I</td>
</tr>
<tr>
<td>Note: D = Direct Effect, I = Indirect Effect, T = Total Effect</td>
<td></td>
</tr>
</tbody>
</table>
Table 5. Hypotheses Testing Results

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Path Coefficient</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1 Job characteristics → internal work motivation</td>
<td>.23</td>
<td>Accepted</td>
</tr>
<tr>
<td>H2 Job characteristics → professional commitment</td>
<td>.32</td>
<td>Accepted</td>
</tr>
<tr>
<td>H3 Job characteristics → organizational commitment</td>
<td>.52</td>
<td>Accepted</td>
</tr>
<tr>
<td>H4 Organizational commitment ↔ professional commitment</td>
<td>.54</td>
<td>Accepted</td>
</tr>
<tr>
<td>H5 Internal work motivation → organizational commitment</td>
<td>.16</td>
<td>Accepted</td>
</tr>
<tr>
<td>H6 Internal work motivation → professional commitment</td>
<td>.20</td>
<td>Accepted</td>
</tr>
<tr>
<td>H7 Internal work motivation → job satisfaction</td>
<td>--</td>
<td>Rejected¹</td>
</tr>
<tr>
<td>H8 Organizational commitment → job satisfaction</td>
<td>.37</td>
<td>Accepted</td>
</tr>
<tr>
<td>H9 Professional commitment → job satisfaction</td>
<td>.21</td>
<td>Accepted</td>
</tr>
<tr>
<td>H10 Job satisfaction → turnover intention</td>
<td>-.32</td>
<td>Accepted</td>
</tr>
<tr>
<td>H11 Organizational commitment → turnover intention</td>
<td>-.42</td>
<td>Accepted</td>
</tr>
<tr>
<td>H12 Internal work motivation → turnover intention</td>
<td>--</td>
<td>Rejected²</td>
</tr>
<tr>
<td>H13 Job characteristics → job satisfaction</td>
<td>--</td>
<td>Rejected¹</td>
</tr>
<tr>
<td>H14 Job characteristics → turnover intention</td>
<td>--</td>
<td>Rejected²</td>
</tr>
</tbody>
</table>

Note: All path coefficients are significant at the p<0.001.
¹ Path coefficients were positive but insignificant
² Path coefficients were negative but insignificant

5. Discussion

Job characteristics appear to affect almost all factors, especially internal work motivation (H1) and organizational (H3) and professional commitment (H2). On the other hand, analysis results did not confirm the proposed direct effect on satisfaction (H13) and turnover intention (H14), but instead job characteristics have been found to exert noteworthy indirect effects on the aforementioned constructs.

On the other hand, internal work motivation positively influences organizational (H5) and professional commitment (H6). These results suggest that a strong internal work motivation contributes to a strengthening of accountants’ attachment to both their profession and employing organization. Conversely, internal work motivation does not have a direct effect on neither job satisfaction (H7) nor turnover intention (H12), as initially hypothesized. It influences, however, both constructs indirectly (see Table 5) through commitment.

With respect to the two commitment forms, results point to a strong positive correlation between them (H4), while both influence job satisfaction directly (H8 and H9), indicating that the greater the attachment accountants have with the organization and their profession, the greater the satisfaction they get from their job. Organizational commitment, however, also has a significant negative effect on accountants’ turnover intention (H11), whereas professional commitment has a small negative indirect effect on the construct. Finally, congruent to the original hypothesis, a significant negative relation between job satisfaction and turnover was indicated by the analysis (H10), consistent with the findings of previous research, as for example those of Dole and Schroeder (2001) for the same professional group.

At this point, according to the above findings it is important to specify the validity of each one of the individual hypotheses which describes the interaction among all those variables (Table 5).
6. Conclusions

The present study examined the relationship among accountants’ job characteristics, internal work motivation, job satisfaction, turnover intention, as well as professional and organizational commitment. Although almost all of the relationships included in the research model have been examined in the past research among accounting professionals field are restricted, especially in Greece. Hence, this study’s findings shed some light to our understanding of some of Greek accountants’ organizational behaviors.

First the research instrument was assessed for its validity and reliability (see Table 2). Subsequently, data were subjected to empirical analysis using structural equation modeling (path analysis). Overall analysis findings confirmed the majority of the initial hypotheses, while fit indexes indicated a good fit of data to the resultant structural model. In addition, the model can explain a noteworthy amount of variance in the dependent constructs.

As for the rejected hypotheses, mediating effects (indicated by the indirect effects among the model constructs - see Table 4) proved that there were intervening factors mediating the relationship between the independent and dependent constructs. In more detail, although internal work motivation and job characteristics did not have a direct effect on job satisfaction and turnover intention, as initially hypothesized, they were found to affect them indirectly through organizational or professional commitment.

The confirmation of the majority of the hypotheses, as well as the existence of significant indirect effects, shows that all these factors are interlinked. This suggest the job satisfaction can be enhanced not only by providing a satisfactory salary, promotion opportunities or having good relations with one’s co-workers, which constitute some of the constructs facets, but, also, through strengthening the variables that are related to it.

Based on the above, it can be suggested that management should focus its efforts on enhancing employee commitment levels, both to the employing organization and their profession, so as to achieve high levels of satisfaction. This can be achieved by providing accountants with tasks that are not mundane but of importance, a work routine that allows for autonomy without suffocating supervision in task performance, as well as offer them feedback as to their job performance. In turn, individuals are intrinsically motivated for increased performance, which trough its effect on commitment results in reduced likelihood of voluntary turnover, causing the organization to lose valuable human resources. Obviously, the benefits of having strongly committed and satisfied employees, who are also less likely to leave, are of extreme importance, as they are associated with cost savings and increased organizational performance.

References


Enterprise System Post-Implementation Use Practices: Analysis of Individual Purchasing Business Processes in Greek SMEs

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Abstract

This is a field study of the use of purchasing best practice processes by Greek SMEs and their implementation with packaged enterprise systems (ES). The study focuses especially on process and ES use deficiencies and their causes. Individual processes are analyzed from the implementor’s point of view over a sample of 19 Greek SMEs which have successful ES (ERP system) implementations. The following categories of purchasing processes are studied: Purchasing requisitions, requests for quotation, quotations, supplier evaluation and selection, orders, material requirements planning methods, receipts and invoicing, as well as B2B e-commerce processes and Business Intelligence analytics. The observed deficiencies in process and ES use can be classified in the following three categories: Firstly, processes which are not used, or are not implemented using best practices, because of a general lack of company maturity, which is to some degree independent from the ES. Secondly, processes which are used but are not carried out with the ES. Thirdly, advanced ES-enabled processes which are not used at all or are not used to their full potential. Major causes of the observed deficiencies are the lack of know-how and sufficient manpower which are related to the size of the companies. The proposed analysis of the use of individual processes can support business process orientation and ES maturity evaluations, especially under low process and ES use maturity conditions.

Keywords: business process, purchasing, enterprise system, ERP system, SME, Greece

1. Introduction

This field study analyzes the practices of Greek small and medium-sized enterprises (SMEs) in using purchasing business processes and carrying out these processes with packaged enterprise information systems (ES). It extends similar analyses of sales and manufacturing processes (Doukas and Mantakas, 2007; Mantakas and Doukas, 2011). The studies are motivated from observations on Greek SMEs which suggest that ES are not used to their full potential of integrating, optimizing, and informating the enterprise (Davenport et al. 2004). Typical types of deficiencies in business process use are the following ones.
(Doukas and Mantakas, 2007; Mantakas and Doukas, 2011): Best practice processes are not used; processes are carried out without the ES, either manually or with office automation software; processes are used in a non-systematic way; process results are not always posted into the ES, hampering information extraction for decision support. These post-implementation practices of companies have not been extensively analyzed. Markus and Tanis’ (2000) remark holds, that despite the wide ES adoption rate, “it is not yet known how widely these technologies have been assimilated (Fichman & Kemerer, 1997) in organizations, for example, how extensively they are used within the organization, how faithfully they are used, and how effectively they are used”.

The basic research questions of the present study are the following ones:

- Do companies use generally accepted best practices?
- Do companies carry out these business processes with their ES?
- In case of process and/or ES non-use, what are the causes of the deficiencies?

2. Prior Research

Field studies which address business processes and cover the following subjects:

- Deficiencies of business process use in connection with ES implementation
- Analyses of individual business processes in connection with ES implementation
- ES and metrics of business process performance.

Shang and Seddon (2007) report process use deficiencies for medium-sized organizations which have SAP and Peoplesoft ERP systems. According to the authors, process use deficiencies originate in inappropriate process changes during ES implementation. The sources of observed deficiencies can be summarized as follows: Inefficient business process reengineering; inefficient ES configuration and use of default ES configurations in particular; complicated process models, demanding excessive work for data entry and processing, even for relatively small jobs; bureaucratic processes with excessive crosschecks which lack flexibility in handling exceptions such as missing data or check points, and result to errors when they are worked around by employees; difficulty of end users in adapting to the new roles and extra work, such as systematic data entry; quality issues of several ES modules in single ES implementations.

Peng and Nunes (2009a) present an ontology of ERP post-implementation risks which contains references to deficiencies of operational and analytical processes, and process results. Peng and Nunes (2009b), and Pan et al. (2011) measure ERP post-implementation risks using this ontology, and report for instance deficiencies in master production schedule (MPS), and material requirements planning (MRP), which are attributed to deficiencies in independent demand forecasts, bills of materials, and inventory.

Beretta (2002) defines the business process as a flexible structure which allows for the organization of information and activities under a value generation goal. He
argues that process-based performance measurement can optimize the design and execution of processes, improving integration of activities, participant knowledge, and participant awareness of their contribution, and can allow in turn for a better exploitation of the advanced potentiality of the ES. The author describes the application of this approach to the maintenance process of a big chemical plant.

The ES field studies of Gattiker and Goodhue (2002), and Wieder et al. (2006) use business process indicators applied on a group of processes, and evaluated subjectively by company personnel. Gattiker and Goodhue (2002) measure business process change, as a result of ERP system adoption and operation, and as a cause of organizational performance change ("ERP impact"). Wieder et al. (2006) investigated the impact of ERP system adoption on business process performance (specifically, on the supply chain performance) and firm performance. Wieder et al. (2006) recognize the need to study individual process changes as opposed to overall changes in company subunits.

The approach of the present study, along with Doukas and Mantakas’ (2007) and Mantakas and Doukas’ (2011), is to analyze individual processes in connection with their ES implementations in SMEs from an external to the companies point of view. This approach is described in the following Section.

3. Analysis Framework

Some aspects of the framework for analyzing business process use practices and especially deficiencies by SMEs (Doukas and Mantakas, 2007) are reviewed and enhanced in the following.

3.1 Selection of a process reference set

Company practices in using process and ES, and especially use deficiencies, can be analyzed by reference to a set of processes defined by the investigator. The selected processes are generally considered best practices, in principle relevant for the company activities in the functional area under consideration. The scope and depth of the process reference set, i.e., the processes and the degree of analysis in sub-processes and functions are set by the investigator. The process reference set may and typically does include processes which have not been included in the company ES implementation plans.

3.2 General issues of process and ES use

The systematic use of all the processes of the reference set and their implementation with the ES by the company under examination is assumed to represent an optimal practice. Deficiencies are departures from this optimality. This can be considered as a special case of Markus and Tanis’ (2000) optimal success concept, applied at a business process level, and evaluated from an external to the company point of view.
The following two remarks refine the basic process and ES use vs. non-use dichotomy:

Firstly, some processes produce results, which can in turn serve as input to other processes. The posting of these results to the ES is therefore important. For example, purchase quotation and purchase order historical data can be analyzed and support companies in supplier evaluation and selection. The posting of purchase quotations to the ES is therefore important, and its omission is a deficiency.

Secondly, part of a process, such as data entry and processing, may be carried out using software other than the ES, as for example spreadsheets. This practice is not in principle a deficiency, as far as the process results are uploaded to the ES.

The above discussion of process and ES use practices can be summarized in the following cases:

- **Case 1.1**: The process is used and it is carried out fully with the ES
- **Case 1.2**: The process is carried without the ES, but process results are uploaded to the ES
- **Case 2.1**: The ES is partially used, for example for data retrieval, but the process results are not posted to the ES
- **Case 2.2**: The process is used but it is carried out without the ES
- **Case 3**: The process is not used at all.

Practice 1.1 and in principle practice 1.2 as well are not deficient. Practices 2.1 and 2.2 are deficient ES use cases.

For processes for which the posting of results to ES is not significant, such as for example simple monitoring processes, the practices are simplified in the following cases:

- **Case 1**: The process is used and it is carried out with the ES
- **Case 2**: The process is used but it is carried out without the ES
- **Case 3**: The process is not used at all.

Finally, there are processes whose implementation is impossible, very difficult, or inefficient without the ES. In these cases, process and ES use are connected. BI analytics are an example.

### 3.3 Qualitative aspects of process use

The eight factors of Table 1 are proposed as determinants and indicators of ES implementation maturity degree. Most of them concern the use of special categories of processes. They are classified in three categories, which are related to the **integrate, optimize, and informate** value drivers of Davenport and al.’s (2004) model.

Company process and ES use practices evolve with time. An ES implementation is generally an on-going process which continues after going live (Marcus and Tanis,
2000; Davenport et al., 2004), and ES implementation matures over time (Deloitte Consulting, 2000; Parr and Shanks, 2000; Ross and Vitale 2000; Holland and Light, 2001; Lockamy and McCormack, 2004; Hammer, 2007).

Several factors of Table 1 are related to and can be supplemented by business process orientation indicators (Lockamy and McCormack, 2004; Reijers, 2006; Škrinjar et al., 2008; Chen et al., 2009; Kohlbacher, 2010; Kumar et al., 2010; Trkman et al., 2010; Kohlbacher and Gruenwald, 2011) and process enablers of Hammer’s (2007) business process and enterprise maturity model.

Table 1. Qualitative factors of process use

<table>
<thead>
<tr>
<th>Process / Factor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Data and process integration</strong></td>
<td></td>
</tr>
<tr>
<td>1.1 Cross-modular transformation processes</td>
<td></td>
</tr>
<tr>
<td>1.2 Inter-organizational processes, supply chain integration, e-commerce</td>
<td></td>
</tr>
<tr>
<td>1.3 Process integration across applications</td>
<td></td>
</tr>
<tr>
<td>1.4 Customer and Supplier Relationship Management processes</td>
<td></td>
</tr>
<tr>
<td><strong>2. Implementation and enforcement of business logic</strong></td>
<td></td>
</tr>
<tr>
<td>2.1 ES configuration and/or customization</td>
<td></td>
</tr>
<tr>
<td>2.2 Workflows</td>
<td></td>
</tr>
<tr>
<td><strong>3. Information management for decision support</strong></td>
<td></td>
</tr>
<tr>
<td>3.1 Tactical and strategic decision support processes</td>
<td></td>
</tr>
<tr>
<td>3.2 Business Intelligence processes</td>
<td></td>
</tr>
</tbody>
</table>

3.3.1 Use of advanced processes and process integration

Integration across functional areas and ES modules is an indicator of mature ES use. Cross-modular data transformations, such as for example purchasing-sales ones, are therefore examined.

E-commerce applications enable inter-organizational data and process integration. In practice, such applications and information exchange between business partners present a considerable lag (Davenport et al., 2004). With respect to company size, Laukkanen et al.’s (2007) field data suggest that small companies attribute less importance to the development of e-commerce capabilities and inter-organizational integration with respect to medium and large companies.

Data and process integration is of concern in case of ES composed of modules or applications, such as ERP, CRM, e-commerce, BI, and other software including legacy systems, especially in best-of-breed solutions where modules come from different manufacturers.
Finally, the use of advanced customer and supplier relationship management processes, supported by a CRM and SRM applications, is an indicator of ES implementation maturity. In Davenport et al.’s (2004) field data, CRM was the least implemented ES module, and rated low among modules planned for implementation within the following two years. Also in Buonanno et al.’s (2005) data, CRM is considered as a driver for ES adoption by relatively few companies, and the percentage is lower for SMEs compared to large companies.

3.3.2 Implementation and enforcement of business logic

During ES implementation, the special business rules of each company are introduced to the ES through configuration and/or customization. In this respect, the amount of ES configuration and customization is an indicator of ES implementation maturity degree. As previously discussed, Shang and Seddon (2007) reported process deficiencies in medium-sized companies due to inefficient ES configuration, especially because of the use of default system configurations. In the upper-end ES (such as SAP and Oracle systems), it can be expected that a big part of business logic is implemented by ES model configuration, although some customization, i.e. software development, for special business rules is usually necessary as well. Davenport et al. (2004), for instance, reported that 74 percent of organizations in their study at least moderately customized their ES. In “smaller” ES, it can be expected that for the same functionality an even greater amount of customization is needed.

The term workflow is used in the present study in the following sense: Several processes consist of a set of stages (sub-processes or tasks). The transition from one stage to the next is controlled by the application of a well defined and objective transition rule. When a rule cannot be automatically evaluated, a decision is taken by authorized personnel. Such a process implementation allows for a strict deployment and enforcement of business logic, and is an indicator of mature ES implementation. “Big” ES implement workflows with workflow engines, while “small” ES can implement workflows through customization (van der Aalst, 1984).

3.3.3 Information management for decision-support

Information can be extracted from transactional data, stored in ES in a systematic and structured way, and can be used for decision support. Numerous studies pointed out the importance of decision support capabilities as an ES adoption criterion as for example Davenport (2000), Marcus and Tanis (2000), Stefanou (2001), Shang and Seddon (2002). In Holsapple and Sena’s (2005) study on the objectives of ERP adoption planning in US “big” ES implementations, decision-support objectives were perceived to rank high among the objectives. Most respondents’ viewpoint was also that several objectives including the decision-support ones should have been given higher importance, and additionally that decision-support objectives should have been ranked higher. In Spathis’ (2006) Greek ES adoption study over a sample of companies with 27.02 million euros average total annual sales, and 315 average personnel, information generation for decision-making was perceived as the second most frequent adoption criterion by
managers, with an 86% frequency, and improved decision making process obtained also a high score among perceived benefits of ES adoption for accounting. Davenport et al. (2004) reported that improved decision making was the more highly desired benefit of ES implementation by their sample organizations. With respect to SMEs, Buonano et al. (2005) concluded instead that limited support to decisions is not among the most frequent drivers for ERP adoption (19.8% frequency), and additionally that this driver is lower for SMEs than for large companies (26.5% frequency).

The use of decision support processes, especially those that can support tactical and strategic decisions, as opposed to routine operational ones, can be an indicator of ES implementation maturity. Advanced data analyses are typically supported by Business Intelligence (BI) applications. Information management comes usually after a maturation period, during which users get familiar with ES and the company realizes its full potential (Davenport et. al, 2004). Considerable time is also needed for the accumulation of historical data in the ES database.

4. Research Methodology

The field data of the present study come from a sample of 19 Greek SMEs (henceforth referred to as the Companies - with capitalized initial) which use the same ES. The ES was produced and implemented by a Greek SME ES manufacturer. The sample Companies and ES are the same as those in Doukas and Mantakas' (2007) study.

4.1 ES and ES Implementation

The ES under consideration is an applications suite which includes a fully integrated ERP, CRM, business to business e-commerce and BI application, based on Oracle technologies. The manufacturer's policy was to offer turnkey solutions and encourage its customers to provide their special business logic for each business process. For each Company, a considerable amount of ES customization was done.

4.2 Data collection

A reference set of purchasing processes was developed. Data were collected using a questionnaire of structured, semi-structured and unstructured questions on the following subjects: Organizational and decisional features of the Companies, ES implementation project features, process and ES use (i.e., whether each process of the process reference set was used, and whether it was implemented with the ES), the causes of deficient process and ES use, and the particular method of process implementation, in cases where various methods were available. The questionnaire was answered by a single informer, the principal ES Implementation Consultant who carried out the implementation projects of all the Companies. The Consultant's answers were checked for completeness and consistency and the Consultant was asked to provide appropriate corrections and/or explanations. Additionally, discussions about Company practices, for each
process, were carried out with the Consultant. The analysis of deficiency causes are based on the informer’s judgments, and take into account opinions and attitudes of the Companies which were communicated by the informer.

The choice of a single knowledgeable informer aimed at ensuring complete and low-noise data, from a single point of view, which was necessary given the relatively small Company sample size. The existence of some systematic biases, especially in the judgments of deficiency causes, cannot be though excluded. The process reference set may have been also influenced to some extent by the ES under consideration.

4.3 Features of sample Companies and ES implementations

The sample consists of 4 small and 15 medium-sized companies according to European Commission’s (2003) definition. Regarding the legal status of the Companies, there exist 6 SA, 2 Ltd, and 1 GP (General Partnership) companies. Two Companies are parent and one is subsidiary in groups of companies. One Company belongs to an international group. Twelve Companies are family businesses. The top management members of all the Companies hold bachelor or master degrees.

The annual turnover of the 19 Companies has a minimum, median and maximum value of respectively 2, 10 and 40 million Euro approximatively. The number of ES users has a minimum, median and maximum value of respectively 3, 10 and 25. Purchases employ 1, 2, 3, or 4 persons in respectively 10, 7, 1, and 1 Companies. Nine Companies have a Purchasing Dept. With respect to operations, four Companies have a purely commercial activity and fifteen have manufacturing activity in various sectors. Among the manufacturing Companies: Eleven have also commercial activity, which covers 10% to 40% of their total turnover; two Companies have a purely make-to-stock (MTS); four Companies have purely project-based (job shop) make-to-order (MTO) production; and nine Companies have both MTS and MTO productions. Companies have their headquarters in the Athens area, but their production or store units (if any), are distributed in different geographical areas of Greece.

Before the present ES implementation, all the Companies were using some other MS-DOS or MS-Windows package or custom made accounting application. One only Company had an ERP system which was abandoned after the adoption of the the present study ES. With respect to the ES implementation, twelve ES implementation projects have been financed in part by the 3rd EU Support Framework. According to the implementor, the ES implementation goals of the Companies were fully met by all the Companies, and all 19 Companies have been more or less satisfied by the ES. There are therefore no ES implementation failure cases.
5. Results

The process reference set is given in Table 2. It includes purchasing processes which apply in general in SMEs. The analysis results for the 19 sample Companies are summarized in Table 2 as well. For each process, the number of potential users is given, i.e., the number of Companies for which the process in principle applies. For some Companies, a process may not apply, due to the nature of Company activities. Next, the numbers of Companies which use the process with and without the ES are given. Processes whose implementation without the ES is difficult, inefficient or impossible are marked with a non-applicable (n/a) sign.

The results for each process are presented in the following Sections. They include a discussion of possible causes of deficiencies which is based on Implementation Consultant’s judgments. A summary of the results and some further analyses are presented in Section 6.

5.1 Purchase requisitions for non-productive items

For productive items, purchase requisitions are created by reorder point and MRP methods and are processed automatically. Only purchase requisitions for non-productive items are considered since they involve an approval process. The approval should be based on a purchase budget, and can in principle be carried out automatically by the ES. Without such a budget, the approval becomes non-automatic, of inferior importance, and essentially bureaucratic.

All the Companies have purchase requisitions for non-productive items, and an elementary approval process which is usually carried out by single appointed employee. Only one Company uses ES for purchase requisition creation, automatic submission for approval to the responsible personnel, and automatic requestor notification, but has no purchase budget. Only one Company has purchase budget, structured per category and cost center. However, this Company does not use the ES.

The non-use of purchase budget could be attributed to the relatively low cost of purchased items. The lack of ES use for the purchase requisitions can be also attributed to the necessary work overhead. All the Companies could in principle use purchase budget and carry out at least historical purchase requisition checks at regular time intervals.

5.2 Purchase requests for quotation

All the Companies have purchase requests for quotations (RFQ), but only two create and transmit them to the suppliers using the ES. Additionally, four Companies use their supplier’s B2B e-commerce applications and post in parallel the RFQ to the ES. The remaining Companies simply call or send email to the supplier, or create the RFQ with text processing software and transmit it by fax. The low manpower availability in Purchases is the cause of ES use deficiencies, as well as the low availability of supplier e-commerce solutions.
Table 2. Purchasing process reference set and analysis results. (PU: Number of potential process and ES users, ESU: Number of ES users, PrU: Number of process users, where the process is carried out without the ES).

<table>
<thead>
<tr>
<th>#</th>
<th>Process Category / Process</th>
<th>PU</th>
<th>ESU</th>
<th>PrU</th>
</tr>
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<tr>
<td>1</td>
<td>Purchase requisition for non-productive items</td>
<td>19</td>
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<td>1</td>
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<tr>
<td>1.1</td>
<td>Purchase budget</td>
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<td>18</td>
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<td>1.2</td>
<td>Purchase requisition processing</td>
<td>19</td>
<td>1</td>
<td>n/a</td>
</tr>
<tr>
<td>1.3</td>
<td>Purchase requisition check and approval</td>
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<td>Purchase requestor notification</td>
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</tr>
<tr>
<td>2</td>
<td>Purchase RFQ</td>
<td>19</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>2.1</td>
<td>Purchase RFQ processing</td>
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<td>3</td>
<td>n/a</td>
</tr>
<tr>
<td>2.2</td>
<td>Transformation of purchase requisition</td>
<td>19</td>
<td>1</td>
<td>n/a</td>
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<tr>
<td>2.3</td>
<td>Electronically send purchase RFQ to supplier(s)</td>
<td>19</td>
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</tr>
<tr>
<td>2.4</td>
<td>Purchase RFQ submission to supplier e-commerce system</td>
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<td>Purchase quotation posting to the ES</td>
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<td>Use of historical data for purchase quotation evaluation</td>
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<td>Selection of best purchase quotation</td>
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<td>19</td>
</tr>
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<td>4</td>
<td>Supplier evaluation and selection</td>
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<td>Use of historical data for supplier evaluation</td>
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<td>5</td>
<td>Purchase order</td>
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<td>Purchase order processing</td>
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<td>5.3</td>
<td>Use of supplier(s) item code(s)</td>
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<td>5.4</td>
<td>Purchase order versioning</td>
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<td>5.5</td>
<td>Purchase order dispatching notification by supplier</td>
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<td>6</td>
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<td>5.6</td>
<td>Match dispatching data with respect to purchase order data</td>
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<td>5.7</td>
<td>Purchase framework agreements</td>
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<td>Suppliers’ pricelists</td>
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<td>Suppliers’ pricelist management</td>
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<td>13</td>
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<td>6.2</td>
<td>Batch insert supplier pricelist to ES</td>
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<td>6.3</td>
<td>Automatic update of sales pricelist based on purchase invoice</td>
<td>15</td>
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<td>6.4</td>
<td>Use of multiple versions of suppliers’ pricelists</td>
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<td>6.5</td>
<td>Automatic update of sales pricelist upon suppliers’ pricelist update</td>
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<td>Purchase order planning</td>
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<td>MRP</td>
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<td>Reorder point method</td>
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<td>7.3</td>
<td>Forecasting algorithms of purchase demand</td>
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<td>7.4</td>
<td>Calculation of EOQ</td>
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<td>7.5</td>
<td>Calculation of inventory circulation</td>
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<td>7.6</td>
<td>Adaptation of standard delivery lead time to purchase order historical data</td>
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<td>Allocation of receipts / scheduled receipts</td>
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<td>8.1</td>
<td>Allocation of back order scheduled receipts of goods, in commercial activity</td>
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<td>8.2</td>
<td>Allocation of back order scheduled receipts of materials, in MTO production activity</td>
<td>13</td>
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<tr>
<td>8.3</td>
<td>Assignment of allocated scheduled receipts of materials to production projects</td>
<td>4</td>
<td>3</td>
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</table>
9 Purchase receipts and invoicing

**Purchase receipts**

9.1 Purchase item receipts 19 19 0
9.2 Purchase order to receipt note transformation 19 19 n/a
9.3 Receipt item quantity check with respect to purchase order 19 19 0
9.4 Lot traceability of purchased items 5 5 0
9.5 Quality control of purchased items 19 2 0
9.6 Return management of received items 19 19 0

**Purchase order invoicing**

9.7 Price check during purchase invoice posting with respect to purchase order price 19 5 n/a
9.8 Billing in supplier quantity units 5 5 0
9.9 Management of imported from abroad items 16 13 3

**Transformations**

9.10 Update of inventory quantity and price upon purchase order receipt 19 19 n/a
9.11 Automatic posting to general and extended ledger upon purchase order receipt 19 19 n/a
9.12 same as process 8.1
9.13 same as process 8.2

10 Purchase Business Intelligence

10.1 Use of BI purchase analytics 19 14 n/a

5.3 Purchase quotations

The following two processes are based on purchase quotation data:

- Evaluation and selection of the best offer
- Evaluation and selection of suppliers

Quotation posting to the ES is therefore important. In case of omission, the processes are carried out manually, which is time consuming and prone to inconsistencies. The historical data of quotations and/or orders can also enable the company to bargain with a supplier for a lower price.

Only two Companies post all supplier quotations to the ES. Quotation posting to the ES increases workload. It could be counter-productive for Companies which employ one person in purchasing, part-time in some cases. For seven Companies which have more manpower, the profits of ES use could probably trade off the personnel cost.

The sample Companies evaluate quotations based on price and delivery time criteria. The ES can support price and lead time search, and can indicate automatically the best offer using a specified business logic. Six Companies use purchase order historical ES data in quotation evaluation. This process can be potentially useful for all the Companies. No Company selects automatically the best quotation. The automatic selection of the best quotation seems appropriate for bigger companies than those of the present sample, especially if complex evaluation criteria concerning supplier’s behavior are used.
5.4 Supplier evaluation and selection

Two Companies have a single main supplier per item, while the others have about three or four. The ES can in general provide historical data of price, delivery time, quality, and other conventional terms. The ES can also inform about deviations between actual and agreed delivery times, for quotations which have been transformed to fulfilled orders.

Three Companies use ES historical data of delivery time deviation for supplier evaluation. The remaining Companies evaluate suppliers empirically. They could in principle use ES historical data, since these data are available, and their use is easy.

5.5 Purchase Orders

All the Companies issue purchase orders using the ES. Four Companies use in parallel their supplier’s e-commerce application. For two Companies, quotations are transformed to orders using the ES, and the status of the corresponding RFQ and quotations is automatically updated.

The ES supports multiple item codes, and all the Companies use this option for representing supplier’s item codes.

The ES supports multiple order versioning, which allows for monitoring for instance price or delivery time changes by the supplier with respect to those initially agreed upon. One Company uses this option, while the other ones cannot support it, and prefer to avoid it as potentially confusing.

All the Companies get dispatching notification by their suppliers, usually by fax or email. Six Companies post these data to the ES and use them for a better estimation of scheduled receipts. They also check manually actual dispatching dates with respect to order ones, using ES data. This process could be in principle used by the other Companies as well.

Supplier e-commerce applications can notify automatically their customers of dispatching data. Automatic notifications are used by the four Companies which use their suppliers’ e-commerce systems.

Companies have framework agreements with suppliers but only one manages them using the ES.

5.6 Suppliers’ Pricelists

Five Companies do not use pricelists for their basic purchase items, because prices change very frequently (stock-priced items). Eighteen Companies use suppliers’ pricelists for at least a part of their purchasing items. Thirteen of them post pricelists to the ES. One more could benefit from using the ES.

The ES supports batch pricelist import, but some pre-processing is practically needed for eliminating unnecessary items. Four Companies use this option, while the other ones post manually needed items. One more Company could practically use this option.
The ES supports the automatic price update of suppliers’ pricelists based on the more recent purchase order. Two Companies use this process, and thirteen more could adopt it.

No Companies use multiple versions of suppliers’ pricelists, since their prefer avoiding this extra data handling, and prefer monitoring price history based on purchase quotations and orders. This practice is not in principle a deficiency.

The ES also supports the automatic update of sales pricelists based on suppliers’ pricelists updates and specified business logic for calculating the gross profit margin. The process applies only for goods with one to one purchase and sales item correspondence. It is used by the four purely commercial Companies.

5.7 Purchase order planning

Purchase order planning (material requirements planning) allows for decreasing inventory cost and product delivery times to customers. It is the most difficult group of material management processes to setup and use, because it requires theoretical knowledge and experience, and a systematic organization of supply chain management, including inbound logistics, and warehouse management.

With respect to purchase order planning, the ES offers the following:

- Implementation of purchase order planning methods
- Historical data and analysis tools, such as BI analytics, for parameter estimation for the above methods.

The Companies use the following purchase order planning methods:

1. Reorder point (based on minimum stock)
2. MRP
3. On demand
4. Based on price and delivery time

The third method is based on actual demand only, while the first too can take into account demand forecasts as well. The fourth method applies in special cases like when buying items of oligopolistic type or items with stock-market prices. Each Company uses in general more than one of the above methods depending on the activities and products. Each of the above methods is mostly used by respectively 7, 2, 7, and 3 Companies.

Demand forecasting and parameter estimation

MRP projects sales demand (sales orders and sales forecasts) to purchase demand. Only one of the six Companies which use MRP uses also sales forecasts as MPS/MRP input.

The ES provides historical data which can support the estimation of purchase items safety stock, lead times, as well as reorder point and reorder quantity for the reorder point method.
Two of the seven Companies which use the reorder point method, use also purchase item demand forecasts based on the previous year data, and calculate these forecasts using the ES.

These two Companies use also analytical models of reorder point and reorder quantity (economic order quantity - EOQ) estimation. One of them uses theoretical models, while the other one uses empirical (ad hoc) models. The EOQ calculation is in both cases supported by the ES. The remaining Companies set empirically parameter values, based on demand history.

Six only Companies calculate inventory circulation and especially slowly circulating items using the ES. However, they do not systematically use these calculations for estimating reorder parameters, but mainly for applying ad-hoc solutions, like for example, instant stock reduction by selling slowly circulating items, using special offers. In principle, all the Companies could calculate inventory circulation and use it in a systematic way for purchasing optimization.

Delivery lead times can in principle be adapted using the actual purchase order historical data. This process is not used by any Company.

In conclusion, the observed purchase order planning deficiencies concern basic aspects of process use, rather than the corresponding ES implementations. MRP could be in principle used by all the Companies, at least for part of their purchase items. Statistical reorder point could be improved by adopting and implementing theoretical models of parameter estimation, in particular for EOQ and safety stock. In general, there is a great margin for process adoption and/or optimization. This requires knowledge and experience in logistics and materials management which can be provided by hiring external consultants and/or specialized personnel. Additionally, special software for demand forecasting and parameter estimation may be necessary, and is in general available at affordable cost.

5.8 Allocation of receipts and scheduled receipts

The allocation of receipts and scheduled receipts presupposes a sufficient warehouse organization and management, along with the corresponding ES implementation.

All the Companies allocate stock using the ES.

For back-orders, in commercial or MTO production activity, the allocation starts with purchase order creation with respect to the corresponding sales order, and it takes place upon purchase item receipt and allocation to the corresponding production order BOM components, or sales order for goods. Allocation of stock is very important, especially in the cases of MTO production and back-to-back commercial sales orders. It ensures that stock is immediately available to the requestor upon receipt, and can contribute to the reduction of production delays. In order for the allocation to function properly, the warehouse should be well organized to ensure that physical stock is in agreement with ES posted stock.

For back orders in commercial activity (specifically, back-to-back orders), seven of the fifteen Companies allocate scheduled receipts with respect to the corresponding sales order, using the ES. For back-orders in MTO production...
activity, four of the thirteen Companies allocate scheduled receipts with respect to the corresponding production order BOM components, using the ES.

Three of the four project-based production Companies assign further allocated scheduled receipts to the corresponding projects.

5.9 Purchase receipts and invoicing

Purchase receipts

All the Companies implement receipts with the ES, and create receipt notes by transforming purchase orders. All the Companies also check receipt quantities with respect to order quantities, and get notified by the ES in case of differences.

Five Companies for which lot traceability of purchased items applies, support the process with the ES. All the Companies carry out quality control of purchased items upon item receipt, either a sample or an exhaustive one by one control. Only two Companies use the ES for this process. The use of the ES requires a systematic organization of a quality control warehouse, which will ensure that rejected items become unavailable.

All the Companies handle purchase returns with the ES.

Purchase Invoicing

Five Companies check purchase invoice prices with respect to purchase order ones during invoice posting to the ES. The other Companies do not have the process or do not use it systematically, and monitor prices essentially without the ES after invoice posting.

The ES supports billing in supplier quantity units. Five Companies need and use this option.

Thirteen of the sixteen Companies which have imports from abroad use the ES for the document management. The ES use could be beneficial for the remaining ones as well, since it allows for an immediate check of suppliers’ errors in purchase orders pricing.

Purchase receipt transformations

All the Companies use an automatic inventory update upon purchase item receipt, and an automatic posting to general and extended ledger upon purchase order receipt.

Receipt allocation transformations have been previously discussed.
5.10 Purchase Business Intelligence

14 Companies use BI analytics and several of the following BI features:

- Dimensions: Time period, items/item categories, suppliers/supplier categories.
- Transactions: Purchase quotations, orders, notes
- Indexes and reports: Purchase orders (quantity and value) per dimension or combination of dimensions, comparison of purchase forecasts and purchase budget with purchase orders, calculation of stock rate increase or decrease, comparison of sales and purchase prices (especially, average prices), price and delivery time check (actual vs. promised), check of suppliers’ prices (actual vs. agreed), calculation of inventory circulation.

6. Summary of Results

6.1 Statistics of process and ES use

The implementation of 28 of the 45 processes (or 62% of processes) of the purchasing process reference set (Table 2) is impossible, very difficult, or inefficient without using the ES. In these cases, process and ES use are connected.

The processes are carried out with the ES in the 37% of cases, and without the ES in 31% of cases. Each case corresponds to one process and one Company, for which the process applies. Process 10.1 represents the group of BI analytics.

The following four processes can support tactical decisions: Supplier evaluation (4.1), purchase demand forecasting (7.3), and purchase planning parameter estimation (7.4, 7.5). They are used and carried out with the ES in 14% of cases. Additionally, about three quarters of the Companies use purchasing BI analytics.

The four cross-modular transformation processes 9.10 through 9.13, are used in 74% of the cases.

6.2 Summary of process and ES use deficiencies

The observed process and ES use deficiencies can be classified in the following three categories:

- Processes which are not used, or are not implemented using best practices, because of a general lack of maturity which is to some degree independent of the ES.
- Processes which are used but are not carried out with the ES.
- Advanced ES-enabled processes which are not used or are not used to their full potential.

With respect to the first category, deficiencies were observed in the following processes:

- Purchase order planning
- Allocation of back order scheduled receipts
- Quality control
- Purchase budget for non-productive items
- SRM

Purchase order planning is particularly important since it allows for decreasing inventory cost and product delivery times to customers. Companies lack know-how in implementing MRP, in setting up statistical reorder point using best practices and in estimating method parameters such as EOQ, reorder point, safety stock, and delivery lead times. They do not calculate inventory circulation or do not use it in a systematic way. They lack also experience in using demand forecasts. In order to overcome these deficiencies, the Companies need to hire external consultants or personnel with knowledge and experience in logistics and inventory management. Argyropoulou et al. (2007) reported similar remarks on MRP use by Greek SMEs.

The deficiencies observed in back order allocation of scheduled receipts are due to the lack of well organized warehouses which results in stock inaccuracies.

The deficiencies observed in receipts quality control are connected with the lack of organization of quality control warehouses. The ES under consideration does not have a special warehouse management module, and no Company uses a third party WMS. High acquisition cost is a serious cause of WMS non-use.

The lack of purchase budget for non-productive items renders purchase requisition check and approval obsolete. This is mainly due to the small cost of non productive items relatively to the cost of the process use, and to the lack of the necessary in-house organization structure to support purchase requisitions management, i.e., issue, approval, and control. Under the current economic crisis conditions, this attitude may change.

No Company has been interested in investing in an advanced SRM system functionality. Supplier evaluation and selection is carried out empirically by many Companies, without a systematic use of ES historical data. The ES does not implement any advanced cooperative model of supplier relationship (Lockamy and McCormack, 2004; Trkman et al., 2007; Reyes and Giachetti, 2010; Koh et al., 2006) other than the use of B2B e-commerce applications in few cases.

With respect to the second category of process and ES use deficiencies, the following cases of omission of data posting to the ES were observed:

- Purchase requisitions and RFQ: Non-use of the ES
- Purchase quotations: Omission of posting to the ES

The deficiency results in loss of historical data which could support decisions. It is mainly due to the workload of ES use in connection with the small manpower in purchasing. However, ES use may be profitable for Companies with relatively bigger manpower.

With respect to the third category, process and ES use deficiencies were observed in the following processes:
Basic purchasing workflow
E-commerce
Decision-support processes and BI

The basic purchasing workflow consists of the following stages: Purchase budget, requisitions (including requisitions approval), RFQ, quotations, quotation evaluation and selection, orders, receipts (including checks and quality control), allocations, invoicing, returns, and payment. Some of these stages are not used or are not implemented with the ES by several Companies. The full workflow use requires the adoption of systematic business logic and its enforcement with the ES. BPR will be also needed, in particular for allocations of receipts in connection with warehouse management.

The use of e-commerce in purchases presupposes the existence of a B2B application provided by the supplier or customer company. Some suppliers from abroad provide currently e-commerce applications to the sample Companies. As an alternative solution, customers can provide their suppliers with a B2B application to post updates about purchase orders in progress. In that case, a B2B portal integrated with the customers’ ERP has to be developed. One Company has implemented such a solution. This possibility will be probably explored more intensively in the near future.

Purchase BI is used by a great number of sample Companies which is mainly due to the promotion effort of the implementer. BI adoption is also boosted by the fact that BI analytics give an immediate result to prospective users. This particularly high BI penetration is probably not typical for Greek SMEs. Additionally, adopters of the present study have a lot more to do in view of a mature BI use. For example, they can extend BI analytics to the following ones: estimation of reorder point, reorder quantity, EOQ, safety stock; supplier evaluation, assessment of best supplier per item with respect to cost and delivery time.

7. Discussion and Conclusion

This study, along with Doukas and Mantakas’ (2007), and Mantakas and Doukas’ (2011) ones, analyze the use of best practice processes by SMEs and their implementation with enterprise systems (ES). The studies draw attention to process and ES use deficiencies, a subject which has not been systematically studied. The approach involves an analysis of individual processes from an essentially external perspective with respect to the companies under examination and covers processes which may not belong to ES project implementation goals of the companies. The analysis of individual processes requires detailed field data which can be gathered by using questionnaires and interviews with informers deeply knowledgeable about the organizational goals, ES implementation plans, process and ES use practices and the corresponding personnel perceptions, as well as of the ES functionality and constraints. ES implementation consultants can in principle offer this vantage point of view.

The analysis of purchasing processes over a small sample of Greek SMEs reveals deficiencies in process and ES use, which are connected to known resource
poverty factors affecting SMEs (Welsh and White, 1981; Laukkanen et al., 2007) and especially in Greece (Kostopoulos et al., 2003), such as the lack of know-how and manpower.

We believe that process and ES use deficiencies as those presented in the previous Sections, apply in general to SMEs at least in Greece, and that deficiencies may be even greater for other ES. In fact, the ES implementor of the present study provided turnkey solutions and implemented the special business logic of its customers, upon request. However, many other competitive ES for SMEs in the Greek market, which actually have a much higher penetration compared to the ES under consideration, are “preconfigured” lower cost solutions. It is therefore plausible to suppose that increased misfits between company business logic and ES models, and consequently increased process use deficiencies may exist for other ES. This hypothesis should be tested. A cross-country comparison could investigate the role economic, market, and cultural differences as well.

Additionally, the role of company size in process and ES use practices should be investigated. Deficiencies in SMEs may be substantially different from those in bigger companies. There are only some implicit hints from other studies in favor of this hypothesis. The medium-sized companies using SAP and Peoplesoft ERP systems of Shang and Seddon’s (2007) study, for instance, faced mismatch problems between company practices and ES models, especially due to insufficient BPR and ES configuration/customization. Several other studies also show that bigger companies face performance dips after ES initial operation (Ross and Vitale, 2000) resulting even in process shutdowns (Markus et al., 2000) and having possibly an economic impact of several years (Wieder et al., 2006). These results imply that the companies have extensive and deep process use before ERP implementation. In the contrary, the SMEs of the present study have still a long way to go in adopting and using best practice processes, especially advanced ES-enabled ones. This hypothesis on the role of company size should be tested. A possible difference between small and medium-sized companies, which has been shown to exist with respect to ERP adoption criteria (Laukkanen et al., 2007), could be also investigated.

Several process orientation studies, such as for example, Reijers (2006), Škrinjar et al.’s (2008), Chen et al. (2009), Kohlbacher’s (2010), Kumar et al.’s (2010), Trkman et al.’s (2010), and Kohlbacher and Gruenwald’s (2011), define dimensions or indicators of process orientation, which are general aspects of process use. Similarly, Hammer’s (2007) process and enterprise maturity model includes general process “enablers”. With respect to the role of ES, the degree of process integration due to the ES use is taken into account in Reijers’ (2006) and Kohlbacher’s (2010) process orientation constructs, while the information and management systems which support the processes make part of Hammer’s (2007) process enablers as well. The role of ES is not referred to, at least explicitly, in Kohlbacher and Gruenwald’s (2011) and Škrinjar et al.’s (2008) process orientation constructs, while it is separated from process orientation in Kumar et al.’s (2010), and Trkman et al.’s (2010) studies. Under low process and ES use maturity conditions, such as those described in the present study for SMEs, a lower level of analysis of the use of individual processes, in connection to the enabling ES seems
necessary in order to understand the deficiencies and their causes. The evaluation of business process orientation indicators is a possible extension to the present work. Additionally, the evaluation of structural measures of process performance (Balasubramanian and Gupta, 2005) could supplement process workflow analysis.

References


Acquisition of cost information at one of the faculty at Wroclaw University of Technology - case study

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Abstract
This paper explores the role which costs play in achieving operational success, determine their continuous analysis as well as control. In practice, an influence estimation of various factors on the economic performance is particularly significant. This requires the usage of applicable methods, which allow to obtain information, that can form fundamentals for economic decision making processes. In the contemporary circumstances, the key tasks of management of universities involves ensuring the continuity of the university and its future development. What becomes, therefore, of a paramount importance, is the effectiveness of carried out processes within the university. In order for businesses to survive and operate in the marketplace, they must internalize the best management solutions available. Making the right decisions often leads to compilation of a various decision outcomes, which incorporate a statement of expenditures and results. Such insight constitutes the fundamentals for economic activity control. The university costs are, as a matter of fact, a reflection of its imperative values as well as its strategies. Their effective management provides the extension of university’s existence into the future.

Keywords: higher education, cost effective, cost information.

1. Introduction
The financial audit determines a financial effectiveness of an university. For the expert’s task is expressing an opinion and making a report, which consists of various financial indicators – dependable on the assessor, which institute about the effectiveness of activities of an university. To make these indicators reliable for the receivers of an opinion, data based on which, these indicators were calculated must be reliable.

There are many definitions of effectiveness. Prakseology defines effectiveness as a characteristic of activities giving some positive outcome, without a consideration for activities’ deliberate […], or not deliberate nature (Pennings, J.M., Goodman, P.S., 1977). The main aspects of efficient activities are effectiveness, lucrativeness and economical value. Other forms of efficiency (frequency, preciseness and reliability) have an additional meaning. (Pennings, J.M., Goodman, P.S., 1977)
Effectiveness is defined in the most simple terms as a degree, with which a desired result was achieved. Definition of effectiveness can, at the same time, serve as its measure – taking under consideration the collection of activities, the more we approach to the situation considered as a target, the more the degree of effectiveness becomes reached. Whereas, activities on their own, can be divided onto effective and ineffective. An effective activity is understood as a state in which, even when the result was not achieved, one gets closer to the final goal. An ineffective activity is considered as an activity, which does not bring about any positive effects, and it maintains only as a plan. One can also distinguish another type of activity, namely, an anti-effective activity. It’s understood as an activity, that move away from the desired goal. Lucrativeness is a difference between a serviceable value and costs of the activity:

When these two conceptions are connected, it will be possible to talk about:
- efficient activity, which is both effective and lucrative;
- efficient activity, but not lucrative, in which the serviceable result and costs of the activity are lower than 0;
- inefficient activity but lucrative, in which a goal was not attained and side effects of such activity were evaluated as positive
- inefficient activity and not-lucrative, is an activity that is inappropriate, that should not be undertaken.

Another aspect of efficient (effective) activity is an economical value. The activity has an economical value, when the relationship between useful results and costs of this activity is higher than 0.

Lucrativity and an economical value as measurements of criteria selection for an activity can occur separately, even though they belong to the same group of terms. However, not always the activity, that is most lucrative is also the most economical. As an efficient activity we can accept a range of other measurements, which play a subsidiary function. Among those, we can mention preciseness,- reliability, energy, cleanliness, defines, simplicity, solidity, assurance, rationality (Pennings, J.M., Goodman, P.S., 1977) All of these terms play a big part in evaluation of activity’s effectiveness, because the more factors we take under consideration during the evaluation of activity’s effectiveness, the more the activity is efficient and thus effective.

Multi criteria evaluation is defined by J.M. Pennings and P. S. Goodman. According to these two authors, the mark of effectiveness is based on: targets, conditions to fulfill and standards (Pennings, J.M., Goodman, P.S., 1977). As a priority, authors consider, appointed state of matter assign by the management. Besides targets, the organization should fulfill a range of conditions, dependable on the type of the business. Standards are accepted numerical indicators, marking out the level of targets and conditions to be fulfilled. Expansion of such an opinion is the definition of M. Bielski. According to him effectiveness of the organization is a multi-dimensional term and to its evaluation, there should be many criteria and various, used to within these criteria, measuring instruments or indicatory devices bearing both numerical and descriptive characterization.

2. The effective cost management concept

Subject literature defines cost management as an activity based on the improvement of actual costs on the grounds of the acquired information with a view
to achieve the objectives set by the organization. Such type of the management is to verify costs up to a preset level by improving in-company economic processes with special reference to activities and decisions taken by the managers, on the basis of all of the information available from various sources (for example accounting systems). Cost management theories originate from Japanese industry practices. According to Japanese concepts, cost management may be defined as a process analysis of incurring costs and of a possibility to lower them in various phases of this process. Jarugowa defines cost management as a process of continuous improvement, which supports the development and application of an appropriate board policies and code of conduct procedures and requires construction of information input system based on significant costs. The author also stresses that such an approach ensures the effectiveness of ongoing processes within the company. For Sobańska cost management term implies all control activities and relationships as well as cause-effect relationships, which serve an early and anticipative deep influences on the cost structure of universitys and lead to a reduction in the level of operating costs of the organization. However, Kaplan and Cooper, specify that this term refers to a system that combines the measurement and calculation of the cost with the effectiveness of the business control processes in an university. Nowak points to Horngrenm Datar and Foster for one of the most interesting definitions of cost management. They assumed that cost management includes management actions in the form of systematic monitoring and continuous cost reduction in order to achieve customer satisfaction. The authors pay special attention to raising the awareness of the managers of the consequences of their decisions regarding costs.

The main objective of cost management, which results from the definitions aforementioned, is to improve financial results of the business university by undertaking continuous improvements of business processes taking place within the university, as well as efficient use of its resources. Cost management is the process of planning, monitoring, analysis and allocation of cost structures, as well as maintaining them at a particular level. Companies must perform their activities more effectively than their competitors. According to the definition on the effectiveness aforementioned, an effective activity is believed to be the one which brings optimum results from the approved effectiveness evaluation indicators point of view. When examining the given definition, one may be led to the conclusion that it does not provide information about what gives evidence of the effectiveness of the process implementation. For the cost management process to be perceived as measurable, it is vital to define the effectiveness determinant of the implemented process. To achieve the above, we need to introduce the concept of effective cost management. By the concept of the effective cost management, we shall have in mind the process of planning, monitoring, analysis and allocation of cost structures, as well as maintenance of costs at their expected level, which allow for future growth and development of the business university.

3. An evaluation of effective cost management

Under certain conditions, companies financial results may, therefore, provide indicators assessing "quality" of cost management. Please note that the assessment of the size of financial performance from the perspective of cost management can't be made through the prism of one period only. The costs born in a particular period may pose a significant burden on the result and yield higher
returns in future periods. Furthermore, the financial results are effected by multitude of management areas. So, when conducting an evaluation of cost management of an university, it is important to remember this. In assessing the cost management of the university, one should pay particular attention to the desirability of the costs incurred, “awareness” of the university during bearing the costs and on the realization of the process itself, which is an effective cost management.

4. Case study

“Wroclaw University of Technology belongs to the best technical universities in Poland – over 32 000 students study here under the guidance of 2 000 academic teachers, at the 12 faculties and the Department of Fundamental Studies, as well as in the 4 regional branches (Bielawa, Jelenia Góra, Legnica, Walbrych). It rates high in the annual rankings of Polish universities. Recently, it has been announced the best technical university in Poland for the second consecutive time in the oldest Polish ranking of higher education schools carried out by the “Wprost” magazine (in 2006 and 2007). Also, the university ranked first in the modern technologies group (disciplines: computer science, electronics, materials science) of the Where to study? ranking” (www.pwr.wroc.pl, 2011).

In this paper we would like to focus on one faculty. Let’s called this faculty “W”. Faculty “W” is divided in two institutes and faculty administration (dean office, financial specialist etc.). Every institutes are consist of administration (e. g. secretary, financial specialist) and few smaller separated group of scientists.

Faculty is responsible for every process and action connected with education. Institutes are rather responsible for research and development area. It is assumed that almost every costs connected with didactics and teaching students are on faculty side. Money for this aim comes from subsidy from Ministry of Science and Higher Education. Financial resources for research and development are in institutes. So almost every cost connected with research and development area is on institute side. It is believed that faculty is responsible for teaching students but institutes are responsible for research and development. That’s why financial resources obtained for research from industry, European Union, Ministry of Science and Higher Education and special public agency are located in institutes. Every grant has his own separated subaccount where the costs are recorded.

3.1 Acquisition of information cost.

At Wroclaw University of Technology there is central administration, that is responsible for all financial and accounting field of all university. Furthermore at faculty or in institutes there is a person or group of people responsible for financial side of each entity. We can say that there is a feedback between people from central administration and from each entity. The platform where people from each entities can look after and control disbursement of funds and find accounting information is HERA system (internal computer system). Access to this platform have only authorised person. People can see every information of their own department or institute. The information in HERA system is very often not full and usually demand very profound analysis. Some information you can find in HERA system, but some not. Usually a lot of important and necessary for decision-making process financial
information are obtained from central administration as a document on paper. You can’t find it and analyse in HERA system.

3.1.1 Acquisition of information cost from the faculty point of view.

In HERA system there are three main group of costs: Didactics, Costs of every single grants, Indirect costs of entity (faculty, institute). At faculty or in institutes there are every three category of costs pointed above. Faculty is responsible for education so the biggest group of costs is didactic, next one indirect costs. The amount of grants located at faculty is really small. There are usually grants connected with education and teaching students.

Institutes are focused on research and development area so the main group of costs is located in second category (costs of every single grants). Really important group is didactics because every scientists are employed in institutes and their salaries are paid from didactics. Because of big amount of specialist laboratory using in research and development process indirect costs are very high too.

In institutes there are usually long list of different grants. We can share them on few categories according to the source of financing. There are grants financing from European Union funds, grants financing from industry, grants financing from Ministry of Science and Higher Education and other public institution.

The financial specialist from faculty can see every costs spending on education from subsidy from Ministry of Science and Higher Education. For the faculty this is the biggest pool of money.

Every grant has their own number and their own assignment costs. So in the system you can see a list of grants and you can see every accounted costs for every single grant. The costs are accounted in many subaccounts. Below we would like show only few of them, these the most important. At faculty side there is not a lot of grants, only these connected with education.

We can put every grants in two other categories – small grants and big grants. The grant is small when his budget is beneath 20 000PLN. At faculty or in institutes there are two categories of all costs (independent of these 3 categories) : direct costs and indirect costs. Indirect costs is divided in two categories: indirect costs of central administration and indirect costs of entity where the grant is located. Direct costs are accounted in many subaccounts.

Main indirect costs at faculty, based on data from three last year are:

- Costs of energy and water
- Costs of salaries (salaries of security and service of cloakroom).
- Costs of access to internet and server
- And other small costs like garbage disposal, costs of correspondence, costs of phone, consumable, equipment, depreciation

It is assumed that salaries of faculty administration is paid from didactic, because their official duties are connected with servicing of didactic.

Indirect costs for institutes are:

- Costs of energy and water for the rooms that are used by institutes workers and the space where the laboratories owned by institute are located. These costs are really high because in this category are costs of energy and water used in laboratories for research.
- Costs of salaries (salaries of security and service of cloakroom and administration).
- Depreciation, and other indirect costs of institutes
The main costs in didactics at faculty are:
- Salaries of personnel
- Scholarships for PHD students
- Other costs like costs of travel, conference, equipment for didactic, and so on

The costs in both institutes are really similar. The biggest costs are salaries because research and development personnel, technician personnel is employed in institutes not at faculty. In two institutes is about 150 workers so the amount of salaries is really high.

It is assumed that every grants are in institutes. Every grants have their own specific so the costs are different. In some grants the biggest costs are salaries, on the other hand in other grants costs are focused on equipment. But globally in every grants the main costs are: salaries, equipment, consumable, travel costs, conference costs and indirect costs. Indirect costs in every grants are counting as a percentage of direct costs.

3.2 Main problem with access to cost information

Faculty and institutes obtain money from different sources. The main source at faculty is subvention from Ministry of Science and Higher Education for teaching process and usually small grants connected with didactics. In institute there are three main sources: statutory grants from Ministry of Science and Higher education for research and development, order from industry and different projects granted from different institutions (e.g. from European Union, polish public institution etc.). Every projects has their own number and their own subaccount in HERA system where expenses are recorded. Rules of accounting aren’t clear for financial specialist from entities (faculties, institutes) of Wroclaw University of Technology because one cost sometimes is recorded in category “X”, the other time in the same kind of cost is recorded in category “Y”. There are a lot of different subaccounts and the procedures of accounting every single costs are well – known but only for central administration not always for financial specialist from faculty or institute. So they get some information and they have big problem with interpretation because the rules are unknown. Sometimes it is even very hard to find a person who can answer a question connected with costs accounting. Workflow and circulation of information is very often unclear and it is very hard to find a person who is responsible for some activities and process.

At Wroclaw University of Technology indirect costs are counted as a percentage of direct costs. This percentage is divided in two groups: indirect costs of central administration of Wroclaw University of Technology and indirect costs of institute or faculty. Indirect costs are costs of energy, telephone, water, administrative costs etc. One of the main costs in institutes are indirect costs because institutes are in possession of big laboratories with big equipment and these laboratories used inter alia a lot of energy. The big problem especially in projects is with indirect costs, like costs of usage of energy and water. Our university get only one invoice for all usage of energy and water. Then these costs are divided into every entities at university. So our faculty “W” and its institutes get from central administration information about usage of energy and water but for all entity. So this is very hard to make estimation how is the real usage of these indirect costs in each project, when faculty or institute have them more than one. Moreover the energy and water is used in didactics process and by workers in their rooms. Let’s take into account for example cost of energy in one project. This is research and development
project and in this project studies are made on three stands situated in one laboratory. In this laboratory beside these three stands are another five, that are used in other project. For this one project it’s impossible to estimate real usage of energy. Institute get only information about usage of energy but for all laboratory (for every eight stands). So the project can be charge for energy only in proportion to all usage in laboratory. To summarise, when in one big laboratory there is a few different research places. Each place is using in different projects but there is no possibility to determine how much energy this stand used, in which period of time and in which project. That’s why indirect costs are counted only as a percentage of direct costs.

Usually in different projects there is a possibility to charge indirect costs like a percentage of direct costs. But increasingly the projects impose to charge indirect costs in the same way as direct costs. This is a big problem for institutes who can show indirect costs only like percentage of direct costs.

Every information about costs, people from institutes and faculties can see in HERA system after one-two months. So the delay in system is so high that they can’t control the financial situation correctly.

Every research and development personnel are employed in institutes. They are responsible not only for research and development area but for teaching students too. These costs are treated like didactic costs (even if these personnel is not only responsible for teaching) and accounting in these group. If they participate in projects they can get additional salaries directly from these grants. The next group of workers are technician. If technician is responsible for service during laboratories for student they are paid from didactic but when they are responsible for service in laboratories but during research and development process they salaries are paid from indirect costs. If technician is employed directly to one grant this person is paid from this grant. The next group is administration. When administration duties are connected with didactics (for example people from dean office) they are paid from didactic at faculty. People in administration in institutes are paid from indirect costs of this entity.

5. Conclusions

Because of huge change in polish legislation in high school field every universities in Poland should evaluate to adjust to new reality. In these article we wanted to show from faculty point of view (because case study part based on interviews with faculty workers and financial information got from them) that a lot of process with accounting and acquisition of information costs need to be change. As we pointed in the first part of this paper only the effective costs management provides the extension of university’s existence into the future. At Wroclaw University of Technology there are a lot of changes now. First of all, there are changes in didactic field. As a first university in Poland they bought one integrated computer system for servicing students and didactic at every faculty. Secondly, begun to make changes in organizational structure in central administration. These changes allow for the purchase of new computer system for accounting and acquisition of information. The audit show that the processes of workflow and almost 70 % of procedures are useless, out of date and need to be change and adjusted to new reality. The Wroclaw University of Technology is one of the biggest university in Poland so the process of change need a lot of time and people efforts and can’t be execute overnight, it is rather slow and careful process.
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Interviews with workers from one faculty and two institutes at Wroclaw University of Technology

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An empirical study of ERP implementation, in Small and Medium Enterprises in Greece

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Abstract

Throughout the world, organisations rely heavily on deploying the correct software for their business operations. Therefore, choosing a particular operational system and software can have a significant effect on a company’s formulated business strategy. The investment required in an enterprise resource planning (ERP) system is very high and inappropriate selection of an ERP system could present difficulties for the company. Meticulous planning is, therefore required, in the ERP selection process. If the business has the knowledge needed to take the right steps in the evaluation and selection of an ERP product, the time taken in the implementation will be less and consequently the chances of success will be greater. ERP selection is very different from the process of purchasing off-the-shelf software such as accounting or payroll packages. Since little is known, about how small and medium sized enterprises (SME’s) implement ERP systems this study has concentrated on Greek SME’s and the questions that the research aimed to address include:

- Has the Greek small and medium size enterprises using and ERP system any differences from the global ones’ (eg. Chinese market)?
- Does ERP system implementation affect the small business in a positive or negative way?

Further, this study has identified that SME’s lack the required knowledge, regarding how companies identify their system needs and how they choose appropriate software vendors and products for one of their most significant areas of operation. The findings from the study also suggest that expenses have a negative effect on the usage of the ERP system, but implementation of the ERP system does present positive overall affects on the SME if done correctly. It is hoped that the findings presented in this paper can aid development of ERP success models and Information Systems (IS) research.
Presently business and organisations face many challenges especially those that result from globalisation (Yusuf et al., 2004), and this has led to unprecedented levels of competition. In competitive global markets, business and organisations need to find better business solutions, with flexible and reliable structures. Much of an enterprise’s infrastructure and organisation is enabled by information systems that directly or indirectly support business processes of crucial importance to growth, survival and competition (Markus et al., 2000a). By managing these processes more efficiently, competitive advantage can be gained via cost reduction, product enhancement, and customer service improvements. Global market change has become a constant, which reveals a clear and imperative need for continuously improving business processes. Since business processes are fundamental building blocks of an organisations’ success, information technologies that focus on process management and improvement have been good candidates to help organisations to fulfil their corporate visions and to improve their competitive positions.

RESEARCH OBJECTIVES OF THE STUDY

The primary purpose of this study is to understand how Information Technology (IT) is adapted (Avgerou, 2008) and used in local companies in Greece in a well defined context and to provide answers to the following questions.

The questions that this article wishes to explore are:

- Has the Greek small and medium size enterprises using and ERP system any differences from the global ones’ (eg. Chinese market)?
- Does ERP system implementation affect the small business in a positive or negative way?

SIGNIFICANCE OF THE STUDY

Presently no similar research findings have been established or published because this study concentrated on micro Greek SME’s (Goutsos et al., 2004, Diakoulaki et al., 1992). According to the new classification of Eurostat. Furthermore, there is limited research in the area of Greek micro SME ERP implementation so this research is unique because of the large scale (across Greece) of the study and because there were no existing research studies to compare the results against.

This article evaluated the existing literature surrounding Enterprise Resource Planning Systems, and through the findings of this survey, new factors not well addressed prior to the literature, about small countries such as Greece, are revealed. The factors are due to the Greek scenario (Diakoulaki et al., 1992) which is rather complicated primarily due to the small size of the Greek business and organisations.

CONSIDERATION OF METHODS APPROPRIATE FOR THE STUDY

In order to undertake research and to handle information, researchers are expected to carefully select an appropriate underlying research assumption or a research paradigm, a research methodology, and a set of methods for collection and analysis of data (Myers et al., 2002).

One the most important aspects of research in the social sciences in general and information systems in particular, is to decide on an appropriate starting point for the
research and on the conceptual framework within which the data will be collected and analyzed. It is also important, especially in information systems research, to decide if the data collected will be of an essentially qualitative or quantitative nature or a combination of these (Green et al., 2005).

**RESEARCH METHODOLOGY**

This study examines information systems from a socio-technical approach. It seeks to examine not how specific information systems work, but how and why people choose and use information systems. As Hirscheim (1992, p.28) argues, information systems are fundamentally social rather than technical, and IS epistemology draws heavily on the social sciences. The aims of social research can be manifold in three common aims, exploration, description, and explanation. The researcher would rather take an anti-positivist view and assume that one can only understand by researching into the individuals who are directly involved in the activities to be studied.

As there was no public research, up to the time this thesis was written, on Greek SME’s the study was designed with a descriptive, exploratory, and explanatory focus. It seeks to discover if Greek SME has used ERP systems, to discover the nature of adaptation, implementation decisions, and procedures that managers and end-users used.

Survey research has been chosen since its one of the most important areas of measurement in applied social research. The broad area of survey research encompasses any measurement procedures that involve asking questions of respondents. The objective of the survey was to collect all the quantitative data, whose analysis could be used for the formation of the toolkit.

Action research (Petter et al., 2008) has not been adopted, as the researcher is not part of the implementation team or in any way has any connection or influence with the implementation project. Ethnographic research is similar to a case study, but again the time factor is a limiting factor of the research approach. Even so, for the reasons of triangulation the researcher has conducted six case studies, to validate the derived results.

Grounded theory has been adopted while, the researcher due to his profession (Accountant/Tax technician) and his academic background will use an Etic perspective throughout the study, but regarding the economic data changes thought the usage of the ERP system an Emic perspective will not be avoided.

A cross – sectional survey will be followed instead of a quantitative method; while the latter neglects aspects of cultural environment (Riemer et al., 2008) and social interaction that could affect systems development . Critics have pointed out that quantitative methods encourage researchers to separate themselves from the phenomena, which is a contradiction of these research objectives.

Another reason for conducting a survey instead of choosing another method is that the former is more flexible, while questions such as who, what, where, how many, how much could be asked, and focus in contemporary events could be given. (Kim et al., 2006).
LITERATURE REVIEW

The development of information systems success models, such as the Delone and McLean model (DeLone et al., 2003), has been an important contribution toward our improved understanding of information systems management. However, several issues in information systems success models remain under question and especially for SME’s in countries such as Greece.

Delone and McLean suggest that in order to develop a comprehensive measurement model/instrument for a particular context, the constructs and measures should be systematically selected considering contingency variables, such as the organisational structure, size, or technology, and the individual characteristics of the system. Yet, most studies in this arena do not elaborate on the rationale for their choice of success dimensions and success measures employed. Further, as was stated in the previous section, in order to fully account for potentially countervailing measures and dimensions of success (e.g., high quality but poor cost-effectiveness), model completeness becomes critical. Through a review of alternative models from the literature, (Melone, 1990) highlights the subjectivity inherent in the selection of a single effectiveness measure. This suggests that where the aim is to gain a full, overarching view of success, it is critical that the complete set of success dimensions be employed, not a selected subset.

Although the Delone and McLean model has been a valuable contribution to our improved understanding of information systems success, their taxonomy is presented without sufficient explanation of its underlying theory and epistemology, with many questioning the suggested causal/process nature of the model e.g., (Ballantine et al., 1996), (Myers et al., 1997). (Seddon et al., 1994) were the first to empirically test the causal structure (part of the structure). Their investigation supported some of the model paths but not others. Other researchers have since tested other causal relationships between the six variables of the Delone and McLean model yielding mixed results (Hunton, 1997). While (Rai et al., 2002) attempted to provide a theoretical underpinning for the causal model, they managed to do so only for the paths leading to the USE construct. This lack of theoretical grounding, combined with a weak explanation for causality and mixed results from empirical studies, raises concerns about the causality of the Delone and McLean model and the utility of the suggested relationships.

Gable’s IS-Impact Measurement Model(Gable et al., 2008) has eliminated the “use” construct from their model, but preliminary findings related to the IS-Impact model validation and extension by (Fazidah et al., 2009) have shown that cultural issues could affect it. It is also stated in the limitations of Gable’s study that such issues could affect it since it is concentrated to the data came only from the Australian public sector.

Although information systems investments are in many ways comparable to traditional investments such as production equipment, they entail a strong organisational element as well. It is a common tendency to measure enterprise systems only in terms of financial criteria. However, it is widely acknowledged that enterprise systems result in considerable intangible impacts in addition to more tangible impacts. Thus, use of traditional financial measures alone may not account for evidence of information systems payoffs (Ballantine et al., 1996), (Kaplan et al., 1992). In addition, economic evaluations and quantitative measures tend to be difficult to obtain and easy to manipulate.
Holland and Light’s model (Holland et al., 1999) can be seen as important as it focuses on the actual organisation, strategic and tactical processes that can exist in an ERP implementation process but from a management perspective. Their model though lacks as the authors stated in their paper, “a set of quantitative measures for assessing the impact of each factor on the implementation outcome for a large sample of companies”

Brown and Vessey (Brown et al., 1999) focused on existing IS research literature and ERP cases to develop a model able to identify variables that might be critical to successful implementation of ERP systems. However, (Brown et al., 2003) find that top management support in and of itself is not enough—they advocate active involvement by top management in project planning and project execution. The latter involves keeping the project on track; endorsing and communicating changes in schedules and rollout plans. In fact, (Nicolaou, 2004) had also found that the concept of system fit went hand in hand with organisational strategic vision. Given that this vision must consider elements of fit, expansion and benefits derived from such expansion — these changes appear to be more in keeping with activities that ERP adopting firms would undertake later in their post implementation life cycle.

The transition from indirect batch-oriented use of information systems to more direct, on-line and integrated IS has changed the way organisations produce and manage information. The modern information systems trend is toward changed organisational structures and behaviours that facilitate interOrganisational activities. New measures and evaluation models are required to measure success with contemporary Information Systems (Ishman, 1996),(Sedera et al., 2003). Yet, most Information Systems success studies continue to rely on instruments and measures that were validated with what are now outdated information systems (Saaninen, 1996). This paper has summarized in the design of the survey questionnaire the critical success factors that are affecting an ERP implementation and is going to explore if there are any inherent factors in the Greek Environment and particularly in SME’s that are affecting the implementation of ERP systems.

**ERP AND THE GREEK ENVIRONMENT**

The international ERP vendors have dominated the Greek market of Enterprise Resource Planning Systems, with some significant presence of local software especially at the level of small and medium size enterprises. In particular, small-size companies do trust local information technology solutions due to their flexibility and quick adoption of legal regulations, and factoring-in cost issues and vendor local support. Nevertheless, the ERP landscape within Greek SME’s remains blur; no comprehensive study of the extent of ERP adoption and functionality use within this business group has been performed to-date nor has there been any effort to promote "true" ERP solutions that encompass typical accounting and sales processes. A call for proposals to support information technology infrastructure and business software by the Ministry of Development that has successfully concluded (the program was called "Do Electronic Business") demonstrated the acute need of Greek SME’s to resort to modern ERP platforms. Almost 90% of the approximately 2500 proposals submitted (and eventually of those funded) requested the implementation of packaged software solutions of
international ERP’s or "quasi"-ERP’s from Greek vendors. Thus, despite the e-business dogmas of B2C, B2B and e-marketplace paradigms, the true need of Greek enterprises is to adopt modern IT solutions for their core processes (and assure effective and reliable backbone transactional IT system) before they embark upon bottom-line improving e-business initiatives.

The philosophy behind Enterprise Resource Planning systems is the creation of value though economy of scales and complete resource planning through processes that are in accordance to industry specific best business practices.

The Greek companies according to the definition of Eurostat are considered small and Medium sized.

Small and Medium size companies may gain competitive advantage and add value, through processes that are contrary to industry specific best business practices due to the following reasons as stated by (Nathanael, 2003):

a. SMEs in general derive their competitive advantage more from the knowledge and experience of employees, and from intrinsic ways of performing critical tasks than from formalized procedures. This knowledge and experience cannot be analyzed into specific process steps, and as a result, it cannot be mapped in an ERP system

b. SMEs have limitations on their operation that are different from large corporations. These may be dictated by the lack of capital, adequate personnel, manufacturing capabilities, regulatory distortions etc. SMEs, as a result, may not be able to streamline their processes, which make the functionalities of ERP systems irrelevant for these companies.

c. ERP systems provide a scope and granularity of processes that are practically redundant for SMEs, which, when applied, increase bureaucracy, without offering useful management information.

As (Nathanael, 2003) states, commercially available ERP’s constrain rather than support their operations. ERP software apart from the accounting module, which is dictated by law, in order to be fully adapted by an SME, needs to be customizable to reflect the business practices of the SME.

This action of course is controversy while a critical success factor of a systems implementation is not to customize the system.

This article will query the need of customization, in order an ERP system implementation to be considered successful and whether this is a critical success factor in the Greek environment.

SURVEY RESULTS

The purpose of this survey was to explore whether Greek SMEs use ERP systems, at least as they are considered and defined in the literature, and to pinpoint the critical success factors for their implementation. It was also important to identify additional influences and there was a specific set of questions that cover the aspect of user satisfaction that is a major part of the pre mentioned framework.

In this paper the data collected are presented in the form of frequencies, percentages, cross tabulations and charts with appropriate explanations and reporting of key results.
Further analysis like cross-tabulating and matching findings with similar surveys is going to be explored in the following chapter.

**Sample sizing**

In order to determine the correct sample size for this survey the sample size calculator has been used.

In accordance with the data from the Greece national statistical agency, the total Greek economy has an emphasis to self-employed businesses and the service sector. Further, more they could not provide data for companies that are using an information system and specifically an enterprise resource planning system.

Since there were no available data regarding the ERP implementations in Greece and the pre mentioned means could not accurately be determined, but while the sample size doesn't change much for populations larger than 20,000 (Guthrie et al., 2008) the following sample was found to be adequate enough for the survey.

<table>
<thead>
<tr>
<th>Margin of Error</th>
<th>5.62%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confidence level</td>
<td>92%</td>
</tr>
<tr>
<td>Population Size</td>
<td>20000</td>
</tr>
<tr>
<td>Response distribution</td>
<td>50%</td>
</tr>
<tr>
<td>Recommended sample size</td>
<td>300</td>
</tr>
</tbody>
</table>

**Table 0-1 Sample Size Calculator from RaoSoft**

- **Correlation:** Point biserial model
- **Analysis:** A priori: Compute required sample size
- **Input:**
  - Tail(s) = One
  - Effect size $|\rho| = 0.17$
  - $\alpha$ err prob = 0.0562
  - Power (1-$\beta$ err prob) = 0.92
- **Output:**
  - Noncentrality parameter $\delta = 3.0028819$
  - Critical t = 1.5921527
  - Df = 301
  - Total sample size = 303
  - Actual power = 0.9205954

**Table 2 Sample size calculator from G*Power**

The recommended sample size, even for the low “effect size” convention as Cohen (1977) calls, was 300-3003 companies, with an error margin of 5.62%, and a confidence level of 92% out of a sample of 20,000 companies or more.

**Response rate**

300 companies were randomly selected from the Greek Stock market and from local chamber of Commerce of Athens and Thessaloniki. The reason for not solely selecting the sample from the stock market was so as the sample should not to be biased, while the companies in the stock market are considered to be the top in Greece. In order to avoid this bias and to include small implementations also to the study companies from the local chambers of Thessaloniki and Athens have been chosen.

Emails regarding the online questionnaire were sent to these selected companies.
14 questionnaires were returned since the correspondence emails did not exist any more. In addition, 11 respondents reported that their company policy did not allow them to disclose any information on their IT departments.

According to (Jobber et al., 1989) the response rate is defined as “the percentage of total questionnaires mailed/sent (and not returned as undelivered) that were returned by the respondents”.

Hence after the follow ups emails (over a period of six months), the usable response rate was 61.09% (168 out of 275 (300 minus 25 (14+11))) which is an acceptable response rate for the future analysis.

Nevertheless, out of the 168 respondents only 154 used an ERP system while the remaining ones use either a CRM or an SCM (supply chain management) system. Therefore, these 14 SMEs are omitted from the survey analysis since they did not use ERP systems in any way. The remaining result for survey analysis is 56% out of the original sample.

The results response rate was beyond acceptable while in an online survey are not considered to be above 30%.

The high percentages of replies are due to the researcher’s attempts, primarily by sending three follow up emails, and two follow up of telephone conversation for companies outside the area of Thessaloniki. For the area of Thessaloniki, the researcher scheduled a meeting with 10 SMEs and hand delivered the paper-based questionnaire, which they completed, and these results were entered into the online questionnaire.

**Data Analysis procedures**

Descriptive statistics, the mean, and standard deviation were computed to summarize and analyse patterns in the response of the sample.

In order to validate the results, the Cronbach’s alpha method has been used, but while data will probably have a multidimensional structure, the Cronbach’s alpha will usually be low.

**Results**

From the selected sample most of the respondents were from, as they can be seen in figure 1, were from the manufacturing sector 47.40%, then whole/retail sector came with 38.31% and finally the service sector with 14.23%. These results are expected as they are close to the ones the European E-Business W@tch at 2008 has published for Greece. We can see a difference in the size the of the companies, and someone could argue that the sample in not representative of the total Greek economy. We must take into consideration the fact that these companies actually use an ERP system and not reflect the total of Greek economy. The Greek statistical agency could not provide data regarding the companies that are using an ERP system, at the time this article was written.

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Figure 1 Area of activity

20.8% percent of the respondents where the CEO of the company followed by the head of IT by 17.5% and then the head of the accounting by 15.6%. A result like this was accepted for two reasons. The first one is the micro scale of the Greek companies and because of this the CEO tends to make the decisions and secondly the dominance that the owner plays in the company (Prahalad, 1993). It is a common belief in Greece that company owners at least from SME’s are reluctant to leave others to make decisions regarding the company, while falsely believe they have all the necessary knowledge to run their business correctly (Karagiannis et al., 2000), (Vrechopoulos et al., 2003). A main characteristic of Greek SME’s is the dominance of their owner throughout the company and the reluctance of hiring managers and consultants (Benos et al., 2007b) in order to perform tasks in the company. It is acknowledged by Greek literature that Greek entrepreneurs of SME’s falsely believe that they have all the necessary knowledge and capabilities to run their business (Benos et al., 2007a). The result is therefore expected that the CEO would have a high response rate to the questionnaire.

The CEO was also primarily responsible for the upgrade of the system. In the Greek Environment, this can be explained in two ways. By cross tabulating the responsible for the system upgrade person with the number of employees the results change while the company “grows” in size, where as the head of the accounting department from above 250 employees is more involved is such a decision. As explained previously, Greek companies, even quoted ones, are family owned (Poutziouris et al., 2006) and usually have few employees. Where the CEO is not the owner is just the director of the SME. It is possible given the nature of the Greek business environment (Goutsos et al., 2004) that the CEO could be influenced to make an improper decision for the SME purely in the grounds that the Vendor will pay the CEO a commission rate (Saarinen et al., 1994) for selecting that Vendor. This practice is also followed by credible auditing firms like Ernst and Young, which earned hundreds of millions of dollars in consulting revenues.
from implementing PeopleSoft software for third parties pursuant to an "Implementation Partners Agreement" it had with PeopleSoft.²

Figure 2 average number of the company’s employees

Figure 3 average turnover

The small and medium Greek company environment, as it can be seen in figure 3 and 4, is verified while only 35.71% have a turnover of more than 50 million Euros per year. In order to be considered a small enterprise the number of employees must fall below 50 employees. As it was seen only 20.8% of our sample had below 50 employees, to be considered as small enterprises, 51.3% is medium and 27.9 are considered large. Therefore, the majority of SMEs in this sample 72.1% are small and medium sized. Comparing the number of employees by sector the Manufacturing sector had 47.4%, followed by wholesale retail sector 38.3%, and Service sector 14.3%. These results do not fully reflect the Greek economy, which is more service oriented (McDonald, 2007) , in accordance with the Greece national statistical agency, with an emphasis to self employed businesses.

² http://www.cfo.com/article.cfm/3004744?f=related
In usual circumstances it is expected that the higher the number of employees the higher the average turnover, but it can be seen that 31.8% of companies with an average turnover of 3-50 million fall into the category of 51-250 employees where the total of 39.6% is the sum of the companies with an average turnover of 3-50 million. While the companies with 51-250 employees would be expected to fall into the category >50 million. What is causing this apparent problem is that these Greek SMEs are not issuing invoices\(^3,4\). This result is a problematic area of the Greek environment since the government has been striving to solve this problem of tax evasion from SMEs not issuing sale invoices since 1981 up today. This point will not be solved in this article but helps to explain the reason for the previous result of adding the Greek companies into small and medium sized instead of large ones.

The above result is also validated by the recent 2009 Corruption Perceptions Index, which is carried out in 180 countries around the world, and measures the degree to which corruption is perceived to exist among public officials and politicians on a scale where 0 is the most corrupt and 10 is graft-free also validate the pre mentioned argument. “Greece is perceived as the most corrupt of EU countries, along with Bulgaria and Romania, an annual corruption perception ranking released on Tuesday (17 November 2009) by Transparency International shows.”\(^5\) Greece holds the 71\(^{st}\) place among 180 countries\(^6\), and is among the last in the European ones as. From the above analysis, it is considered that throughout this study Greek companies are considered to fall correctly into the new EU directive definition of SME’s.

\[\text{Figure 4 Vendor Implemented ERP System}\]

\(^4\) http://www.eipa.eu/files/repository/eipascope/20100114122130_Eipascope_2009_2_Article3.pdf
\(^5\) http://euobserver.com/843/29003
\(^6\) http://www.transparency.org/policy_research/surveys_indices/cpi/2009/cpi_2009_table
SAP dominates the Greek market followed by Microsoft Navision whose share is still 3 times less than SAP while the Greek ERP show similar uptake by Greek SME’s. This is also justified by the fact that most of our sample was in the manufacturing sector, in which SAP has a clear advantage (Werner et al., 2003), (Tsili et al., 2008) in conjunction with the other vendors at least in Greece. The Greek ERP vendors (Jacobides, 2007) show similar uptake by Greek SMEs. The above Greek ERP “map” is validated and doesn’t changed since 2009 and probably will not up to 2013 as it can be see by the survey called “Greece Enterprise Application Software 2009-2013 Forecast and 2008 Vendor Shares”, conducted by IDC- CEMA. In their survey it can be seen that SAP dominates again the market, it follows, Singular Logic, Microsoft (Dynamics Navision), Entersoft and Oracle.

Another issue that the survey showed, and was expected, was the few years that the systems have been implemented, only 3.2536 years (mean). This of course can be explained because the ERP trend is quite new to the Greek SME’s (Fotios et al., 2007 ). The “newest” systems arrive from the manufacturing sector of 3.0559 years, followed by services 3.4613 years, and finally the “older” arise from the whole/retail sector 3.4573years. This paradox though, while ERP systems are primary implemented in manufacturing companies, can be explained from the fact that more manufacturing companies have recently implemented and ERP system compared to the other sectors. ERP systems are being adopted globally due to the advantages of using these systems versus legacy systems. Enterprise systems are rich in terms of functionality and their potential benefits to adopting organisations (Markus et al., 2000b) through the employment of “best practices” (O’Leary, 2000).

Typically firms initially deploy standard modules, as they did in our sample (table 73) such as financial accounting, personnel administration, general logistics, materials management, production planning, and sales and distribution (Kirsch et al., 2006). Firms after stabilizing their initial deployments then web-enable their implementations by implementing modules such as SCM, CRM, EDI, E-Commerce (Shields et al., 2001). The findings from studies (Su et al., 2010, Quezada et al., 2009, Willis et al., 2002), however, suggest that performance benefits vary with the number and type of modules implemented and the usage of the ERP system over time.

The average cost of such an implementation is 1-150,000 Euro ,with a high std deviation 1.452, with barriers concentrating in the small implementations of up to 30.000 Euros 30,3% and medium implementations 300,000-1,500,000 with 35.5% .

The results have shown that 65.4 % reported a budget higher than the expected budget (Chan et al., 2003), (Wixom et al., 2001), which was almost up to 50% of the actual one. There was a 75% of more than 30% budget overrun in the whole /retail sector, and the manufacturing sector was the most over budgeted by 53.8% (table 76). These results can be explained from the poor business cycles (Wargitsch et al., 1998) that the pre-mentioned companies had documented, something which either lead them to follow the best business practices of the ERP system (Weill, 2004) and reorganize their whole business processes (Fattah, 2003) , or to customize a lot the system in order their processes to be adapted (Gargallo et al., 2007).

Given that ERP implementation is in its infancy most SMEs adopting tend to implement all at once (Karuppan et al., 2008), (Shaw, 2007), (Hatzakis et al., 2007). Most of the systems have been implemented in an “all at once implementation” 57.8%,
and it will be interesting to see in the analysis if this is affected by sector or size of the company. We see that the service sector decided to install specific modules or to focus to specific key business processes, rather than installing the system “all in once”. This can be explained because the service sector as mentioned earlier had installed the least modules needed in order for the system to go-live (Quattrone et al., 2006).

Packaged implementation lead to the dissatisfaction of the end users, after the implementation took place (Motwani et al., 2005). This could be explained from the user resistance in the new system (Shang et al., 2004). If we see this result in conjunction with the result that 46.8% of the overall users suggested that they can do their job without ERP, it is actually controversy. On a second view, though we can see that the results from the manufacturing sector are actually similar with only 2% of difference, which is in the margin of statistical error. Apart from that, the question referred to the packaged implementation so the service and the wholesale / retail sectors could be omitted since they primarily choose to install the ERP system either in modules or in few key business processes.

Most of the companies implemented the system for instant and accurate need of information (Ahituv et al., 1987) 25.9%, and decision support needs (Lai et al., 2008) 19.79%, followed by 14.84% - Increase of sales (Ghose et al., 2006). Only 10% upgraded Through a European Union subsidy/ allowance (Sandvig, 2003). This possibly means that Greece has to put more efforts to promote EU funds. No one has selected the -Usage of the State of the art software (Sankaran et al., 2008) or other.

One of the withholding factors of acquiring an ERP system is the cost of it (Kulonda et al., 2009, Özogul et al., 2009). If we bear in mind the installed modules we could see the service sector is less reluctant while it actually install few modules and not an ERP system, as it is considered by literature. The demand for life – long education of the personnel is considered to be one of the main restrains of the acquisition of an ERP system (Liang et al., 2010). As it was seen from the user satisfaction results 62.5% require more training. In addition, if we also bear in mind the fact that vendors “hide” in their initial offers these costs then the overall change before and after the implementation is justified. A constrain in the implementation of an ERP system is the demand for external advisors (Wu et al., 2007). The change between before and after implementation is quite high, but we must bear in mind the nature of the Greek SME’s, and CEO’s. Since CEO’s / owners are quite dominant and restrictive (Tsoukas et al., 2005) , the “intrusion” of advisors could result the leak of sensitive information outside the company. Apart from that, the cost of using external advisors is quite high, and compared to almost 50% budget overruns we have seen, the transfer is from before to after implementation is justified.

Regarding the economic data, the researcher had to contact the accounting departments to gather at least an estimate of the questions asked. Most of the companies where reluctant to reveal sensitive economic data and this is the reason why the formation of the questionnaire was so vague.

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7 At the time this article was written, the low response in adopting a system through a European Union subsidy/ allowance was noticed, and a EU funding program was granted by November 2009 named ESPA 2007-2013 for SME’s
They did respond though in the multiple-choice questions. The results can be seen below.

**Figure 5 changes in sales**

About 60.7% percent reported more than 2% and up to 5% of total upgrade in their gross sales after the implementation of the system and another 41.3% saw a 0% raise. This rise was more than expected and probably is due to the web capabilities such a systems has, of holding an electronic shop 24 hours per day 7 days a week.
Figure 6 changes in expenses

Regarding their expenses 48% saw a -5% decrease in their expenses while all the others saw a 2% increase by 26.%. This is probably the result of more effective inventory control and the reorganisation of the tasks of the employees. Unfortunately this lead to the unemployment of low non-experienced workers.

![Histogram](image)

Figure 7 changes in production efficiency

Regarding the production efficiency a huge 80.2% saw an increase. This massive increase is probably due to the fact that most of our sample was in the manufacturing sector. The effects from adopting good practice skills from the system and the more efficient production (e.g. Less 1st material thrown away, etc) line lead to this result.
Figure 8 changes in personnel efficiency

Regarding the personnel efficiency 60% saw a rise of more than 2%. This could be due to the less time consuming functions the personnel had to perform in order to complete their tasks.

As an overall we could say that a successful ERP implementation affects the small business in a positive way.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Some limitations should be noted, but at the same time, they present opportunities for future research.

Although the overall response rate in the survey is acceptable, the implication for this study may have been enhanced if the response rate had been higher. The number of respondents should be expanded. Some strategies can be implemented to boost response rates. For example, the Greek national Statistic Department, to add in their annual questionnaire (which is obligatory, to whichever company is sent to) apart from economic data questions, to include questions about Information Technology. A similar agency to the Greek one, the Cyprus one did and they could provide data overall the Cyprus company that uses an ERP system. In Greece at the time, no similar data could be retrieved.

A decision support system (DSS) and other application software in the fictional areas of business such as computer-assisted design (CAD) and computer-assisted manufacturing (CAM) could be included. Thus, this study focuses on small and medium sized companies in Greece.

Future research could be conducted of SME’s in several countries so as more valuable and contributing results to appear in the cultural issues that affect the ERP implementations. Comparative studies could be conducted to particularly examine the differences and similarities of critical success factors in an ERP system success in SME’s among Europe, or globally. For instance, is the proposed framework affected by the size and the sector a company operates in?
Mean scores on the dimensions and measures establish a benchmark against which further, future executions of the survey can be compared. Differences across the respondent cohorts suggest either differing expectations or differing experiences, both of which suggest possible value from management action. For instance, is the use of the ERP system obligatory for the users?

Differing expectations may suggest the need for better conditioning of expectations of particular groups, or increased training. For instance, what is the response towards the implemented system, among different levels of management? Differing experiences of the ERP system may suggest value in closer attention to the source of these differences, and may point to problem organisational entities, modules, versions, processes, cultures, or even individuals. Dependent upon organisation size and number of respondents, useful comparisons may be possible across stakeholder-groups, or across organisational units. It is also possible to ‘repeat’ the study for other systems or modules, or at a later date, in order to compare across systems and across time, while the ERP implemented systems have only recently been implemented.

DISCUSSION

As it was addressed in literature Enterprise resource planning systems are rich in terms of functionality and their potential benefits to adopting organisations (Markus et al., 2000b) through the employment of “best practices” (O'Leary, 2000). Some of the influences they could have to an organisation include:

Integrating the organisation’s activities by processing a large majority of an organisation’s transactions (O'Leary, 2000) and managing the information needs of companies (Gefen et al., 2000) is a major task and ERP systems if implemented successful can aid the integration of the process, people, system and the tasks allowing the business to spend less time figuring out what’s going on and more time improving what should be done better and concentrating on that (Slater, 1999). The project scope includes issues associated with facilitation of intra-organisation communication and collaboration (O'Leary, 2000) which are important elements in business operations. Both small and large companies can benefit from the technology investments in enterprise, systems and strategically (Markus et al., 2000a) as they enable organizational standardisation, thus eliminating information asymmetries and providing on-line and real-time information such as access to on-line ERP databases (O'Leary, 2000). An interesting aspect of ERP systems is that there are options to purchase only the modules needed presently and acquire any extra modules can be purchased at a later date and integrate into the system (Gefen et al., 2000).

Limitations of ERP systems have also been widely documented; as identified below. ERP’s can have a negative impact on the work practices and culture of an organisation (Allen et al., 2001). Many authors such as, (Gefen et al., 2000) suggests that there is a need for extensive technical support prior to its actual use to overcome these cultural (rational) difficulties. It has also been identified that there is a need for competent consulting staff to extensively customise the ERP (Gefen, Forthcoming 2000) to increase the acceptance of a new system and to reduce the “lack of feature-function fit” between the company’s needs and the packages available (Markus et al., 2000b). Another finding suggests that it takes an average of 8 months after the new system is installed to see any benefits (Koch et al., 1999). For example, the Total Cost of
Ownership (TCO) of ERP, as identified by the Meta Group (Koch et al., 1999), includes hardware, software, professional services and internal staff costs.

The pre mentioned influences are interesting to the field of Information Systems because ERP systems are a very complex information system which provide a single solution from a single supplier with integrated functions for major business functions from across the value chain. (Paul Bocij, 2002).

These influences could be identified as both direct and indirect. For instance the business cycles of the implemented system company’s are integrated to the ERP system (Argoneto et al., 2010), while if these cycles on the planning stage have been found to be weak they could be replaced from the business cycles the ERP system proposes (Nandhakumar et al., 2005). For instance, a company in order to sell an item via a typical information system, they should go to the inventory, “design” the item and then go to the sales module to print the dispatch note or the invoice. In an ERP system, the item should be designed, bought or manufactured and then it could be able to be sold or dispatched. This extra step of “buying” does not allow the company to have any missing data from the cost accounting view.

Literature review revealed that there is lack of research on the adoption and selection of ERP systems, in the Greek Environment (Angeliki K. Poulymenakou, 2005, Ge et al., 2009). Published research in the ERP systems mainly focuses on issues related to the implementation phase of the ERP lifecycle (Rose et al., 2006). This study can help CEO’s to recognise the importance of an ERP system (Boonstra, 2006). The impact it could have to their organisation (Malhotra et al., 2009) and with the help of the toolkit as a decision support tool to provide to them better planning. With a proper plan, an ERP system may be implemented successfully in an SME (Koh et al., 2009), and may be utilised effectively and efficiently.

While Small and medium sized enterprises are the overwhelming majority by 99.8% in EU-27, the benefits from the usage of an ERP system in SME’s should be evaluated and further reviewed. SMEs in the EU-27 employed, on average, 4.3 persons in 2005\(^8\). This figure varied considerably between Member States from highs of 12 persons per SME in Slovakia and upwards of 7 in Estonia, Ireland, Latvia and Germany, to less than 3 in the Czech Republic (2004) or Greece. As stated in the 2008 review of Eurostat, Greece is considered to be among the EU countries that hold not only SME’s but also micro scaled companies.

ERP implementations on SME’s and micro companies have not yet been fully explored by literature (Scott et al., 2009, Razmi et al., 2009), while ERP systems are primarily implemented into large organisations.

The pre mentioned influences and the need for a more accurate and cost effective way of business operation, in the current recession years, leaves no further choice but to operate with a single solution from a single supplier with integrated functions for major business functions from across the value chain. SME’s may gain competitive advantage (Lavie et al., 2008) and add value, through processes that are contrary to industry specific best business practices. Even so the companies should be aware of lock ins, which is a situation which makes a customer dependent on a vendor for

\(^8\) Eurostat Statistics in focus31/2008
products and services, unable to use another vendor without substantial switching costs.

SMEs have limitations on their operation that are different from large corporations (Allee, 2000, Ching-Chin et al., 2010). These may be dictated by the lack of capital (Beckman et al., 2008), adequate personnel (Wright et al., 2002), manufacturing capabilities (Trentesaux, 2009), regulatory distortions (Anderson, 2003) etc. SMEs, as a result, may not be able to streamline their processes, which make the functionalities of ERP systems irrelevant (Lasserre, 2004) for these companies. ERP systems provide a scope and granularity of processes that are practically redundant for SMEs, which, when applied, increase bureaucracy, without offering useful management information.

The above restrictions as (Nathanael, 2003) states, commercially available ERP’s constrain rather than support their operations. ERP software apart from the accounting module, which is dictated by law, in order to be fully adapted by an SME, needs to be customizable to reflect the business practices of the SME. This action of course is controversy while a critical success factor of a systems implementation is not to customize the system.

Studies indicate that nearly 30 to 50 percent of all global ERP deployments worldwide are problematic ones (Umble et al., 2002), (Mabert et al., 2003). This high incidence of problematic implementation is attributed to firms failing to proactively manage their organisational transformation needs in tandem with the technical implementation of their standard ERP systems (Scott et al., 2000, Koch, 2002).

The researcher has found through personal interviews problems that are most common in the Greek environment. The problems identified can be found in SME’s implementation throughout Europe, (Computer Fraud & Security Bulletin,(1987), (Hashimzade et al.), (Goossenaerts et al., 2009) but not to the same extent as in Greece.

The pre mentioned companies needed two software packages, and as (Schneider, 2006) indicates this is a common problem in SME’s. The first should be used for IRS purposes, printing invoices and despatch notes etc. In addition, the latter should be used for the company itself.

The most common problem that Greek SME’s face is the selling of goods/services without providing the proper invoices or despatch notes. Some could consider that this is a whistle blowing action for criminal activity but unfortunately it’s the everyday reality for Greek SME’s(Gianaris, 1981). Of course this action is leading to the failure of the primarily reason for which an ERP system is implemented. Accurate and correct information to anyone, which is interested in. Of course not all Greek companies act like this, while the ones’ the survey took place are the Greek stock market quoted ones so they are considered to be legitimate and gain from the usage of an ERP system.

The second area that the author has found to be problematic is what it is considered by the Greek Vendors to be an ERP system (Spanos et al., 2001). The Greek Vendors consider every software, which is based on SQL to be an ERP system, something that in most cases is very wrong. Instead of searching ways to provide software packages that could help the companies as a whole they try to find ways of "binding" them to their software. They sell their base system, and later on they charge outrageous amounts for installing modules to their systems (Scott et al., 2009).
The third problem that the author has found is the “commission” that the vendors pay to the persons in charge of the implementation, so as their system to be chosen instead of their rival (Canada et al., 2008, Dimitropoulos et al., 2009). Of course, this attitude “blows” the whole implementation to the air while none of the literature critical success factors is used.

The fourth problem that the author found was that most of the vendors in Greece try to hide costs from the implementation in order to get the job, and later on while the company couldn’t do much to escape from this situation they have to pay the extra cost to get the job done (Ketikidis et al., 2008). A common practice is to charge very small amount/hours for the training of the users, something that again leads to the failure of the implementation. The researcher located discussions on internet blogs (2007) that made reference to the usage of Microsoft Navision where a company did not pay for the annual service fee for 2008 while the system was implemented and they discovered they had to pay a penalty of 50% for the renewal of the system for 2009 found a similar practice9 If credible companies like Microsoft Greece, and for all the pre mentioned reasons the researcher has mentioned follow such “bad” practices, the Greek ERP market is at baby-born stage.

CONCLUSION

As addressed in literature an ERP system is designed independent of country or culture. Each country though has its own specificities: organisational, cultural, political and economic (Robertson et al., 2004, Morris et al., 2008), and these can have an important influence on the potential of the new IS and especially an ERP system.

ERP vendors encourage the use of global templates to facilitate the implementations. The global template incorporates standardized definitions of organisational structures, master data and business processes (Betz et al., 2007). However, in literature it is argued against the extensive use of global templates due to the lack of flexibility at a local level to take advantages of regional opportunities and to account for cultural differences (Hanseth et al., 2001, Liang et al., 2004b). But global templates are being increasingly adopted by large companies to improve the information flow due to standardisation (Ellingsen et al., 2007).

(Krumbholz et al., 2001) investigated cultural differences between a large pharmaceuticals company’s operations in the United Kingdom and Scandinavia. They found differences in how the ERP system should be implemented to take into account different legislative requirements in each country. They did not find any significant cultural differences studied the adoption of innovation in particular ERP systems, across different European cultures. It was found that national culture does affect the adoption of ERP systems and more specifically that there would be a negative impact in countries with higher levels of uncertainty avoidance, masculinity and power distance.

Some authors argue that these cultural differences are further exacerbated when comparisons are made between eastern and western counties. (Liang et al., 2004a) argue that these systems are based on “rule based” mature economies rather than relation based governance systems like China. (Wu et al., 2003) compared the

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9 http://www.pctechnology.gr/vbulletin/showthread.php?t=37062
Implementation of locally developed ERP systems to foreign developed ERP systems in Taiwan and the impact on user satisfaction. As would be expected, they found significantly higher satisfaction to the local system as it reflected the local use preferences. (Davison et al., 2001) supports this divide between east and west by arguing that the majority of ERP vendors are western and are therefore unlikely to support various aspects of eastern culture. By using simplistic examples he supports his argument; such as the automatic allocation of numbers by the system which may be offensive homonyms. In addition, the majority of reports in ERP systems tend to be online while Asian workers prefer paper based reports.

The Greek environment could not be compared to the Asian study, but the Greek issues addressed in the discussion chapter were a clear indicator that cultural issues such as the Greek environment could affect an ERP system.

Researchers such as (Al-Mashari et al., 2003) and (Kumar et al., 2003) indicate that firms that emphasize CSFs throughout their ERP deployment process achieve smoother implementations and consequently quicker attainment of performance benefits. Most firms use a standard CSF-based approach while implementing their ERP systems. Researchers such as (Jarvenpaa et al., 2008) and (Krumbholz et al., 2001), however, indicate that the “not invented here” and “unsuitable for our environment” are common barriers that hamper information system deployments such as ERP. Their studies suggest that national and organisational culture characteristics underlie these barriers and influence the success of the implementation process.

In addition to the pre mentioned studies, this article has discovered influences of Enterprise Resource Planning (ERP) systems implementation in Small Medium Enterprises and particularly in Greece. This research focused on critical success factors for implementing an ERP system in an SME in the Greek environment.

We could also say as an overall that a successful ERP implementation affects the small business in a positive way.

This research project was intended to provide practical new insights into the implementations of an ERP system into the Greek environment. Identifying one key success factor is impossible and ambiguous due to the complexity of an ERP implementation project. This research project will try in the future to embed a framework that would utilize the results from this research. The results provided will also be used for the development of an ERP implementation toolkit.
References


A successful deployment of an ERP system: A case study of a small Greek company

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Abstract

The purpose of this paper is to present the findings of a case analysis of a successful ERP implementation in the context of a Greek small enterprise. Past research has identified factors that are important to the successful implementation of ERP systems. However, the majority of the papers describe unsuccessful cases of ERP implementation systems examining and pinpointing the factors which led to failure. In Greece, there is a relative lack of empirical studies in examining the adoption of ERP by Greek firms, but most importantly there is a complete lack of studies of Greek small enterprises having applied an ERP system either with success or failure. The results of this study highlight some crucial factors that influenced the ERP implementation process in a small commercial company. Moreover, some determinants of successful application of an ERP system are extracted being valuable for other small companies in considering to implement ERP.

Keywords: Enterprise Resource Planning (ERP); Small and Medium Enterprises (SME); User Satisfaction; Case study.

1. INTRODUCTION

Information Technology (IT) Information Systems (IS) and particularly Management Information Systems (MIS) provide great benefits in improving process productivity and efficiencies as well as increasing the ability to speed up decision-making within and across organizational boundaries. Enterprise Resource Planning (ERP) systems are becoming one of today’s most widespread IT solutions. The primary functions of ERP are the integration of all the enterprises subsystems and business functions, i.e. supplier selection, production, finance, purchasing, sales and customer service. Nevertheless, planning and implementing an ERP system require an enormous investment on behalf of the firm in terms of time, cost and resources. Additionally, the firm must address the issues of culture as well as day to day company activities for achieving its objectives.
A great number of companies have implemented ERP packages attempting to integrate and optimize their various business functions and processes, but their efforts, in many cases, were not successful. According to a number of studies the main reasons leading to failure of ERP projects are the lack of strong and committed leadership, a clear implementation plan along with a strategy to implement it, problems in software customization and testing, lack of technically well educated and trained staff and, finally, a lack of financial planning, budgeting and justification (Sarker, 2003).

This paper describes a case of a successful implementation of ERP by a small commercial Greek company attempting to understand and identify the factors and issues associated with the success of the particular ERP project. An important prerequisite for a Management Information System, proposed in the literature, is the top management support (Sarmaniotis and Stefanou, 2005; Chen and Popovich, 2003). Fortunately, the particular company supported and stimulated the staff to adopt new IT solutions and particularly an ERP system. Moreover, training programs as proposed in the literature (Rigby et al., 2002) were vital to the success of the ERP system implemented. The critical point was that training focused first on the process connected to the ERP system and then to teaching the ERP applications’ features and functions. Another critical determinant that has been taken into account was the user (company’s staff) involvement. It should be noted, that user involvement has been found to be a predictor variable for ERP perceived usefulness, influencing ERP acceptance (Gyampah, 2007; Wu and Wang, 2007). Moreover, suggestions are made for solving problems during the planning and the implementation phases as well as for further research.

2. LITERATURE REVIEW

There is a lot of research focusing either on critical key success factors for ERP implementation (Upadhyay et al., 2011; Ngai et al., 2008; Al-Mashari and Al-Mudimigh, 2003; K. Hong and Y. Kim, 2002;) or on pitfalls and complexities in ERP implementation (Ip, et al. 2002; Ribbers and Schoo 2002). Some others focus on the fundamental corporate capabilities driving ERP as a strategic concept (Motwani et al., 2005; Mandal and Gunaskaran, 2003; Jacobs and Bendoly, 2003; Hitt et al., 2003). A third stream of research papers proposes theoretical models for ERP implementation (Finney and Corbett, 2007; Stensrud and Myrtveit 2003; Stewart and Rosemann, 2001). Finally, few papers look at the influence that user satisfaction and user perceived experience have on the behavioral intention to use an ERP system and how these two factors contribute to implementation success (Gyampah, 2007; Wu and Wang, 2007; Wu and Wang, 2006; Zhang et al., 2005; Gyampah, 2004).

The majority of the above studies have stressed the importance of top management support and commitment as prerequisites in successful ERP implementation. Top management can provide clear directions to staff members of all segments of the organization in order to cooperate and integrate information within and across all functional areas in an organization. Furthermore, business process reengineering is an imperative in order to achieve improvements in critical measures of performance (cost, service, quality etc). The lack of performance measures is one of the main reasons that leads ERP systems to failure (Yusuf et al., 2004; Hammer and Champy, 2001), due to the fact that organizations underestimate the extent to which they have to change the existing business processes and as a consequence the staff have many difficulties in changing the way of doing their business. The capability of
organizational change depends on the company’s capacity to change the embedded structures and processes in the organization. In that case the role of the company’s leadership in pursuing organizational change when implementing a new information system is extremely crucial (Stefanou, 2001).

Additionally, many researchers argue that user involvement in the development of an ERP system is integral to the success of the system (Mandal and Gunaskaran, 2003; Zhang et al., 2005; Yusuf et al., 2004). The implementation of new technology seems to be a threat for the staff who have to cope with differences between old and new work systems. According to Zhang et al., (2005), even the characteristics of different users may also affect the ERP implementation success.

Furthermore, many authors have focused on the users involvement, as a critical factor for implementing ERP systems. While they have taken into account user satisfaction as an important key success factor to the successful implementation, the majority of them based their conclusions of the perceptions and attitudes of top managers of the organization that implement these systems. In any case, both of them, managers and end-user satisfaction are important mechanisms and criteria for determining system success.

The ERP software suitability and usability is an issue that many authors and practitioners have mentioned for implementing an ERP system. According to them, companies should conduct requirements analysis in order to ensure their selection of ERP packages that most fit their requirements. Additional dimensions of the system such as flexibility, ease of use, usefulness of functions are major determinants of ERP success (Yusuf et al., 2004).

Concluding with the literature review we can point out that many of the above mentioned papers describe unsuccessful cases of ERP implementation system examining and indicating the factors which led to failure, though, successfully implementing an ERP system in a firm is extremely difficult (Yang et al., 2007). In Greece, there is a relative lack of empirical studies in examining the adoption of ERP by Greek firms, but most importantly there is a complete lack of studies of Greek small-medium enterprises (SME) having applied an ERP system with success.

3. RESEARCH METHODOLOGY

A case study approach was employed to identify the factors that facilitate or inhibit the success of ERP implementation in a small company. A case study examines a phenomenon in its natural setting, looks intensely at an individual or small participants, gathers information from one or a few entities (people, groups, or organizations) and draw conclusions only about that participants or group and only in that specific context (Yin, 2003). Furthermore, the case study method is well suited to the study of Information Systems implementation and considers an ideal methodology when a holistic, in-depth investigation is required. Due to that case study is a preferred strategy when “how” and “why” questions are being posed, and the researcher has little control over events (Feagin et al., 1991; Yin, 2003).

Based on the above, this study used the case study technique for data collection to gain insights into the topic being investigated. The criterion used to select the company was that the specific company is a small company that was implementing an ERP system successfully. Data was collected primarily through interviews, observations and archival sources, in order to confirm the validity of the processes (Sarker and Lee, 2003). The authors interviewed the project manager of the studied company and executives who were familiar with the ERP implementation progress.
All interviews were taped to ensure accuracy of written data and follow-up phone calls and e-mails were also made to seek clarification or further information. Additionally, reports, newspapers articles, evidence from different case studies and books from the existing literature had been reviewed and were compared with the initial case study to validate the findings from the case. Finally, when the case study was documented, was reviewed by the project manager of the studied company in order to crosscheck the accuracy of information.

4. CASE ANALYSIS

The study was carried out in a small commercial company that implemented an ERP system, specifically the LogicDis of Singular Logic. The name of the company is withheld due to the willing of the executives, subsequently termed company X. The company X is an importing-exporting commercial company that was founded in Thessaloniki in 1946. In its 4,000/m2 privately owned facilities, the company imports and supplies the Greek market with a wide range of products such as home and office items, gifts, ornaments, electrical equipment, as well as products that cover the needs of companies for promotional actions. Moreover, the products are distributed to Cyprus, to Serbia and FYROM. The wide range of products is designed for all who wish to experience little everyday pleasures in smart, “smiling” prices.

Realizing the commercial changes and challenges that arise, the company X invests in human resources, in computer technology as well as in communication. Additionally, it builds on important partnerships with worldwide established companies, such as Hyundai, whose batteries are distributed in Northern Greece, but also with Mare Ochiali, an upcoming wearing glasses business.

In order to improve its services, the company X decided to upgrade its inventory management process and an ERP solution seemed to be the logical answer, in order to provide the ability to integrate accounting, inventory and materials management. The executive manager of the company X underlined that before the final selection of the vendor and software the owners (top managers) and him had clearly determined their objectives and requirements. Moreover, they had set as a primary goal for the project to increase organizational efficiency, to achieve internal control, to reduce the time for some basic functions and finally to increase their effectiveness. Also, some other criteria were: the depth of the system’s functionality and usability, the specialized coverage of financial, inventory, logistics and the reliability and consistency required in sensitive business installations. In the end, they had to elaborate the budget, though the specific company is a small one and could not afford an enormous investment.

After considerable study the choice was made and the software was LogicDis Prime ERP from Singular Logic. Singular Logic is currently the leading software and integrated IT solutions group in Greece. With understanding of the entire range of market requirements, Singular Logic offers advanced and integrated IT systems. It also offers full support services, regardless of the company’s size, investing capacity and internal infrastructure. Singular Logic is specializes in small and medium-scale enterprises, since those enterprises form the backbone of Greek economy. Singular Logic philosophy met the company’s X business needs and reflected company’s requirements. The implementation approach initiated 3,5 years ago and involved the installation of some basic modules such as Merchant Management Subsystem (indicative Inventory Management, Sales, Purchases, Serial Numbers, Lots, Guides, Parts Guarantee, Cost of Imports and Exports) and Financial
Management Subsystem (General Ledger, Accounts Payable & Receivable, Financial Management, Budget Bill). Based on company’s X scope, re-engineering implementation with Prime ERP was planned to take 8 months, beginning in early 2007. This was a short time and the company was in a hurry but the executive manager underlined that the company had the capacity to change easily the embedded structures and processes due to the fact that all people of the organization are familiar with new technology tools. Consequently, the staff felt confident about their abilities to use the system. Technical issues and training lasted less than 2 months and the software was viewed as a very helpful on the whole. Moreover, the staff found the Prime ERP to be a flexible system which offers a familiar interface that is easy to use and the adoption was very quick. At that point, it should be noted that the majority of the users who would involve with the system, participated in the whole ERP project (from the idea stage, to selection and finally to implementation phase) and they expressed their opinion for the decision making. It is possible that these users, either because of their participation as project team members or because of their knowledge and experience in new technology tools, tend to have increased satisfaction with the ERP system. However, usage and practice was needed for exploiting the capabilities of the ERP system and the staff during that period detected some issues that should be improved. In any case, since 2007, the whole system has been subjected to continuous improvement efforts. Configuration and customization of the Prime ERP modules were undertaken by the project manager and a team of users (2-3 persons) and they were supported from the vendor’s consultants.

The whole project cost €68000 included some extra services relating to customization arising during the first 3 years. In that cost €20000 were added for the purchase of small mobile devices connected to the company’s ERP, through Internet, in order to provide direct (in any place and any time) information to sales representatives staff. It is obvious that top management commitment and support was an important prerequisite for this strategic decision. Once managers started to think about this project, they tried to explain and to justify their idea in that way those employees felt motivated to go along with the project and they were not opposed to the changes that were going to occur. The return for investment (ROI) of such a project is very difficult to calculate. The company X, despite the global financial crisis and particularly in Greece, managed almost to double its turnover in the second year, since the ERP system was adopted. Additionally, the gain in efficiency, in speed, in cost and time saving and in customer service are even more difficult to evaluate, but have obtained for sure, and this is something that have appreciated from all the staff of the organization. Today, approximately 70% of the firm’s employees are end users (total 12 employees) and are involved with the ERP system.

5. DISCUSSION

At Company X, all the staff considered the change efforts to be successful. The success of the implementation and deployment of the ERP system in our case is due to consistent and support of top management. This is a critical success factor, proposed in the literature by many authors (Sarker and Lee, 2003; Dong, 2001). Top management should be the driving force and must be willing for accepting that a lot of learning has to be done and many changes are required in business processes (Upadhyay et al, 2011). Hopefully, in this case top management and leadership were
of great value and ERP-directed. Furthermore, in this case, top management explained and justified the significance of the project to their employees. Consequently, top management was able to develop a shared mission of the organization and was also able to communicate the new system more effectively to company’s employees and gained everyone’s commitment and support. Due to that top management managed to increase their behavioral intention to test the new system and thus to convince them to participate to the preparation of the project. It is obvious, that user involvement and participation is another critical determinant as it has been found in the literature to be a predictor variable for ERP perceived usefulness, influencing ERP acceptance (Upadhyay et al., 2011; Zhang et al., 2005; Al-Mashari and Al-Mudimigh, 2003). In addition to that, it should be underlined that the project manager had experience and knowledge of ERP systems and this was very catalytic for the successful implementation.

Moreover, a team of experienced consultants undertook the directorship of the project. Vendors should be carefully selected since vendor support plays crucial role to the project success (Thong et al., 1994) and the package must match the business processes (Chen, 2001). In our case, the selected package is a user-friendly one and users are very satisfied with it. The project team worked very closely with the consultants of Singular Logic. Furthermore, training programs as proposed in the literature (Mandal and Gunaskaran, 2003; Yusuf et al., 2004; Zhang et al., 2005; Gyampah, 2007) were vital to the success of the ERP system implemented. The staff had a better understanding of how their jobs are related to other functional areas within the company. Additionally, training during technology implementation influenced user attitudes, performance and acceptance of the new system. In particular, end users had more favorable perceptions on the benefits of the system and higher level of satisfaction after training.

As it has been mentioned in case analysis, top management had clear goals and objectives that were essential to guide ongoing organizational efforts for ERP implementation. However, the company X tried to introduce a new system, fortunately not “all-at-once”, within a time frame of only 8 months of preparation. According to the literature, implementing an ERP system involves reengineering the existing business processes to the best business practices. Company X, due to the unrealistic time frame, underestimated the extent to which it has to change the existing business processes in order to accommodate the ERP system. Consequently, during the first year the staff with the consultants had to customize some extra functionalities, which increased the implementation cost. Hopefully, due to the fact that Company X is a small enterprise and so there is business agility, responded very quickly.

6. A CONCEPTUAL RESEARCH FRAMEWORK

Based on the ERP literature and the findings of the presented case analysis, a conceptual research framework is developed and depicted in Fig.1. This framework illustrates the critical factors that need to be addressed for a successful ERP implementation in small firms.

Firstly, it should be underlined that the dimension of the reengineering process might not be the principal success factor in small companies– as reported in the literature for large companies- due to their magnitude and hence their greatest flexibility of
their capabilities. Such a process does not need a long time to be integrated and it is not a difficult task due to limited processes and fewer staff involved. Additionally, top managers in the case of small firms is usually the owners of the firms. Consequently, top management is still a significant prerequisite and, thus, a key success factor but it is considered that owners are playing the role of top management.

Moreover, it is even more necessary in small companies to involve employees in an ERP project planning and implementation. They should be motivated to participate in all stages of the ERP implementation process (from the idea to the final step) and to have a positive attitude towards the whole venture. This goal is easier to attain in small companies due to the fact that they are characterized by coherence and unity. Finally, it is important to mention that an ERP software dedicated to small companies is more customized to the company’s special needs and it simplifies the efforts of the end users, thus increasing their positive attitude and satisfaction.

7. CONCLUSIONS

This paper provides valuable insight into the issues of the ERP implementation process, focusing in a small import-export commercial company. The Greek financial crisis and the competition from global market provided an opportunity to the specific company to change the way of conducting business by adopting an ERP system.
Introducing a new ERP system poses a great challenge for an organization. Some issues affecting ERP implementation were discussed and some critical factors that are prerequisites were examined. ERP has long been applied and promoted in the large companies. Instead, in the small companies there is an absence of any technological advancement or development or in some cases there has been slow. Consequently, there is a relative lack of empirical studies and particularly of cases with successful ERP stories in small companies. This study, demonstrates the necessity for top management commitment and support, clear setting and understanding of goals and objectives, budget planning, working process re-engineering, users involvement, package selection, consultant role and experience, training programs, users acceptance of technology and users satisfaction. A managerial implication of this case analysis is that users where involved to the whole ERP project design. Top management took into consideration their opinions for the decision making and encouraged participation of its employees in the process of ERP implementation. This was very integral to the success of the system. Additionally, top management place a great deal of emphasis on training and its impact on the perception of training effectiveness. Top management believed that users are the people who produce results and should be held accountable for increasing the system’s performance. Due to that, top management considered the overall satisfaction of users with the system implementation.

In addition, the ERP vendor, Singular Logic and its software provided the firm with a major advance in the area of information systems. With Prime Logic Dis the company X is equipped with a common solution that provides the flexibility to respond immediately to business requirements. Moreover, even if it is not easy to measure the return on investment (ROI) of such a project, the implementation and deployment of PRIME Logis Dis consider as a successful project, since ERP has provided the company with a lot of advantages. The company X has already achieved business agility and has already enhanced its competiveness. Furthermore, the Company X doubled its turnover in the second year of ERP adoption, under circumstances of financial crisis. Today, company X is preparing the integration of a new information system, a CRM which will allow it to manage customer relationships better.

References


The allocation of indirect costs in the universities for research and professional services – process approach

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Abstract

Higher education in Poland is in a situation where it is necessary to revise and streamline the way of its current working. "It is necessary to change the system of learning management and approximate it to the manager's management based on rational planning, methods and techniques of strategic management and training of personnel" (Ministry of Science and Information of Poland, 2004). Very important factors influencing this situation are: changing demographics, more stringent regulations related to the quality of education and costing and internal needs for cost information. Since universities are entities with a complex organizational structure, providing complex services (teaching, research) and having diverse audience of their activities (students, individual departments, external companies, etc.), management must be done in a professional manner. This mainly concerns the effective management of human and material resources (due to limited resources) and financial management (characterized by high amounts of scale). Is needed more detailed information about costs and efficiency of activities and processes undertaken in the universities, the costs associated with university students and a completed set of research projects and professional services. It is necessary therefore to introduce in the functioning of the university appropriate tools providing costs information supporting decision-making processes. The tool could be an activity based costing (ABC).

Keywords: cost calculation, university, research process, indirect costs, direct costs of projects

1. Introduction

The aim of this article is to analyze the problems connected with the allocation of indirect costs at universities. The literature and undertaken analyses indicate that the problems can be reduced to three basic issues. First, it is necessary to precisely define the indirect costs, which represent a kind of support areas for other activities. Management and representation costs of university should not be allocated, because finding of any relationships between them and cost objects would be very difficult even if not impossible. Second, the allocation of accurately defined indirect costs should be done in three main areas at universities,
i.e. teaching, research and professional services. The last issue concerns further allocation of costs of mentioned areas to cost objects, for example to courses or students, to research projects, or to orders from private sector.

The authors are especially interested in allocation of indirect costs in areas of research and professional services. In accordance with the literature, funds for research grants do not fully cover all the costs of resources applied by universities in the research projects, especially administrative, technical and other overheads costs. As a result research costs can be financed from other sources. On the other hand, using unverifiable indirect cost mark-up can cause overestimation of costs of research projects. This problem is especially important in the case of professional services, where the lack of understanding of indirect costs can lead to under- or overestimated offers.

The issue of under- or overestimation of research projects was described by J. Ratnatunga and E. Waldmann (Ratnatunga and Waldmann, 2010), who proposed a typology of research costs, including grouping of indirect costs occurring in research projects. Their methodology is a starting point for considerations presented in this article. The authors verify solutions presented by J. Ratnatunga and E. Waldmann and suggest some supplementations to their methodology. They indicate the examples of areas supporting research projects on both central and departmental levels. They also propose how to group indirect costs in order to further allocation of them. For each indirect cost pool it is indicated methodology of allocation, first to different types of activities (if the pool is used for various purposes), and then to individual research projects or professional services.

2. Cost calculation in universities

2.1 The meaning of indirect costs for calculating cost objects in university

Cost calculation of teaching or professional services or research projects in a university use a full-cost account (with a kind of simplification/reduction), which assumes, that costs are divided into groups: direct costs and indirect costs. This division gives possibility of establishing the connection between expenditure of resources and products or services made of them. Direct costs (individual) are the equivalent of the resources used directly connected with produced product or services. It is possible to allocate them directly to cost objects and to provide documentary evidence (necessary documents) by original documents. For a research project it may be for example the costs of material used for project realization, the costs of taking parts in meetings or conferences where research results are shown, the cost of external services required only for the project, the costs of publications or salaries of people executing the project. These costs do not come under any account activities.

The other group of costs are indirect costs, which are common for different products or services (cost objects). They arise in every phase of economic process: supplies, manufacture, sales and management. They are divided into: departmental (production) cost, distribution and selling costs and overhead costs (general expenses).
The departmental costs include costs of departmental production, which cannot be directly ranged as definite cost objects, because they are related with them in different amount. As far as university is concerned they are departmental costs of the department (the department is the basic “production unit” in a university). They include costs connected with administration and management, maintaining the surface, assuring the suitable working conditions, equipment depreciation, using the materials and energy, repairs and conservation, etc. For the research project for instance it may be using the energy or equipment and room’s depreciation and also costs of providing financial and administrative maintenance of the projects.

Supplies costs are beard when a company is supplied with resources necessary for keeping the business, but they are not included in the purchase price. These are usually: delivery costs, loading and unloading costs, carriage charge, transport insurance. In the case of university supplied costs participate in indirect costs in the lesser degree in general, but they aren’t meaningless. And for the research project these costs may participate in the full cost.

Sales costs are non-production costs, beard by the whole entity in the process of selling products and services. For a university first of all there are costs connected with running the marketing activity: promotion, representative costs, costs of printing the promotion materials, taking parts in educational trading etc..

Overhead costs (general expenses) are non-production costs too. They are connected with the maintaining, organizing and functioning of the entity as a wholeness. We identify two groups of such costs:

- administrative ones – connected with providing the management board (salaries, travel costs, taxes, office expenses, etc.) – in the process approach named costs of supporting processes,
- general production ones – connected with this part of production (services), which isn’t allocated to individual departments (for instance: costs of buildings’ maintenance, the transport costs, costs of the cleaning or guarding). For a university these are conventionally called "the didactic supporting".

In the case of university supplies costs, selling costs and overhead costs (general expenses) are treated jointly and called general indirect costs (head office costs). Indirect costs in the full costs account are calculated for cost objects on the basis of a cost driver. Costs drivers are quantitative or valuable measures, constant or variable, characterizing determined relationship (realistic or conventional) between allocating costs (proportional or positive correlation one) and objects of their references. It often happens that these measurements are proportional to the quantity of the production. There is usually just one cost driver used for one type of costs or place of their formation. As far as university is concerned there is a different method of calculation the cost of the cost object in use – indirect cost mark-up, usually expressed by percentage quantity of the direct costs. The whole cost of cost object is the sum of direct costs and the part of indirect costs.

The deformation of amount cost per unit of cost object (teaching or professional service, research project, etc.) caused by using the indirect cost mark-up by the very high part of indirect costs in the full costs (in the strictly production companies the indirect costs are more than 40-70% of the full costs (Januszewski, 2002), (Wnuk and Leszczyński, 2004)) may be the reason of incorrect economical decision. They may
bring a university to the market or financial or even law regulation problems (European funds 7 draft, task budget, efficiency audit).

The defects of the full cost account are mostly connected with the method of cost calculating in a university and allocating the indirect costs (by the indirect cost mark-up) for cost objects. Consequently, information generated by a university cost system have the low aptitude, not very useful for decision making processes, both operational and the long-term ones, for instance relating starting, continuation or abandonment educational course, cooperation, outsourcing, etc.

The indicated shortage of the full cost account and its limitations in services and projects cost calculations may be eliminated by the other cost accounts – first of all by the activity based costing

2.1 The essence of ABC for universities

Activity based costing is based on the measurement of costs by the structure of activities. The idea of the ABC is expressed in the statement that the products or services are not the direct cause of the cost. Costs arising because of specific actions, which are used for products or services (so-called cost objects) (Cooper and Kaplan, 1998), (Miller et al., 2000). The fundamental problem in the development of activity based costing is therefore to define the activities and processes of the organization. All analyzed studies presenting the experiences of ABC implementations in universities (Cox et al., 1999), (DETYA, 2000), (Granof et al., 2000) suggest their three major processes:

- the teaching process,
- the process of research,
- the process of professional services.

The teaching process includes all activities related to didactic. Apart from the conducting classes will include also actions such as preparation of classes, consultation, promotion and evaluation of graduate students.

The process of research is connected with conducting of research projects funded by both the university's own sources and external sources. Detailed analysis of the activities in this area may result from additional, individually determined for the project objectives.

The third major process includes the activities of expertise and is referred to as "the process of professional services". It contains works on all kinds of expertise, industry studies, participation in editorial.

Please note that apart from the time and qualification of faculty and staff all main processes also absorb other resources such as: education specialist equipment, materials, and laboratories.

2.2 The current state of knowledge

Most information about the possibility of using activity based costing in the educational environment can be found in publications such countries as Australia, United Kingdom and the United States. P. Crooper and R. Cook (Crooper and Cook., 2000), identify the cause of interest in the local universities in ABC as the need for "strong financial management within universities through improvements in planning, monitoring and resource allocation, thereby necessitating the introduction of more sophisticated costing". On the basis of their paper, published in 2000, we can conclude that no British university has denied the use of activity based costing for reasons such as failure or providing incorrect information to make decisions.
Another important information is the fact that in 1998 nine British universities used the ABC and further 16 were going to do it. Unfortunately, the authors couldn’t find the activity based costing models developed for the local universities and any information about the area in which ABC was/is used. It is known that these models were characterized by imperfections that prevented its use in a wider range of British universities. The limitations include:
1) unacceptable way of allocating the costs of faculty to activities,
2) unacceptable way of allocating the costs of general education.
The limitations of the conceptual models of ABC for UK universities are confirmed by the fact that from 1993 to 1998 raised percent of universities that do not want to implement ABC (from 3% to 7%).

A wide range of information about activity based costing in the educational environment comes from Australia. In 1998, the local government has said that the functioning of public higher education is ineffective. The effect of these conclusions was a project that had the task of finding an appropriate method for cost calculating. Ernst & Young, appointed to implement the project, proposed use of activity based costing, and obligated to verify the method in a number of selected educational institutions. The continuation of the project was the initiative of one of Australia’s universities (University of Newcastle), which has begun work related to using activity based costing in area of library and computer facilities. Based on these implementations, was prepared two reports provide information about how to use activity based costing in the educational environment, whether at the level of the entire university, and in some selected areas.

On the use of activity based costing in the educational environment was also carried out research in the United States, their results clearly indicate the possibility of resolving the problem of "lack even rudimentary information about the costs" (Granof, 2000) in American universities. The Jackson State University were to even attempt to implement "modernized" activity based costing, ABC based on time (TDABC). The results of the pilot study demonstrated a better insight into the costs of university, the opportunity to increase resources measurement and better cost control. The calculation based on TDABC demonstrated significant differences in the cost of students of individual departments, and in the cost of individual courses (Kaplan and Anderson, 2007).

There are several publications that focus on describing the applicability of activity based costing in selected organizational units supporting university teaching, such as a library or in the area of technological support (Ellis-Newman and Robinson, 1998), (DETYA and The University of Newcastle, 2001), (Gerdsen), (Heaney, 2003). You can also find studies that describe the activity based costing for a typical academic units such as departments (Cox et al., 1999), (DETYA, 2000), (Granof et al., 2000). Generally, you will notice that the process which is mostly described is the teaching process. Also at the Wroclaw University of Technology (Poland) developed activity based costing models (Klaus et al., 2007), (Klaus and Kowalski, 2007), (Klaus-

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2 A Study to Develop a Costing Methodology for the Australian Higher Education Sector (2000), A Study to develop a costing methodology for Library and Information Technology Activities for the Australian Higher Education Sector (2001)
Rosińska, 2009), (Kowalski, 2007) focused on education. Therefore there is the need to broaden the range of cost information for the other two processes: research and professional services. Knowledge of the costs of research becomes important aspect for universities. There is a noticeable upward trend connected with the number of projects carried out in universities, particularly European projects, which are subject to stringent regulations in terms of their planning and execution (among others 7th Framework Programme of the European Union). The modelling of professional services area is extremely important for the valuation of the services. Only a detailed analysis allows specifying the real cost of the services.

3. Indirect costs and project management in universities

3.1 „Rigid” budget of the projects

The well-known procedure used for costs of research projects consists of two main steps: preparation of a project budget before the beginning of the project and realization of budget expenditures resulting from the accepted schedule. As a result of this, it is difficult to talk about cost management of research project. A project budgeting is limited mostly to planning the expenditures of the project in the three main groups: salary costs, other direct costs of the project (including equipment, materials, services and conferences) and the indirect costs of the project. The estimation of salary costs is often performed without any methodology which would include time consumption. Even if the WBS (Work Breakdown Structure) of the project is created, it is difficult to talk about man-days assignment to each task. This results from the fact that planning of adequate man-hours or man-days considering time consumption of most research projects is very difficult if even not impossible. Most of the research problems are very complex and not fully structured, usually their effect is unknown or is a hypothesis, not to mention the way to reach a predetermined goal. Even if the steps of the research process are carefully planned, usually the realization of the project reveal the proper ways of acting. Because scientists preparing budgets are aware of this, the budgets of the research projects are a kind of proposals, in which the research team commit themselves to finish the research for a particular salary. There are no typical types of calculation like e.g.: activities, man-days or the salaries of individual team members differentiated according to their knowledge and experience. It is a sort of Fixed Prize Contract. The relationships between the workload and salary is contractual in nature. Such approach has both the pros and cons. On the one hand, it is difficult to imagine research projects in the formula of Time and Material Contract, because it could lead to unreasonably expanded research procedures or even misuse of funds. On the other hand however, the lack of correlation between workload and reward may be demotivating for researchers, and lead to over or underestimation of budgets. Undoubtedly, there is a need to seek salary cost management tools associated with research projects. Timesheeting is not the only solution although it increases our knowledge significantly (it allows to calculate post factum the real salary for man-hour). On the other hand, it is difficult to imagine standardization of research activities and evaluation how many man-hours does the project require (e.g. for the analysis of the existing knowledge about the investigated subject).

One solution can be contracting of research tasks within the research teams and allocated budget. As the knowledge about the project is developed and the detailed
schedule is prepared, research teams decide how the money will be allocated to individual tasks. Realization of a given task is rewarded with a salary in accordance with the plan.

The presented subject certainly requires further analysis and issues such as: changeable WBS of the project, reserves, budget modifications in the case of differences between the assumed and real time consumption of the project.

### 3.2 Direct and indirect costs of research project

J. Ratnatunga and E. Waldmann in the article “Transparent Costing: Has the emperor got clothes?” proposed a typology of costs concerning research projects and indicated grouping of indirect costs that occur in research projects.

In the case of the research the division of the costs into direct and indirect is not explicit, an attempt to identify the cost categories belonging to these two groups seems to be doomed to failure. The vast majority of costs indicated by J. Ratnatunga and E. Waldmann can be both direct and indirect costs, e.g.: subcontracting, equipment depreciation and computing. While indicating indirect costs of research projects J. Ratnatunga and E. Waldmann use often „only for the project“ phrase (e.g. cost of leased equipment for the project, equipment for the project). According to the authors the problem of proper identification of costs for research projects lies in the fact that in most cases the “costs only for the project” are extremely rare. Usually, the resources are shared firstly between various activities undertaken at the universities such as: research, teaching, professional services, and secondly between different research tasks carried out sometimes at the same time.

Of course, direct costs are the easiest category to manage in the case of research projects. Typical direct costs are easy to identify at the stage of budgeting and do not make difficulties during identification of costs of the realized project. Travel costs and participation in conferences are good examples of this. It is one of the best recognized categories of costs for managers of research projects. The experience of the authors shows that during the preparation of research projects budgets the number of necessary or desirable conferences is easy to indicate and so their cost. Generally, scientific conferences realize scientific objectives and it is difficult to imagine there the separation of costs into research and teaching. It seems also rare that a single conference can serve a number of research projects, and even if it is true the costs can be divided equally to all the supported projects or else by a cost driver based on the number of products associated with the participation in the conference (such as articles, speeches or posters). Similar clear situation is in the case of other direct costs.

Other most common examples of direct costs (found in the literature and proposals for funding) may be the categories such as: depreciation of the equipment, materials, papers and books. However, it is clear that for these categories the adjective “direct” will not always be proper. Authors think that all our colleagues can give examples where the equipment and materials serve more than one research project and sometimes are used for teaching as well. It is worth noticing that in the case of equipment and software used in research projects it is impossible to assign all the costs to one project. The same approach is in the case of purchasing books, scientific journals or access to databases.

Table 1 shows the proposal of direct costs of research projects from the point of view of presented consideration.
Table 1. Direct costs of research projects

<table>
<thead>
<tr>
<th>Costs</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Travel costs and participation in conferences</td>
<td>Direct</td>
</tr>
<tr>
<td>2. Materials</td>
<td>Indirect / Direct</td>
</tr>
<tr>
<td>3. External services</td>
<td>Direct</td>
</tr>
<tr>
<td>4. Purchasing books, journals, access to specialized databases</td>
<td>Indirect / Direct</td>
</tr>
<tr>
<td>5. Depreciation of equipment and computer software</td>
<td>Indirect / Direct</td>
</tr>
</tbody>
</table>

3.3 Estimation of indirect costs of projects

Indirect costs for research projects in university can be viewed from two levels: general level - the functioning of the entire university and the level of the unit in which the research project is implemented (it is mostly the department). Taking into consideration this approach, the indirect costs could create cost pools of resources at the university and department level. Each cost pool of resources in the first place should be settled through three basic processes of university: the teaching process, the process of research, the process of professional services (as a consequence we obtain information on the cost of basic processes), then the costs of the research should be assigned to each research projects.

Tables 2 and 3 represent the indirect cost proposals for research projects (grouped in cost pools of resources of university), including the two mentioned levels. The tables contain also the concept of assigning costs to the three basic processes of the university.

Table 2 Indirect costs of research projects – departmental level

<table>
<thead>
<tr>
<th>Indirect costs – departmental level</th>
<th>Fundamental processes involving resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Faculty staff</td>
<td>(1) Teaching process</td>
</tr>
<tr>
<td></td>
<td>(2) Research process</td>
</tr>
<tr>
<td></td>
<td>(3) Professional services process</td>
</tr>
<tr>
<td>2. Organizational units of the department:</td>
<td>(1)</td>
</tr>
<tr>
<td>2.2 Dean’s office</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>2.3 Library</td>
<td>(1), (2), (3)</td>
</tr>
<tr>
<td>2.4 Administration of the department</td>
<td>(2)</td>
</tr>
<tr>
<td>2.5 Scientific journal editors</td>
<td></td>
</tr>
<tr>
<td>2.6 (...)</td>
<td></td>
</tr>
<tr>
<td>3. Space of the department:</td>
<td>(1)</td>
</tr>
<tr>
<td>3.1 Didactic and research area:</td>
<td>(1), (2), (3)</td>
</tr>
<tr>
<td>- classrooms</td>
<td>(1), (2), (3)</td>
</tr>
<tr>
<td>- specialist workshops</td>
<td></td>
</tr>
<tr>
<td>- laboratories</td>
<td></td>
</tr>
<tr>
<td>3.2 Circulation area and other spaces of general use</td>
<td>(1), (2), (3)</td>
</tr>
</tbody>
</table>
The most important cost pool of resource identified at the department will faculty staff (Table 2 - pos. 1). Cost pools of resources like faculty member will consist of costs such as salaries and other employee benefits, functional additives and any other costs that are attributable to the employee, such as allowances for travel, the cost of space assigned to him, the cost of IT services rendered in his favor, you can also include the costs of the functioning of organizational units of the department (e.g. libraries). Cost pools of resources representing the cost of organizational units at the department (Table 2 - pos. 2), and cost pools of resources representing the cost of specialist laboratories (Table 2 – pos. 3.1.: specialist workshops, laboratories) should include the costs: related to salaries of employees working in their field, with the derivatives of those workers, the costs of maintaining the surface, the costs connected with equipment (e.g. depreciation of devices) and other costs (e.g., IT services). Cost pools of resources such classrooms (Table 2 – pos. 3.1: classrooms), as well as the cost pools of resource "circulation area and other spaces of general use" (Table 2 – pos. 3.2) will contain only the costs associated with maintaining the surface. From the perspective of the research process at a level of department, we can identify additional cost pools of resources: material and laboratory reagents (Table 2 – pos. 4) and specialized equipment and software (Table 2 – pos. 5).

Cost pools of resources at the department level will be consumed by three basic processes of the university. This does not mean that all resources will be equally used in individual processes. It is worth noting that can appear situations where resources are consumed for the one process (e.g., resource like a dean's office will be used only during the realization of teaching, the resource like scientific journal editors relates only to the process of research), then the costs associated with the use of such resources will be assigned only to the substantial process. There will also be those resources that do not directly serve any of the fundamental processes (such as circulation area).

**Table 3** Indirect costs of research projects – university level

<table>
<thead>
<tr>
<th>Indirect costs – university level</th>
<th>Fundamental processes involving resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Central Administration</td>
<td>(1), (2),(3)</td>
</tr>
<tr>
<td>2. Main Library</td>
<td>(1), (2),(3)</td>
</tr>
<tr>
<td>3. Rector</td>
<td>(1), (2),(3)</td>
</tr>
<tr>
<td>4. Language Center</td>
<td>(1)</td>
</tr>
<tr>
<td>5. Physical Education Center</td>
<td>(1)</td>
</tr>
<tr>
<td>6. Careers Office</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>7. Publishing Companies</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>8. (...)</td>
<td></td>
</tr>
</tbody>
</table>

Not all cost pools of resources at university level will be consumed by research process. Certainly it will be the cost pools of central administration, library, or publishing companies (they will be shaped the cost of the research). It is worth to
highlight that the full range of cost pools of resources at university level depends on the specificity of each university.

Problematic issue is the allocation of costs associated with the research activities to individual research projects. It seems to be reasonable to consider each cost pool of resources (related to indirect costs) from the viewpoint of research activities. Thus, it is necessary to - analyze actions of individual resources at the level of department and university level and - the selection of appropriate activity drivers.

3.4 Case study - costs settlement of a research project

For the purposes of this article the authors present a proposal of cost calculation of the research project at the Department of Computer Science and Management, Wroclaw University of Technology (Poland). The research project concerns the scope of economic science, so it is characterized by some specificity, but you can assume that the proposals are a starting point for further research related to method of calculation of indirect costs at universities.

An application for funding for the project concerned the following types of costs:
- Salary costs,
- Other direct costs of the project,
- Indirect costs of the project.

Salaries for the project, unfortunately, have been calculated in a "traditional", so without logical connection between the amount of salaries and effort necessary for the project. Some direct costs of the project shows a typical character of "direct costs", we can mention here: the costs of conferences and delegations, the cost of computer services and statistical processing. Dubious, however, are direct costs like: the costs of depreciation of equipment purchased for the project (it is also used to carry out statutory research - that is another project) and costs associated with the acquisition of books and magazines and the costs associated with the materials (they also serve the statutory research). Indirect costs for the project have been imposed "from above" and they constitute 25% of direct costs (cost calculation method approved for research projects at the University).

The consequence of the method of estimating the cost of the project is that the “real cost” of this project certainly is different from the “budget cost” of the project. Each cost groups (salaries, other direct costs, indirect costs of the project) have been estimated incorrectly. Incorrect estimation of the costs related to salaries seems to be less problem (salaries will be consumed by any accepted method), it is worse in the case of the indirect costs of the project - according to the method of calculation the budget cost of the project may be underestimated. Thus, the project can generate losses for the University.

Taking into account the considerations described earlier by authors, the drafting of the budgets of research projects should follow the following guidelines:

1. Personnel costs of projects should be assessed taking into account the workload. From the perspective of university management is necessary to keeping working time records, as well as an attempt to standardize the activities carried out within the research process.
2. Indirect costs of the project should be estimated taking into account the process approach, which means that it is necessary to identify any actions of research process. In the case of indirect costs related to the functioning of administration
the issue is not as complicated as is the case with the activities carried out by faculty staff. This raises the question of: it is possible to standardize the activities of faculty staff?

The authors propose to define the following research activities realized by faculty staff:

a) the acquisition of general knowledge and awareness,
b) the analysis of the current state of knowledge,
c) conceptual works,
d) planning/preparation of research,
e) performing research, conducting procedures relating to the research,
f) verification and usage of the results,
g) the presentation and dissemination of research results,
h) services related to research,
i) activities support research.

Above actions certainly are adequate for projects related to economics research. Whereas, it is necessary to verify for other fields of science.

For each of the research action you can specify the final product, which will become the cost object. Examples of cost objects and the way of settlement of costs of the research is presented in Figure 1. The costs of objects of research should be assigned to appropriate research projects.

![Figure 1 Diagram of the cost flow – research process](image)

Settlements of costs should be realized through the drivers selected in accordance with the methodology of ABC. To determine the costs of the activities the most important information will be the structure of working time. Selection of tools for measuring and documenting the time spent on research requires separate consideration. Moreover, the settlements of costs of activities on products of various research projects is possible due to base on a quantitative drivers, for example, amount of publications written for the research project or in doubtful cases through
duration drivers (e.g. the duration of works devoted to literature studies performed for the purpose of the research project).

To find the total cost of the project we should of course take into account the direct costs and indirect costs other than those related to faculty staff.

4. Summary

Considerations of the authors focused on the settlements related to research costs, however they should be also connected with process of professional services. In the article mentioned the need for calculating indirect costs of university through three main processes: the teaching process, the process of research, the process of professional services, made even try to identify which processes consume resources of university (look: Table 2, Table 3), while it is not shown what activities could be found within the process of professional services, what cost objects could be identified for these activities and what the costs drivers could be used.

The authors also intend to undertake further works related to the costs settlements in the process of research. This works should be linked, among others, with:
- Identifying the activities carried out by other than faculty staff resources (concerning pools of indirect costs) at the level of department or the university,
- Selection of appropriate drivers for the settlement of indirect costs,
- Consider use in the settlement of research costs the ABC based on time (TDABC).

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Role of IT executives on the firm’s ability to achieve competitive advantage through it capability

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Abstract

Contrary to prior studies that have tried to examine the role of IT capabilities on firm performance in isolation from the role of senior IT executives, we propose that there is a positive relationship between the power of senior IT executives and the likelihood that the firm will develop superior IT capability. Furthermore, the contribution of IT capability to a firm’s competitive advantage is much stronger in firms with powerful senior IT executives as they are the driving force that may ensure the continuous renewal of IT capability. We develop a two-stage econometric model designed to test the contribution of senior IT executives on their firm’s ability to achieve superior IT capability, and the impact of co-presence of powerful senior IT executives in firms with superior IT capability on their firm’s competitive position. Empirical evidence based on a sample of large US firms strongly supports our hypotheses.
ICT Value Creation at Four Levels of Analysis: Review of Extant Research and a New Conceptual Model

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Abstract

We reviewed extant literature on ICT value and provided a synthesis of its findings. The literature showed that ICT creates value for investing firms, their industries/ecosystems, and their countries. Complementary resources were also shown to play a critical role in this value creation. While the literature expanded our understanding on ICT value creation, our review identified venues that future research should explore. To that end, we proposed a model of ICT value creation process which addresses aspects which were understudied in the literature. The proposed model describes the ICT value creation process which takes place at four cascading levels. By identifying relations between these four levels, the model explicates different ICT resources and complementary factors, which drive the value creation at each of these cascading levels.

Keywords: Information and Communications Technology (ICT), Productivity Research, ICT Value Creation, IT Productivity
Introduction

Information and Communications Technologies (ICTs) are an integral part of digital economy in many countries. Individual organizations, both public and private, have deployed ICTs in all aspects of their operations. In so doing, they aimed to achieve efficiencies in their internal processes and improvements in how they interact with external entities, such as partners, customers or governments. Worldwide ICT spending has totaled $3.4 trillion in 2010 and was forecasted to total $3.6 trillion in 2011 (Gartner 2011). OECD reported that significant value added in the business sector was created by ICT in many countries (OECD 2008).

Much research has been conducted to understand the value of ICTs. The majority of that research has focused on the effects of investments in ICT on enhancing the economic performance of: 1) firms, where the contributions of each individual firm’s ICT investments to its overall performance are analyzed (e.g., Brynjolfsson and Hitt 1995); 2) industries, where the impacts of ICT investments on productivity are measured and compared across industries (e.g., Oliner and Sichel 2000); and 3) countries, where the overall impact of ICT investments on an economy is studied (e.g., Dewan and Kraemer 2000). Another body of research has been dedicated to understanding the nature of these economic impacts of ICT investments. Depending on the level of analysis (whether firm, industry or country-level), researchers have offered a number of metrics, of which productivity has been the most commonly used. Contemporary studies of ICT value have extended the initially narrow operationalization of the “economic performance” construct, and have even gone further to proposing that some of the impacts of ICT investments are intangible in nature. Finally, a growing body of research has focused on understanding the process of achieving positive returns from ICT investments. This research has identified a plethora of factors that mediate the conversion of ICT investments into performance gains.

By and large, extant research has confirmed that investments in ICT can result in performance and productivity improvements both at the macro and micro levels. Further, research also has provided insights into the conditions that facilitate the realization of these benefits. For instance, investments in complementary assets, such as decentralized decision making systems, job training, and business process redesign, have been shown to enable and enhance the achievement of positive returns on ICT investments (Dedrick et al. 2003). The realization that investments in ICT alone might not create positive returns has been credited with explaining some of the earlier mixed results.

Nonetheless, in only looking at ICT investments at the aggregate level, existing research offers limited insights as to the type of investments that are most beneficial. Thus, the existing research is unable to offer actionable advice to practitioners and policy makers beyond confirming an impact of ICT investments on returns. Specifically, due to its focus on more tangible macro-level performance indicators, prior research has almost exclusively treated ICT investments in aggregate. Thus, this research is unable to discern the individual contributions of singular ICT investments, or even investments made in broadly categorized groups of ICTs.
Of equal importance is the absence of any substantive research on the cascading effects of ICT investments among the three levels of analysis commonly studied (firm, industry, and country). The economic performance of countries is driven by their industries, and the performance of the latter is determined by the performance of firms in each industry. The performance of a firm invariably is driven by the “performance” of its employees. This missing link between the effects of individual-level performance enhancements on higher-level performance, and the often ignored cascading effects between the different levels of the ICT hierarchy of effects, warrant further study.

Taking stock of extant knowledge vis-à-vis the effects of ICT investments on performance, we review prior literature examining the effects of ICT investment at the country, industry, and firm levels. To address the research gaps mentioned above, we propose a model that: 1) examines the contributions of different types of ICTs to positive returns; 2) extends the existing multi-level analysis of ICT impacts with an individual-level analysis focusing on the impacts on employee job performance; and 3) investigates how investments made at micro levels (individual and firm) translate to benefits achieved at macro levels (country level).

Our goals in this work are as follows:

- Describe the state of knowledge about ICT performance impacts, by producing a synthesis of research insights gained from extant literature. This will include a review of metrics used to measure the impact of ICT investments. These recently have been extended beyond financial gain, to considering nonfinancial gains such as innovation.
- Develop a comprehensive theoretical framework that incorporates the four levels of analyses previously described, and delineates the individual contributions of different types of ICT investments to positive returns.
- Identify the factors that contribute to the achievement of positive returns at each level of analysis.
- Provide guidelines for effective practices and future academic research for conducting multi-level analyses of ICT impacts.

Given the one-way bottom-up nature of ICT investments’ cascading effects, it is reasonable to suggest that for ICT investments to be impactful at higher levels, they need to produce positive returns at lower levels. Hence, a significant portion of our work will be dedicated to understanding how the individual use of ICTs can impact performance at these multiple levels.

2 Overview of Extant Research

Studying returns from ICT investments has been a research focus for the past several decades. Earlier studies in the 1980s have raised the possibility that a paradox exists, whereby investments in ICT were observed to result in no measurable increase in productivity. This paradox was later dismissed, and more rigorous studies revealed that ICT investments have significant positive impacts at the firm, industry and country levels. This body of research ushered a new era in which the focus shifted from trying to prove/disprove the existence of an effect to understanding that effect and its facilitating conditions. Specifically, researchers have
started focusing on understanding the nature of these positive impacts, the conditions under which these are achievable and the process by which they are achieved.

During the past several years, a general consensus has risen as to the mechanism by which ICT investments result in positive impacts. Typically modeled as inputs to the production process, ICT resources act to enhance that production process, and consequently add value to its outputs. This results in improvements in some type of economic indicator. The enhancements to the production process were proposed to be moderated by external factors, which are seen to be responsible for explaining the variations in returns of ICT investment. This framework of study is shown in Figure 1.

While research in the 1990s has focused primarily on understanding the direct impacts of ICT resources on economic performance indicators (e.g., labour productivity, profitability), research in the decade that followed has paid considerable attention to the complementary factors that moderate the attainment of these positive results. More recent research has focused on further explicating the constructs included in this framework, such as the types of value-added outputs (Kohli and Grover 2008), and on understanding some of the interdependencies between them.

The subsections that follow summarize the findings of relevant studies categorized based on their unit of analysis. An appendix that enumerates relevant studies in the ICT value literature and highlights their significant findings accompanies this paper.

![Diagram of Framework of Past Research](image)

**Figure 1:** Framework of Past Research

### 2.1 Firm Level Research

Since most ICT investments are made by firms, researchers have attempted to identify the contribution of ICT resources to the performance of the investing firm. These studies often were motivated by the need to justify investments in ICT as firms heavily rely on IT. In fact, ICT accounts for half of all business investments in
equipment (Brynjolfsson and Saunders 2009). Given the discretionary nature of ICT investments like investments in research and development (R&D), advertising or capital expenditure, managers often are concerned about the returns that can be generated from investing in ICT1.

Most research in the firm level used econometric methodologies based on production economics and related the input factors such as IT capital, non-IT capital and labour to the firm performance measures in order to estimate the marginal products or output elasticity of input factors. Despite the early discouraging findings, later studies established the significant positive relationship between IT investments and firm performance. Different studies have employed different performance measures, including economic value added (EVA) measured as an increase in sales, accounting ratios such as Return on Assets (ROA), Return on Equity (ROE), or Return on Sales (ROS), as well as stock market-based measures such as market valuation of common equity, short-window abnormal stock return, and Tobin’s q. While performance measures are obtained from accounting and financial databases such as COMPUSTAT and CRPS, firm-level studies use IT spending data from one of the three sources: International Data Group (IDG), ComputerWorld magazine, and Information Week magazine.

Four important findings emerged from these firm-level studies. First, IT investments contribute to firm performance. Various studies illustrated a wide variety of potential returns to IT investment at the firm level. These studies provided an equivocal answer to the question of “Does IT create value?” The answer is “Yes, IT creates value for organizations investing in IT”. Second, IT shows higher gross marginal returns than non-IT investments.

Brynjolfsson, Hitt and Yang (2002) reported that while a dollar of computer capital was associated with more than $10 of market capital, a dollar of non-IT capital was associated with approximately a dollar of market value. Such findings provide a good justification for managers who allocate limited financial resources to various capital investments, to invest in IT. Third, not every firm enjoys the same level of return on their ICT investments. Some firms use IT more productively than others, which is the notion called the “firm effect” in IT returns (Brynjolfsson and Hitt 1995; 1996). This phenomenon raises an important question in regards to possible reasons for the existence of such an effect. The existing literature contemplated two likely causes of the firm effect: (i) there are idiosyncratic differences in firm characteristics. These can include “market position, rigidities in cost structures (e.g., labour contracts), brand recognition, or the vision and leadership abilities of key executives” (Dedrick et al. 2003); (ii) managerial choices such as restructuring the organization, introducing new management control systems, redesigning processes, encouraging employee involvement, or upgrading employee training, all of which can influence specific features of the organizational structure, strategy, and managerial practices to create systematic differences across firms (Dedrick et al. 2003). Studies after the late 1990s

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1 Please note that most of prior research has used the label Information Technology (IT) to describe investments made in Information and Communications Technology (ICT). To remain true to the spirit of the literature reviewed, we use the term “IT” in this section. We strongly believe that the proposed framework and all ideas discussed in this paper are relevant to the larger category of ICT investments.
predominantly corroborate the second argument asserting that management practices and complementary investments, which we will discuss later in the paper, explain part of the variation in returns on firms’ IT investments. Fourth, firm-level studies showed that IT influences the levels of other input factors. In particular, IT resources are a net substitute for labour. It is also clear in the literature that IT deployment results in a shift towards highly skilled workers in firms and they get paid higher wages. The process, which is referred to as skill-biased technical change, starts with computer-based automated systems substituting for low- and mid-level white collar workers. This process is followed by a change in the complexity of work which requires human intervention. This creates more demand for highly skilled workers. Hence, changes in the skill levels of the employees explain the increased wage rates associated with IT use in organizations.

At the firm level, the extant literature was not able to provide convincing evidence to establish a linkage between IT resources and firm profitability. While some studies propose that the modeling techniques and datasets used in the literature are not adequate to measure such a linkage, and that it is likely that the linkage between IT resources and firm profitability does exist (Dedrick et al. 2003), a more plausible explanation is that IT investments do not necessarily result in higher profitability. This is justified by the fact that profitability appears as the last in the chain of effects of IT investment. IT can directly affect the firm’s output as well as various operational factors such as inventory turnover, coordination, product quality, order accuracy, etc. However, these benefits might not be translated into profitability due to the strategic and competitive environment surrounding the company. For example, Hitt and Brynjolfsson (1996) argue that IT can enable firms to produce more output for a given quantity of input (i.e., business productivity) without generating higher profits that they would have earned otherwise. This is driven by the fact that the value associated with IT use might be passed on to the customers in the form of lower prices or better services. Therefore, the fact that IT’s influence on profitability was not shown in the literature should not be interpreted as though IT does not create any value at the firm level.

Some studies in the literature investigated the relationship between IT and intermediate (operational-level) performance measures. This line of work argues that improvements in intermediate operational measures result in better financial performance (Mukhopadhyay et al. 1995; Mukhopadhyay et al. 1997). Barua et al. (1995) demonstrated that IT influences operational measures like inventory turnover, yet ensuing operational improvements do not lead to financial returns. Some of the intermediate operational benefits associated with IT investments in general, or specific IT components in specific, are better coordination of procurement processes, improved accuracy and reduced shipment discrepancies in supply chain (Srinivasan et al. 1994), reduced inventory holding and obsolescence cost, reduced transportation cost (Mukhopadhyay et al. 1995), reduced material waste (Banker et al. 1990) and shortened cash conversion cycle (Magretta 1998).

Some studies found a disparity in profits between leading and lagging firms in IT-intensive industries. They also found that while leaders in the past had a few percentage points better profit margin than others, the gap between the leading and lagging firms has been growing in IT-intensive industries since the mid 1990s.
This highlights the importance of effective IT use in such industries. On the other hand, the literature shows that there is no comparable widening in the performance gap between leading and lagging firms in non-IT-intensive industries. Brynjolfsson and Saunders (2009) interpret the result as indicating that IT provides an opportunity for firms in these industries to differentiate their strategies from the other firms.

The caveat in the firm-level studies is that they used datasets which contain information about large firms, and hence their findings are most applicable to large firms, and thus, should be interpreted cautiously.

2.2 Industry Level Research

Industry-level studies in the literature examine whether productivity improvements seen in different industries are associated with IT and, if so, whether the positive returns of IT are specific to certain industries. These studies often use datasets from government agencies whose mandate is to collect and publish economic indicators. These agencies such as the Bureau of Economic Analysis in the U.S. publish and provide analysis on aggregate data on industries.

Productivity is the ratio of output to input. A commonly used measure of productivity is labour productivity, which is the output per hour worked. Labour productivity calculated for every industry is the key variable used in industry-level studies. Labour productivity is a result of three main factors: capital deepening, labour quality and multifactor productivity. Capital deepening occurs when employees are given more capital. If they are given better, faster tools -ceteris paribus- to do their jobs, they should be more productive. In the context of IT, labour productivity associated with capital deepening is caused by the increase in IT resources that employees use. It is reasonable to assume that when they are given more IT resources, they will be more productive. Educational background and skill sets determine labour quality. All else being equal, higher quality labour is more productive. Multifactor productivity encompasses other factors that are not associated with capital deepening or labour quality. For example, technological improvements in production processes can create an increase in the level of output without increasing the inputs. Employees can be more productive as a result of IT because IT can change the nature of their jobs. For example, IT can shorten the time for an employee to prepare a price quote, and hence, he or she can close more deals. While all these sources of labour productivity are important, the latter is perceived to be critical as it represents permanent structural gains (Dedrick et al. 2003).

The consensus in the literature is that the revival of labour productivity has been associated with IT investments, especially since 1995. While there was no measurable productivity improvement of IT before 1995, productivity increased at an average rate of 2.6 percent a year between 1995 and 2000, and it has been the leading cause of the labour productivity growth beyond the long-term average of 1.4 percent a year (Brynjolfsson and Saunders 2009).

The literature also reveals that IT-intensive industries, which are industries with higher ratio of IT capital to total capital, showed a higher labour productivity increase
than other industries in the 1990s. Most studies found that productivity growth in manufacturing industries was higher than service industries. However, a detailed analysis on service industries demonstrated that most service industries have had labour productivity growth rates comparable to the economy-wide rate (Triplett and Bosworth, 2002). Hence, the evidence refuted earlier claims that labour productivity improvements are confined to manufacturing sectors.

Another wide agreement in the literature is that there has been a growth in multifactor productivity (MFP) in IT-producing industries. This growth in MFP is attributed to technological advances in these industries (Jorgenson 2001). On the other hand, an early study showed that there is no MFP acceleration in service industries (Gordon 2000). While the result was disappointing since service industries are where IT has been heavily deployed, a later study (Triplett and Bosworth 2002) provided counter evidence. It identified MFP, IT capital deepening, and IT outsourcing as the sources of labour productivity growth in service sectors and demonstrated that more than half of the labour productivity acceleration was caused by MFP.

While the literature demonstrates the contribution of IT to the growth in employee productivity, it also recognizes that IT is not the only cause of that growth. For example, Brynjolfsson and Saunders (2009) commenting on an empirical finding indicating that labour productivity grew at about 3.6 percent a year between 2000-2003, which was even greater than the rate of 2.6 percent a year between 1995-2000, pointed out that “information technology wasn’t the sole cause of the increased growth.” They argued that the increase was because “American firms adopted productivity-enhancing business practices along with their IT investments.” This highlighted that complementarities at the firm level are an additional important factor at the industry level.

2.3 Country Level Research

Country-level studies concern the impact of IT on the economy as a whole. Two important indicators for country-wide economic performance are gross domestic product (GDP) growth and labour productivity growth. The former represents the standard of living. If a country wants to prosper (i.e., increase its standard of living), it has to increase its GDP per capita (i.e., output per capita). Brynjolfsson and Saunders (2009) argue that the only reasonable way to increase GDP per capita is to increase labour productivity. Countries can stimulate productivity growth by means of strong institutions, the rule of law, education, as well as technology and innovation. Hence, country-level studies specifically try to identify IT contributions to the growth of the economy.

While early studies have found either small or no relationships between IT and labour productivity or GDP growth, later studies have demonstrated that IT “had a major impact on labour productivity and economic growth at the country level” (Dedrick et al. 2003). In the U.S., for instance, IT contributed around 28 percent of the 4.8 percent of GDP growth and around 42 percent of the 2.11 percent of labour productivity in the 1995-1999 period (Jorgenson 2001). Other studies have confirmed a similar trend in other developed countries. For example, Schreyer
(1999) found that IT contributed to labour productivity and GDP growth in all G-7 countries between 1990 and 1996. However, a study by Dewan and Kraemer (2000) found that the trend does not extend beyond the wealthy nations. That is, there is no relationship between IT and productivity or GDP growth in developing countries. They argued that the lack of complementary assets, such as basic infrastructure or human capital, is the cause of the conflicting finding.

Various cross-country studies compared IT’s contribution to productivity and economic growth in the U.S. to other countries. For example, Basu et al. (2003) cite investments in intangible organizational capital as an explanation for why productivity accelerated so rapidly in 1995 in the U.S. but not in the UK. Bugamelli and Pagano (2004) found that IT investments were delayed at least seven years in Italy compared to the U.S. They argued that the absence of complementary business reorganization is a likely reason for the delay. Also, there is more evidence that a business environment which is not strict or heavily regulated in a country facilitates the attainments of productivity and economic growth caused by IT. These findings also highlight the existence of complementarities at the country level.

2.4 Reflections on Past Research

Probably due to the daunting measurement issues that make it almost impossible to obtain accurate estimates of each of the factors in the model, the majority of past research has treated ICT investments in aggregate (and focused primarily on hardware). This made it impossible to separate the effects of the individual components of an ICT infrastructure (hardware, software, services, etc). Exceptions have been a number of studies that examined the effects of specific types of systems, such as enterprise resource planning (e.g., Hitt, Wu, and Zhou 2002). A lack of data availability and measurement difficulty has further affected the extent to which the causality of the proposed model of the effects of ICT investments can be fully tested. The majority of available research has focused on two or three of the constructs in the model depicted in Figure 1, often bypassing important mediators and ignoring the role of moderators. For instance, most of the earlier research has estimated the effects of ICT investments directly on economic performance indicators, ignoring the two mediators in-between. Even subsequent studies that addressed the issue of complementary factors treated these factors as moderators of the ICT investments-performance relationship.

Another issue impeding the ability of extant research to fully answer how ICT investments can create value, and subsequently improve economic performance, is the sole focus on one level of analysis at a time. While separating the analysis into the three levels helps to answer different, yet equally important, questions vis-à-vis the role of ICT investments in creating value at the firm, industry, and country levels, understanding how added value at the firm level can affect value creation at the industry level, and the subsequent effects of that on a country’s economy, is of no less importance.

In the section that follows, we introduce a theoretical framework that describes the process by which ICT resources impact economic performance. Our framework describes these effects at four levels of analysis, adding a new level that addresses
individual performance, and highlights how these are interrelated. While the constructs included in our framework are similar to those proposed previously, we highlight how these constructs are operationalized differently at the various levels of analysis.

3 The ICT Value Creation Process: A New Conceptual Model

The model depicted in Figure 2 describes the complete process through which ICT resources create value at the individual, firm, industry/ecosystem, and country/global context levels. While it is true that ICT investment decisions are typically made at the firm level (with the possible exception of country-level investments in infrastructure), their impact is often manifested at the individual level, or even by other firms that collaborate as a part of one business process. In today’s global economy, these collaborating firms often cross geographic boundaries, and improvements in the production system of a global business network can contribute to the economic growth of multiple countries.

In what follows, we present a detailed description of the flow of this process through which ICT resources create value. We further highlight how the different factors affecting the creation of value are operationalized differently at the various levels of abstraction and, importantly, how value created at one level can have an upward cascading effect. This hierarchy of effects is central to understanding how investments in ICT resources can manifest as value creation at the different levels, albeit not necessarily creating observable impacts on economic performance.

\[\text{At this point, it is important to understand that the proposed framework does not describe how ICT investments can create value and enhance a firm’s economic indicators. ICT investment decisions are typically made at the firm level, and the nature and appropriateness of the investment itself can play a significant role in determining whether added value is created. Rather our model traces the process through which ICT resources existing at the various levels can collaborate to create value at these levels. Hence, our model does not address how ICT investment decisions are made, but rather the impact of ICT investments in general, and the process through which they create value.}\]
Figure 2: Conceptual Framework of the ICT Value Creation Process
3.1 Value Creation at the Individual Level

Investments in ICT can be generally categorized into: 1) investment in tools that are used by individuals to enhance job performance; 2) investments in organizational tools that help firms improve efficiency and/or create additional value (e.g., new or enhanced products and services); 3) investments in tools that help a firm collaborate with its direct environment, including its suppliers, partner firms, customers, governments, etc.; and 4) investments in the infrastructure that enables firms to operate within countries and allow firms to cooperate across geographic boundaries.

As proposed in Figure 2a, ICT resources that operate as an input to the individual production system typically comprise tools that help individuals increase their work performance (e.g., office suite), or those that help individuals communicate and collaborate (e.g., e-mail systems). Such resources can enhance the efficiency and effectiveness with which an individual employee performs the business routines for which he/she is responsible, and which are parts of one or more of a firm’s various business processes.

At this point, it is important to clarify that we categorize the different ICT resources from the perspective of their users and the level at which they create value. An ERP system that helps a firm coordinate all the activities involved in the larger business process of manufacturing, selling, and delivering its products is used by individuals within that firm. From the perspective of one of its users, the utilized component(s) of an ERP system is a productivity-oriented tool that helps the individual to perform the assigned business routines more efficiently and effectively. Hence, that ERP component can lead to value creation at the individual level, possibly manifesting in the form of improved task performance. That added value could subsequently result in increased individual productivity. From the perspective of a firm, an ERP system is a tool that allows for better coordination between the various parts of the business process, with potential for improvements in decision-making. At the firm level, the value of an ERP system could be manifested in the form of better products or services and/or more efficient business processes. Such added value could result in lower costs, higher sales, and/or increased profitability.

As has been previously argued by other researchers (e.g., Dedrick et al. 2003), the relationship between the value-added output of the individual production process and enhanced economic performance, such as increased labour productivity, is not deterministic. As with ICT resources at the other levels of abstraction, improvements in the production process due to ICT use can be manifested in the form of qualitatively different outcomes. For instance, the use of patient health systems to facilitate handling patients in a hospital is unlikely to increase the individual productivity of a particular health care provider (e.g., nurse, physician), measured as the number of patients seen. Such ICT resources, however, will likely reduce the number of errors committed by the provider, an outcome that is rarely reflected in traditional economic indicators. Importantly, by enhancing the outcome of the provider’s production system, ICT resources indirectly impact the production system at higher levels of abstraction. A more accurate diagnosis or a an error-free patient record in itself acts as an input to the production process concerned with treating the
patient, which is likely performed by a number of other providers. Improved inputs to this process will invariably have positive effects on its output, in this case being better patient treatment. Needless to say, the impact of health-oriented ICT resources is rarely limited to better and error-free diagnosis. The functionality inherent in these systems also allows different providers to coordinate their activities and share information. In so doing, these systems also function as ICT resources at the firm level when helping nurses coordinate with physicians within the same hospital, and/or ICT resources that act as an input to the business ecosystem comprised of the providers from one hospital and all those who collaborate with them to treat the patient (e.g., laboratory analysts, pharmacists, insurance providers, etc).

While the majority of behavioural ICT adoption and acceptance research has focused on examining the factors that encourage or inhibit the adoption and use of particular ICTs, recent research has paid well-deserved attention to the issue of system use and subsequent effects on performance. Goodhue and Thompson’s (1995) theory proposes that the performance impacts of using an ICT are mostly influenced by the extent to which the technology fits the task in the context of which the technology is employed. Within the context of our framework, the task-technology fit theory implies that the relationship between ICT resources, individual routines and task performance is non-linear. Rather, there is an interdependency between the ICT resources deployed and the individual routines assigned.

More contemporary research has focused on understanding “effective” use of ICT to enhance performance. Users’ choices in how to employ an ICT affect which of the technology’s features they become exposed to. At minimum, they directly affect what the ICT can achieve. Accordingly, researchers have started focusing on how an ICT is utilized rather than simply focusing on its features (some of which may be unused, misunderstood, or undiscovered by users). Specifically, they have looked more closely at “usage” itself, offering taxonomies of its types and demonstrating how the nature of ICT utilization affects the benefits attained (e.g., Boffo and Barki 2003; Burton-Jones and Straub 2006). In their theoretical model of ICT adoption and use, Al-Natour and Benbasat (2009) propose that utilization of an ICT, in addition to affecting performance outcomes, has the additional effect of changing the nature of the assigned routine. In an iterative structuration process, the ICT becomes embedded within the structure of the routine for which the technology is used. While specific complementary factors that moderate the effects of ICT resources on creating value via their employment in a routine were not discussed explicitly, their model highlights the role of user characteristics (e.g., experience with the ICT) as an additional determinant of how an ICT is employed in a specific task. Independent research has proposed and examined the effects of a host of variables that facilitate the achievement of improved performance through ICT utilization in the context of a task. For instance, computer self-efficacy, including its many sub-dimensions, was shown to significantly mediate the effects of a particular ICT on task performance (Compeau and Higgins 1995).

Collectively, individual-level research on ICT adoption and use has confirmed the non-deterministic nature of the relationship between ICT resources and task performance and/or performance indicators (e.g., individual labour productivity). Many moderating factors, including the fit between the technology and the task, as
well as a host of complementarities, such as knowledge and expertise, have been shown to interact to determine performance gains. Given that such gains can have an intangible nature, their manifestation in the form of economic performance indicators is not necessarily evident. Yet, enhanced performance at the individual level, if achieved, forms an improved input to the production process at the next level of abstraction, namely the firm level.

3.2 Value Creation at the Firm Level

The proposed framework differentiates between the business process completed by a firm and the larger one completed by a set of cooperating firms. In today’s global economy, firms rarely create value in isolation. Instead, firms cooperate to create products and services. As a consequence, an individual firm often creates products or services that become a component of another’s products or services. In our framework, we look at value creation at the firm level, and extend that with an analysis of value creation in a business ecosystem.

This view of the firm and its boundaries is more consistent with the well-established knowledge-based view of the firm, rather than the traditional resource-based view. In a resource-based view, a firm is viewed as a unique bundle of “idiosyncratic resources and capabilities, where the primary task of management is to maximize value through the optimal deployment of existing resources and capabilities while developing firm’s resource base for the future” (Grant 1996, p. 110). Alternatively, in a knowledge-based view of the firm, firms are seen as institutions for producing goods and services because they can create conditions under which multiple individuals can integrate their specialized knowledge. Accordingly, the production process, with its inputs being one or typically many types of knowledge (Grant and Baden-Fuller 2004), is proposed to require the coordinated efforts of individual knowledge specialists (Grant 1996).

The view of the firm as an integrator of specialized knowledge is helpful to determine the boundaries of a firm. In fact, Grant (1996) proposes a simple analysis of the vertical boundaries of the firm. He asserts that if production at stage B requires access to knowledge utilized at stage A, then A and B will be integrated within the same firm. However, if the output of stage A can be processed at stage B without the need to access the knowledge utilized at stage A, then stages A and B are conducted more efficiently by separate firms. When this occurs, these two firms are said to be involved in a strategic alliance, which is an “agreement characterized by the commitment of two or more firms to reach a common goal entailing the pooling of their resources and activities” (Teece 1992, p. 19). Thus, central to any type of strategic alliance, such as supplier-buyer partnerships, outsourcing agreements, or joint research projects, is the notion of coordination. It entails the management of dependence among activities and resources (Malone and Crowston 1994), which typically is achieved through governance controls.

Consistent with the knowledge-based view of the firm and its boundaries, our framework conceptualizes the production system of a firm as the coordinated efforts of individual knowledge specialists within the boundaries of that firm. Other coordinated efforts that contribute to the product or service of firm, but which are not
performed within its boundaries (e.g., creating the chip for the Apple iPod which is completed by offshore companies), become a part of the production system of that firm's ecosystem.

Our framework further extends the view of strategic alliances, and rather examines value-creation at the business ecosystem level. Unlike strategic alliances which are characterized by formal agreements, membership of a firm’s business ecosystem is determined by influence. As such, a firm’s business ecosystem is comprised of all firms that affect its production system. While this view of the third-level of abstraction can create complexities vis-à-vis quantifying the inputs and outputs of the production system at that level, such conceptualization is more suitable to the study of value creation by ICT resources. Unlike firms within an industry, firms within a business ecosystem collaborate, intentionally or unintentionally, to create value for the consumer and the economy. Their ICT resources and investment in these act as inputs to their combined production system. Similarly, focusing only on firms that are a part of a formal strategic alliance risks ignoring a lot of added value that is gained, and which subsequently acts as an input to an ecosystem's production system, but which is created at a firm that is not a formal partner, but which may be a supplier of a product or service that the ecosystem employs. Consider, for example, a firm like Microsoft which manufactures computer software and employs significant ICT resources in their production system. While firm X might not be a formal partner of Microsoft but rather a user of its product (e.g., their database server), improvements in Microsoft's product resulting from the deployment of additional ICT resources will invariably, but indirectly, affect firm X’s production system (e.g., improvements in the ability to track inventory as a result of better database servers).

The proposed framework posits that a firm’s production system represents the firm’s business process for creating a product/service. As discussed earlier, this product or service is not necessarily a finished output, but can function as a component of another firm’s product or service. Inputs to this production system include all of the outputs of the individual production systems, as well as ICT resources and other capital and labour resources necessary to complete the business process. At the firm level, the ICT resources of concern are those that facilitate the coordination of efforts between the individual knowledge workers, such as firm-wide applications (e.g., ERP systems) and those that assist in performing management duties and decision-making, such as decision support systems and management information systems. Importantly, ICT resources at this level have a business process focus rather than a specific routine. Together with other capital and non-capital inputs, these systems, in addition to the outputs of individual routines, become inputs to the firm-level production process, and subsequently affect its output, namely, the value-added product/service (or more accurately the component of the ecosystem’s product/service produced by that firm).

At this point, it is important to highlight that the individual-level improved labour input to the production process at the firm-level could take many shapes and forms. Better individual task performance results in improved performance at the business process level. More interestingly are those value-added outputs of the individual-level production system that manifest as enablers of improved production process at the firm level. For example, equipping bank tellers with computer systems that allow
them to facilitate the process of client withdrawals and deposits improves the quality of each bank teller’s performance in his/her assigned routine. Thus, it serves to enhance the individual production process concerned with the firm business process concerned with customers' withdrawals and deposits. A spill-over effect of that enhanced output is an improved input to the firm-level process of making decisions regarding service fees and secure deposits. By providing an enhanced output at the individual level, namely more accurate and timely withdrawal and deposit information, these individual level production systems enhance the value created via the firm-level business processes concerning making decisions on fee schedules and ensuring compliance with secured deposit regulations. Needless to say, there is a need for firm-level ICT resources to enact these firm-level processes, such as domain-specific decision support systems. In the proposed framework depicted in Figure 2, we use the term “improved labour input” to denote all types of inputs to the firm-level production process. This could be direct in nature, such as improved individual labour productivity, or indirect in nature, such as error-free information that eventually helps a manager make better decisions at the firm level.

Affecting the efficacy of firm-level ICT resources to improve the output of the production process are a number of complementary factors that have been discussed extensively in the literature. Of these, probably the most significant are those concerning changes in the business process that facilitate the creation of additional value through the deployment of firm-level ICT resources.

Similar to the case of individual-level economic indicators, the attainment of value-added products/services at the firm level does not necessarily translate into better economic performance, such as firm profitability. For instance, the value-added nature of the production outcome could be intangible, and the firm might not be able to charge a price premium. More importantly, the additional value created at the firm level will likely transform into additional value created at higher levels of abstraction, which themselves could be manifested as improved economic performance.

As highlighted in the previous section, firm-level studies of the role of ICT investments have been plentiful. Yet, with few exceptions, these studies have rarely examined more than one relationship at a time, often bypassing important mediators and/or ignoring the role of important moderators, such as the complementary assets required to extract value from ICT resources. We propose that behavioural research into the effects of ICT resources on value creation, and subsequently, enhanced economic indicators offer a promising start. For instance, Cenfetelli et al. (2008) have looked at the effects of deploying website functionality to help consumers find, select, and purchase products on creating consumer welfare, in the form of increased satisfaction and improved shopping experience. Al-Natour et al. (2008) complemented this work and further investigated the effects of website functionality on a firm’s ability to extract price premiums. In so doing, these two studies traced the effects of ICT resources through the production process to value creation and subsequently, enhanced economic performance.

Similarly, there appears to be a lack of research on the effects of the individual-level production system on value creation at the firm level. Again, behavioural research into the adoption and use of ICT resources seem to offer some of the few studies on...
the topic. DeLone and McLean's (1992; 2003) model of IT success describes a mechanism of how improved individual task performance could be manifested as enhanced performance at the firm level. Similarly, Burton-Jones and Gallivan (2007) examine experimentally how better individual performance in a task can enhance the collective performance of a group at the firm level.

3.3 Value Creation at the Business Ecosystem Level

As discussed previously, our framework focuses on value creation at the business ecosystem level rather than the narrower strategic alliance level, or the more loosely related industry level. By definition, a firm’s business ecosystem consists of all companies that either directly or indirectly affect its production system. Hence, the outputs of the production systems of these individual firms, which are enhanced by the deployment of ICT resources, act as inputs to the production process of the ecosystem as a whole. Another input is the ICT resources deployed and utilized at this level of abstraction. Examples of such ICT resources are those that allow firms to coordinate their activities and communicate and collaborate with other firms in their ecosystems. For instance, coordination between members of a strategic alliance requires the deployment of ICT resources such as supply chain management (SCM) systems and electronic data interchange (EDI) systems. Coordination with other members of the ecosystem, but not members of the firm’s strategic alliance, could require the use of such systems as electronic procurement systems or industry-wide networks and marketplaces that facilitate the purchase of supplies and the acquisition of resources (e.g., office supplies, computer hardware and software).

While it is true that most value in an ecosystem is created by members of the strategic alliance, additional value is created by other firms in the ecosystem. The production system in an ecosystem concerns all of the coordinated efforts to create the product or service; hence, its output is that of a value-added product/service. Needless to say, the output of one of the ecosystem’s member firms, enhanced via the deployment of ICT resources at the firm level, acts as a main input of the ecosystem-level production process. Additional inputs include ICT resources deployed at that level, the effects of which on enhancing the output of the ecosystem’s production process are moderated by a number of complementary factors. Such factors could include, but are not limited to, policies and regulations governing commerce and trade activities (and thus determining the extent to which, and the freedom with which, companies can cooperate), and labour market structure and labour laws that determine the extent to which firms can cooperate across geographic boundaries.

As with the previous two levels of analysis, value-added outputs of the production system at the business ecosystem level may or may not be manifested in the form of

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3 It is important to note that industry-level analyses are useful. At minimum, they provide concrete insights as to the extent to which ICT resources are utilized in different industries, and the value they add. Industry-level analyses however, offer limited insights into understanding the incremental and aggregate effects of ICT investments made by related firms. Hence, we find it more appropriate to use the notion of a business ecosystem in our framework, which is concerned with understanding the cascading effects of individual firms’ investment in ICT.
improved economic performance of the ecosystem. Yet, of more importance is that
the value created at the ecosystem level constitutes a value-added input to the
production process at the next level of analysis, namely the economy. Given the
possibility of members of an ecosystem to exist in different economies, the value
added in one ecosystem could affect and enhance the production process of multiple
economies.

3.4 Value Creation at the Country / Global Network Level

It is a recognized fact that in today’s global economy, one country’s economy rarely
operates in isolation from other economies. The proposed framework in Figure 2
provides a descriptive explanation of this phenomenon. The production process at
the country level concerns the creation of all products and services “by” a country.
These products and services could be inputs to other firms’ products or services,
some of which may exist outside the geographic boundaries of the country in
question. More interestingly, these products and services could be finalized
products, the creation of which require the coordinated efforts of many companies,
some of which may exist outside the geographic boundaries of the country in
question.

Consequently, the boundaries of an economy per se are becoming increasingly
more malleable. While our framework does not contradict prior findings vis-à-vis the
effects of aggregate ICT investment on an economy’s output, it can offer new
insights as to the extent to which geographic boundaries are important. According
to the proposed cascading process of value creation through ICT resources, a
country’s production process (its economy) will be impacted by value-added outputs
of all ecosystems of which there are member firms that are physically located in that
country. The individual outputs of these companies, as well as the combined outputs
of their ecosystems, function as additional inputs to the economy production
process. The extent to which the economy-level production process is influenced by
these inputs depends in large part on how much of the ecosystem member
companies’ outputs are central to the ecosystem’s outputs, and the order in which
their products are produced and consumed in the ecosystem. Hence, countries
whose companies cooperate more extensively form a global network. In such a
network, effects of investments in ICT as well as other economic conditions can have
stronger cascading effects in global network member countries than others.

A larger spill-over effect of a business ecosystem’s output can also be observed at
the country level. Value-added products produced by ecosystems that are sold
(representing one of the production processes in a country’s production system) in a
country can enhance the output of that trade process and be manifested in the form
of improved consumer welfare. Similarly, value-added products produced by an
ecosystem comprise parts of the economy production process for all member

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4 At this point it is important to highlight that profitability indicators of an ecosystem’s member firms
inherently include an indirect measure of other members’ ICT investments, and their value creation. A
company using an output of another’s in its production will be charged a price for that output that
takes into consideration ICT investments and their created value. Thus, the profitability indicators of
the receiving firm, which treat the prior firm’s outputs as an input, take into account the cascading
investments and created value.
countries, and thus, help to enhance the productivity of these countries. Similar to other levels of abstraction, whether these value-added outputs translate into improved economic performance indicators (GDP growth) depends in large part on the type of value being added, and whether it is tangible and quantifiable in nature.

In addition to inputs from business ecosystems that operate in whole or in part within the geographic boundaries of a country, ICT resources deployed at the country level affect the value-added product of an economy. Such resources are qualitatively different than those deployed at lower levels of abstraction. Mainly, they concern infrastructure resources that allow companies, regardless of the structure of their ecosystems, to utilize their inter- and intra-organizational ICT resources, and further cooperate across geographic boundaries. The effects of these ICT resources on the output of the economy will be moderated largely by macro-level complementary factors such as standards and general regulations governing and facilitating the process of inter- and intra-country cooperation.

4 Policy Implications

The findings in the extant literature on IT value offer great insights to policy makers. By relating our conceptual understanding of ICT value creation depicted in Figure 2, we listed a few broad-level public policy implications in this section. Policy makers can design their specific policy actions by adopting our suggestions into their specific contexts.

The extant literature reveals that IT investments affect the labour mix of investing firms. Specifically, it has been shown that IT substitutes for labour responsible for routine tasks and complements labour working on problem-solving or complex tasks. Over the last few decades, this resulted in a shift to a more skilled labour mix in many industries. Since highly skilled workers use ICT resources more effectively and efficiently, their employment is critical for firms to realize more value from the ICT investments. Therefore, it is important from a public policy perspective that the labour market can accommodate the demand for highly skilled workers. While different countries might have different strategies to sustain the required level of highly skilled workers (e.g., special immigration policies for skilled workers), supporting education programs that help a country develop its own skilled workforce with desired skill sets is more beneficial in the long run. As IT knowledge is needed not only by IT professionals, and any employee with IT efficacy adopts/uses ICT tools more effectively and efficiently (Compeau and Higgins, 1995), policy makers should ensure that sufficient IT knowledge is provided in the education programs of all professions.

The literature also reveals that complementarities at the business process level moderate the benefits of IT investments enjoyed by firms. Therefore, policy makers should ensure that the economy has sufficient workforce that has both business as well as IT knowledge, so that this workforce can identify necessary process level changes needed for the success of an ICT implementation and execute these changes. In order to achieve that, policy makers should provide support to Management Information Systems (MIS) departments that are designed to integrate
business and IT education and promote information systems education in higher education.

While the education of upcoming members of the labour market is important, it also is important that the existing workforce is IT competent. Policy makers can encourage firms to provide IT training to their employees to develop needed IT skills in their workforce by providing some incentives, such as cost subsidies or tax breaks. Moreover, policy makers should encourage individual employees to get IT training to improve their skills by providing interest-free loans or subsidies for the fees paid for such an education. Policies along these lines will be beneficial not only to employees, as they are more employable with their newly acquired IT skills, but also for employers as their demands for highly skilled workers are being satisfied.

The ICT infrastructure of a country functions as a complementary resource for the participants in its economy. Today, state-of-the-art ICT infrastructure is essential for many firms’ operations. Countries have to furnish such infrastructure as individual firms cannot acquire the infrastructure in another way. Furthermore, in a global economy, the competition that a firm faces is not confined by the borders of the country in which it operates. The firm can be at a competitive disadvantage if its global competitors enjoy better ICT infrastructure in their countries than its own. To protect the competitiveness of the firms in a country, policy makers should ensure that the ICT infrastructure of that country is not lagging behind the technology curve, and is capable of supporting the increasing ICT infrastructure needs of its economy.

While the growth in labour productivity is an important measure to represent the contribution of ICT at the firm, industry, and country levels, we would like to offer a word of caution: firms should focus not only on ICT which is designed to improve labour productivity but also on other types of IT which provides various other benefits and may operate at higher levels than the individual level described in our proposed conceptual framework. For example, firms should invest in inter-organizational ICT to improve their relationships with their partners, even though such technologies are not designed to improve employee productivity. Other aspects of value created by ICT resources should be considered. To do so, we should go beyond the convenient measure of labour productivity and identify/use new measures that allow us to capture various forms of ICT value.

Companies whose innovations are used by other firms have profound effects on their economies. If ICT helps these companies produce better products and services, the value of their investments in these technologies will spread to other firms using their products and services. Therefore, policy makers should ensure that innovative companies make ICT investments to support their innovative processes. This can be done by providing these firms with various incentives, such as subsidies or tax breaks. Beyond making sure that innovative companies make investments in ICT that they need, policy makers should also understand their infrastructure needs and provide the ICT infrastructure required.

The cascading nature of the ICT value creation process described in our proposed framework implies that investments at higher levels are likely to have a wider impact. For example, ICT investments made by a firm at its ecosystem level are not only
beneficial to the investing firm but also beneficial to other firms in its ecosystem. As autonomous firms consider their own benefits while evaluating investment alternatives, they may choose to invest in ICT at the individual or the firm level, even though an ICT investment at the ecosystem level may provide greater benefits to the overall economy. When there is goal incongruity between the decentralized decision makers and the central planner, economists suggest some sorts of incentives to the decentralized decision makers to align their incentives with the central planner. In the ICT investment context, this may mean that policy makers can provide incentives to firms which may not otherwise invest in ICT at higher levels, so that they can make these investments.

Globalization can be considered a threat to local economies. As our proposed framework describes, an ecosystem can spread across countries. A firm can choose to operate in a global ecosystem which consists of participants from multiple countries as opposed to the country it resides in if it finds that participating in the global ecosystem is more beneficial. ICT facilitates the operations of firms on a global scale. Specifically, a country's ICT infrastructure plays a crucial role in its firms' ability to establish effective partnerships beyond its boundaries. Therefore, policy makers must ensure that the country has such infrastructure in place. Furthermore, given that the effective functioning of a global ecosystem is partly contingent on the ICT infrastructure of all countries involved, policy makers should enter into agreements with other countries to jointly improve their ICT infrastructures.

5 Future Research Directions

As overviewed in this paper, much of past research has generally focused on establishing the linkage between ICT investments and enhanced performance. In that vein, these studies have left little doubt in regards to the existence of this linkage and of its significance. More contemporary research has extended our knowledge on ICT value by examining the facilitating conditions under which value is created through the deployment of ICT resources. Our proposed theoretical model builds on this stream of research and focuses on the cascading nature of the effects of ICT resources across four levels of analysis.

Future research should pay long overdue attention to the plethora of behavioural research that examines the role of ICT in enhancing individual task performance. In this paper, we have reviewed some of this research, but a more extensive review of these studies, and focused efforts to integrate their findings with IT productivity research, are needed.

To fully understand the nature and the mechanism through which the cascading effects of ICT resources transpire, multi-level studies are needed. In the behavioural research sphere, this need has been recently recognized and findings thus far are encouraging. The studies by DeLone and McLean’s (1992; 2003) and Burton-Jones et al.’s (2006; 2007) offer a good starting point. Economically-oriented research efforts should similarly be directed towards employing multi-level analysis to better understand these cascading effects. Such studies will need to be longitudinal in nature, and typically span a longer period of time than in other contexts, since the
effects of ICT resources are rarely seen swiftly, especially at higher levels of abstraction.

The need for better and more sophisticated measurement cannot be overstressed. The utility of extant research is limited by missing or incomplete data, and in the case of firm-level studies, the sole focus on large organizations. Specifically, measurement of ICT resources needs to step beyond hardware alone. Creative means for measuring the value-added resulting from their deployment are necessary to fully understand the impacts of ICT investments. At higher levels of abstraction, capturing the incremental and aggregate effects of investments in ICT resources made at lower levels will require the application of sophisticated measurement models and analysis.

While our theoretical framework largely ignores the role of competition in affecting the utility of ICT resources, and the creation of value-added products and enhancing firms' performance, competition is not to be ignored. At minimum, competition can influence the decision to invest in ICT resources and dictate the types of these resources. More importantly, competition can significantly affect the kind of products/services created, and the investing firm’s ability to transform the ICT mediated value-added products/services into better economic performance.

The question of whether ICT resources are only an input to the production processes at the four levels is an important one. For example, the conversion of value-added products or services, created by a production process that is enhanced by the application of ICT resources, to higher firm profitability necessitates the application of more ICT resources in other processes such as those to market and sell these products or services. As such, future research should step beyond this narrow view of the production system, and especially the role of ICT resources in it. This issue is compounded in the case of the service sector, which comprises a large portion of the economy in many counties and is its largest user of ICT resources, since traditional means of producing and delivering services have been replaced by electronic ones.

6 Concluding Remarks

The paper reviewed extant literature on ICT value and provided a synthesis of its findings. The consensus in the literature is that ICT creates value for investing firms, their industries/ecosystems, and their countries. However, it is clear that the benefits of ICT are not direct; some firms enjoy greater returns on their ICT investments than others. The majority of the literature attributed this to complementary investments, such as the organizational and business practices of successful firms. The literature also revealed that firms’ ICT investments can produce payoffs at the industry level as well as at the county level, and complementarities do exist at these levels. While the existing literature expanded our understanding of the value ICT creates, there are still venues that future research should explore.

In this paper, we propose a model of the ICT value creation process that can take place at four cascading levels. An analysis of the value created by the ICT investments at the employee level is a fruitful area for the future research. In particular, understanding how employee-level ICT use triggers value creation at the
firm/industry/country levels is most valuable. We also believe that focusing on ecosystems is more meaningful than industries. That is because the value shown at the industry level is just an aggregate of the value at the firm level, but analyses at the ecosystem level can capture different aspects of the value created, which cannot be captured at the industry level.

While the literature identified a set of complementary investments on organizational practices, future research should identify and classify all the salient organizational practices that can moderate the impact of ICT investments. It is also important to understand how a complementary investment at one level facilitates the value creation at another level. Research along this line would be promising. The literature confirms that ICT investments not only improve labour productivity or output levels, but also influence consumer surplus due to the improvements in the quality, timeliness, availability, or variety of products and services. However, existing measures of the value created by ICT do not capture these aspects. Therefore, future research should strive to develop measures which gauge the value of ICT that is not accounted for with the current measures.

7 Acknowledgement

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8 Bibliography


## 9 Appendix

<table>
<thead>
<tr>
<th>Study</th>
<th>Level of Analysis</th>
<th>Input(s)</th>
<th>Output(s)</th>
<th>Complementary Factors</th>
<th>Major Finding(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson et al. (2001)</td>
<td>Firm</td>
<td>Market valuation of Y2K expenditures (relative to the median industry spending on Y2K compliance)</td>
<td>Market value using Ohlson model (which uses accounting data to determine market value)</td>
<td>N/A</td>
<td>Market value of the firm increases by 20.3 times the amount spent on Y2K when the firm spent more than the industry median. It decreases by 40.5 times Y2K spending when the firm spending is less than the industry median. Industry median Y2K spending was also associated with an increase in the market value of firms within the industry of 123.5 times the industry Y2K spending.</td>
</tr>
<tr>
<td>Aral, Brynjolfsson, &amp; Wu (2009)</td>
<td>Firm</td>
<td>Investments in Human Capital Management (HCM) software adoption</td>
<td>Sales</td>
<td>Performance pay, monitoring practices</td>
<td>There exist three-way complementarities among IT, performance pay, and monitoring practices. HCM adoption is associated with a disproportionately large productivity premium when it is implemented within a system of organizational incentives that includes both monitoring and performance pay, but has little benefit when adopted alone.</td>
</tr>
<tr>
<td>Aral, Brynjolfsson, Wu (2006)</td>
<td>Firm</td>
<td>Enterprise Systems Investments</td>
<td>Productivity and performance effects at decision of purchase and at go-live</td>
<td>N/A</td>
<td>There was significant difference between the firm's productivity at the time of ES investment and at go-live, showing that productivity follows ES investments and not vice versa.</td>
</tr>
<tr>
<td>Aral &amp; Weill (2007)</td>
<td>Firm</td>
<td>IT investment allocation</td>
<td>Market valuation, profitability, cost and innovation</td>
<td>IT capabilities</td>
<td>IT investments only lead to performance if IT investments are consistent with the firm's strategy. Furthermore, firm’s IT capabilities enhance the effect of IT assets and broaden the impact.</td>
</tr>
<tr>
<td>Authors</td>
<td>Firm, IT, ICT, or IT capability</td>
<td>Investment Goals</td>
<td>Measures</td>
<td>Results and Findings</td>
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</tr>
<tr>
<td>Aral, Wu, &amp; Morabito (2007)</td>
<td>Firm, Enterprise Systems, Investments</td>
<td>Productivity and performance effects at decision of purchase and at go-live</td>
<td>Regional IT infrastructure, Access to quality R&amp;D personnel</td>
<td>The study compares the results of similar study on companies in US with companies in Italy. Show comparable productivity increase in both countries, while ERP did not increase inventory turnover in Italy as it did in US. Finally, the causal relationship of investment leading to productivity is also similar in both countries (slightly less in Italy). In terms of complements, better regional IT infrastructure and R&amp;D personnel had a positive impact on productivity.</td>
<td></td>
</tr>
<tr>
<td>Bartel, Ichniowski, &amp; Shaw (2007)</td>
<td>Firm, IT investment</td>
<td>Productivity growth (operational efficiency in manufacturing plant), number of customized products</td>
<td>Labour skills</td>
<td>In a valve manufacturing plant, IT investment lead to increased productivity and greater number (variety) of products. Furthermore, the IT related new machines required labour with higher skill levels and specialization.</td>
<td></td>
</tr>
<tr>
<td>Barua et al. (1995)</td>
<td>Firm, IT capital</td>
<td>Measures of operational performance (Capacity utilization, inventory turnover, inferior quality, relative price, ROA and market share)</td>
<td>N/A</td>
<td>IT investments affect intermediate measures such as inventory turnover but there is no evidence as to the benefits for the firm performance as measured by ROA.</td>
<td></td>
</tr>
<tr>
<td>Bertschek &amp; Kaiser (2004)</td>
<td>Firm, ICT capital</td>
<td>Productivity</td>
<td>Workplace reorganization</td>
<td>Firms that perform organization change (enhancement group work and flattening or hierarchies) do not realize significant productivity gains related to ICT investment, non ICT investment and labour.</td>
<td></td>
</tr>
<tr>
<td>Bharadwaj (2000)</td>
<td>Firm, IT capability</td>
<td>ROA, ROS, OPINC/Assets, OPINC/Sales, OPINC/# of employees,</td>
<td>N/A</td>
<td>Increasing IT capability increases a firm's competitive advantage. High IT capable firms have higher profitability ratios and lower OPEXP/Sales in all four years that the study covered. COGS/Sales was found to be lower in two out of four years.</td>
<td></td>
</tr>
<tr>
<td>Bharadwaj et al. (1999)</td>
<td>Firm</td>
<td>Market valuation of IT investments</td>
<td>Tobin’s q (the ratio of the market value of a firm's assets to the replacement cost of those assets)</td>
<td>N/A</td>
<td>The coefficient on IT spending ranges between 1.7 and 10.3 in five, single year regressions.</td>
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<tr>
<td>Black &amp; Lynch (1997)</td>
<td>Firm</td>
<td>IT capital</td>
<td>Productivity</td>
<td>Work place practices, human capital</td>
<td>Productivity is not affected by presence of a particular management practice such as TQM, but by implementation, especially the extent of employee involvement.</td>
</tr>
<tr>
<td>Bresnahan, Brynjolfsson, &amp; Hitt (2002)</td>
<td>Firm</td>
<td>labour, IT capital, Non-IT capital</td>
<td>Sales-material billed</td>
<td>Computer enabled organizational change, new computer enabled forms of output</td>
<td>The combination of three related innovations- 1) information technology (IT), 2) complementary workplace reorganization, and 3) new products and services-constitute a significant skill-biased technical change affecting labour demand in the United States.</td>
</tr>
<tr>
<td>Brynjolfsson and Hitt (2000)</td>
<td>Firm</td>
<td>IT investment</td>
<td>Labour productivity, MFP growth</td>
<td>N/A</td>
<td>IT investment increases both labour productivity and MFP growth. Specifically, the impact of IT investment on MFP growth is maximized after a lag of 4 to 7 years.</td>
</tr>
<tr>
<td>Brynjolfsson &amp; Yang (1999)</td>
<td>Firm</td>
<td>Market value of computer capital</td>
<td>Market capitalization</td>
<td>N/A</td>
<td>One dollar of computer capital is valued at ten times one dollar of conventional capital.</td>
</tr>
<tr>
<td>Authors</td>
<td>Firm Type</td>
<td>IT Investment Description</td>
<td>Market Capitalization Description</td>
<td>Work Practices</td>
<td>Impact</td>
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<tr>
<td>Brynjolfsson et al. (2000)</td>
<td>Firm</td>
<td>IT Investment (such as greater use of teams, broader decision making authority, increased worker training)</td>
<td>Work practices (such as greater use of teams, broader decision making authority, increased worker training)</td>
<td>One dollar of spending on IT brings about approximately a five dollar increase in the market value of the firm. Market valuation effects are greatest for firms that have high levels of investment in both IT and organizational capital. Decentralized organizational practices in combination with IT investments, have a positive impact on firm market value.</td>
<td></td>
</tr>
<tr>
<td>Brynjolfsson &amp; Hitt (2003)</td>
<td>Firm</td>
<td>IT Stock (defined as the stock of computer capital)</td>
<td>MFP and output contribution in short term (1 year) and long term (5-7 years)</td>
<td>Organizational Capital</td>
<td>In short run (1 year) the return on computer investment are comparable to the cost, while in long run (5-7 years) the return is not only the output but also the MFP.</td>
</tr>
<tr>
<td>Brynjolfsson, Hitt, &amp; Yang (2002)</td>
<td>Firm</td>
<td>Installed base of computer capital</td>
<td>Total stock value market value of firm</td>
<td>Worker knowledge, new organizational structure, redesigned incentive systems</td>
<td>One dollar invested in stock market corresponds to over five dollars in firm's stock market valuation</td>
</tr>
<tr>
<td>Chari, Devaraj, &amp; David (2007)</td>
<td>Firm</td>
<td>IT investment (in a year), international diversification (foreign sales to total sales ratio and number of countries in which firms)</td>
<td>Performance (Tobin's q)</td>
<td>N/A</td>
<td>IT investment enhances the firm's performance related to international diversification.</td>
</tr>
<tr>
<td>Source</td>
<td>Type</td>
<td>Description</td>
<td>Methodology</td>
<td>Results</td>
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<tr>
<td>Chatterjee, Pacini, &amp; Sambamurthy (2001)</td>
<td>Firm</td>
<td>Announcements of IT investments in IT infrastructure and IT applications</td>
<td>Stock returns on Days 0 and +1 (where 0 is the date of the IT investment announcement)</td>
<td>N/A Investments in IT infrastructure are more likely to capture a competitive advantage for the firm compared to the investments in IT applications. Accordingly, stock returns were found to be respective of 1.06% and 0.43% for IT infrastructure and IT application investments.</td>
<td></td>
</tr>
<tr>
<td>Chatterjee, Pacini, &amp; Sambamurthy (2002)</td>
<td>Firm</td>
<td>IT investment announcement</td>
<td>5 day CAR (-2 to +2) share price reaction</td>
<td>N/A There are significant abnormal returns on stock value and trading volume associated with IT investment announcement</td>
<td></td>
</tr>
<tr>
<td>Cheng &amp; Nault (2007)</td>
<td>Industry</td>
<td>IT capital stock of suppliers</td>
<td>Output in downstream industry (Revenue)</td>
<td>N/A A 10.5% increase in supplier industry's IT capital leads to an increase in 0.63%-0.70% increase in suppliers output and increase of $66-$72 million in downstream industry's output.</td>
<td></td>
</tr>
<tr>
<td>Cotteleer &amp; Bendoly (2006)</td>
<td>Firm</td>
<td>ERP investment</td>
<td>Order lead-time</td>
<td>N/A There is improved performance over a longer period, even after correcting change in inventory levels, order and business scale etc.</td>
<td></td>
</tr>
<tr>
<td>Council of Economic Advisors (2001)</td>
<td>Industry/Country</td>
<td>IT investment</td>
<td>Labour productivity and GDP</td>
<td>N/A Labour productivity is greater in industries with intense IT investment than it is for those with less intense IT investment. Increased IT investment had a major impact on labour productivity and economic growth at the country level. US labour productivity, which grew at 1.5% per year in the 1973-1995 period, grew at the rate of 3.1% per year in 1995-2000. Similarly, GDP grew at 3% per year in the earlier period and accelerated to 4.8% per year during the later period.</td>
<td></td>
</tr>
<tr>
<td>Dehning, Richardson, &amp; Zmud (2003)</td>
<td>Firm</td>
<td>IT investment announcement</td>
<td>Three-day CAR around the date of the IT investment announcement (day -1, 0, +1)</td>
<td>Nature of Industry, Firm's Strategic Objectives</td>
<td>When firms make a IT investment with a transform strategic role and within an industry that is influenced by IT transformation, they experience abnormal returns. The study builds on earlier studies that used similar models but could not differentiate when IT investments lead to returns.</td>
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<tr>
<td>Devraj &amp; Kohli (2003)</td>
<td>Firm</td>
<td>Technology usage (reports, processing time, number of records accessed)</td>
<td>Mortality, Revenue per admission, revenue per day</td>
<td>N/A</td>
<td>IT payoff is dependent on IT usage within an organization.</td>
</tr>
<tr>
<td>Dewan &amp; Kreamer (1998, 2000)</td>
<td>Country</td>
<td>IT investment</td>
<td>Labour productivity</td>
<td>N/A</td>
<td>IT investment positively correlated with labour productivity in developed countries, but not in developing countries. (The difference in result was explained by the lack of complimentary assets such as infrastructure and knowledge base)</td>
</tr>
<tr>
<td>Dewan &amp; Min (1997)</td>
<td>Firm</td>
<td>IT capital</td>
<td>Output</td>
<td>N/A</td>
<td>IT capital is a net substitute for both capital and labour, and shows excess returns relative to labour input.</td>
</tr>
<tr>
<td>Dewan, Shi, &amp; Gurbaxani (2007)</td>
<td>Firm</td>
<td>Risk defined as: &quot;SD of one-year daily stock returns following investment&quot;, &quot;SD of realized annual earnings over 5 years following the investment&quot;</td>
<td>Productivity and Market Value</td>
<td>N/A</td>
<td>Firms that have greater IT risk enjoy greater marginal product of IT as compared to firms with lower IT risk. Moreover, 30% of gross return on IT is associated with risk premium of IT. Thereby there is an unusual variance in valuation of IT capital investments.</td>
</tr>
<tr>
<td>Firm</td>
<td>IT investment</td>
<td>Productivity</td>
<td>Number of information workers</td>
<td>Notes</td>
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<tr>
<td>Dos Santos et al. (1993)</td>
<td>Announcements of IT investments and innovative IT investments (innovative IT investments are defined as a first use of technology, a new product or service or a new IT application within an industry)</td>
<td>Stock returns on Days -1 and 0 (where 0 is the date of the IT investment announcement)</td>
<td>N/A</td>
<td>No abnormal returns for the sample of 97 IT investments from the finance and manufacturing industries from 1981 to 1988 were found. However, it was observed that after innovative IT investment announcement firm value increased by 1.03%. For non-innovative (-0.09%) and unclassified investments (-0.46%), value enhancing effect was non-existent.</td>
<td></td>
</tr>
<tr>
<td>Francalanci &amp; Galal (1998)</td>
<td>IT investment</td>
<td>Productivity</td>
<td>Number of information workers</td>
<td>Firms with higher proportion of information workers gain more from their IT investments than those with a lower proportion.</td>
<td></td>
</tr>
<tr>
<td>Gao &amp; Hitt (2004)</td>
<td>IT capital stock</td>
<td>Trademarks holdings</td>
<td>N/A</td>
<td>Firm's seeking product variety invest in IT (or increases the demand to invest in IT)</td>
<td></td>
</tr>
<tr>
<td>Gilchrist et al. (2001)</td>
<td>IT investment</td>
<td>Labour productivity, MFP growth</td>
<td>Decentralized computing architectures</td>
<td>IT has a substantial impact on labour productivity growth and on MFP growth in the durable goods sector.</td>
<td></td>
</tr>
<tr>
<td>Greenan et al. (2001)</td>
<td>IT investment</td>
<td>Labour productivity</td>
<td>N/A</td>
<td>Gross returns to IT investments are positive and greater than returns to non-IT investments.</td>
<td></td>
</tr>
<tr>
<td>Author(s)</td>
<td>Type</td>
<td>Event</td>
<td>Stock Return</td>
<td>Stock Market Value</td>
<td>Abnormal Stock Market Returns</td>
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<tr>
<td>Hayes et al. (2000)</td>
<td>Firm</td>
<td>Announcement of IS outsourcing</td>
<td>Stock return on days 0 and +1, (where 0 is the day of the announcement)</td>
<td>N/A</td>
<td>Positive market value gains for smaller vs. larger firms and service vs. non-service firms were found. Accordingly, abnormal stock market returns were 6.279 and 8.983 for service and small firms, respectively.</td>
</tr>
<tr>
<td>Hayes et al. (2001)</td>
<td>Firm</td>
<td>Announcement of ERP implementation</td>
<td>Stock return on days 0 and +1, (where 0 is the day of the announcement)</td>
<td>N/A</td>
<td>Overall positive reaction to ERP announcements was found. The reaction was the most positive for small/health firms and those involve with larger ERP vendors such as SAP and PeopleSoft. Accordingly, stock returns for all firms were 17.480 and for ERP vendors 16.389.</td>
</tr>
<tr>
<td>Hitt &amp; Brynjolfsson (1996)</td>
<td>Firm</td>
<td>IT Stock (measured as the market value of the firm's IT systems plus three times the firm's spending on IT labour)</td>
<td>ROA, ROE, One year total return to shareholders</td>
<td>N/A</td>
<td>A positive relation between IT stock and ROA in three out of five years of data. However, no relation between IT stock and ROE. A positive relation between IT stock and one year total return to shareholders was observed only for one year out of five years examined. IT investment affects productivity and contributes to consumer welfare through lower prices. However, it does not necessarily improve profitability.</td>
</tr>
<tr>
<td>Hitt &amp; Tambe (2006)</td>
<td>Firm</td>
<td>IT Capital stock</td>
<td>Variations in establishment level data</td>
<td>N/A</td>
<td>Spillovers of technology within an industry might be overstated due to measurement errors in older studies</td>
</tr>
<tr>
<td>Hitt, Wu, &amp; Zhou (2002)</td>
<td>Firm</td>
<td>ERP investment</td>
<td>Firm's market valuation (measured as Tobin's q)</td>
<td>N/A</td>
<td>Initially, even though a firm performance might fall when ERP is implemented, the market rewards firms that invest in ERP systems</td>
</tr>
<tr>
<td>Im et al. (2001)</td>
<td>Firm</td>
<td>Announcement of IT investments</td>
<td>Stock returns on Days -1 and 0 (where 0 is the date of the IT investment announcement)</td>
<td>N/A</td>
<td>Factors such as company size, time lag effects and industry sector influence the return on IT investments. Accordingly, small firms yield more positive returns for announcement of IT investments. Stock price reactions become more positive over time. As opposed to manufacturing firms, financial firms experience increasing returns from IT investment announcements.</td>
</tr>
<tr>
<td>Study</td>
<td>Type</td>
<td>Measure</td>
<td>Metric</td>
<td>Result</td>
<td></td>
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<tr>
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</tr>
<tr>
<td>Jorgenson (2001)</td>
<td>Industry</td>
<td>IT investment</td>
<td>MFP</td>
<td>IT investment contributed more than one-half of the 1 percent increase in economic growth since 1995. About one-half the productivity growth since 1995 has occurred in the IT-producing sector but growth has occurred in IT-using industries as well.</td>
<td></td>
</tr>
<tr>
<td>Jorgenson &amp; Stiroh (1995)</td>
<td>Country</td>
<td>IT investment</td>
<td>GDP</td>
<td>IT investment associated with a 0.5 percent incremental economic growth.</td>
<td></td>
</tr>
<tr>
<td>Kettinger et al. (1994)</td>
<td>Firm</td>
<td>Strategic deployment of IT</td>
<td>ROS, market share</td>
<td>The study found companies that gain and sustain a competitive advantage due to their IT deployment for five and ten year periods after implementation.</td>
<td></td>
</tr>
<tr>
<td>Kohli &amp; Devaraj (2004)</td>
<td>Firm</td>
<td>DSS Usage (Aggregate of the CPU time for the number of times a report is executed)</td>
<td>Rate of reimbursement (reimbursements/revenue)</td>
<td>DSS usage leads to organizational performance improvements.</td>
<td></td>
</tr>
<tr>
<td>Kraemer &amp; Dedrick (2001)</td>
<td>Country</td>
<td>IT investment</td>
<td>Labour productivity</td>
<td>Growth in IT investment per worker is positively correlated with labour productivity growth. Level of IT investment (as a percent of GDP) on the other hand, is not correlated with productivity growth.</td>
<td></td>
</tr>
<tr>
<td>Krishnan &amp; Sriram (2000)</td>
<td>Firm</td>
<td>Market valuation of Y2K expenditures</td>
<td>Market value using Ohlson model (which uses accounting data to determine)</td>
<td>Market value of the firm relates positively to Y2K expenditures, but the coefficient is less than the coefficient on earnings or book value, and less in IT-sensitive industries.</td>
<td></td>
</tr>
<tr>
<td>Author(s)</td>
<td>Type</td>
<td>Metric</td>
<td>Description</td>
<td>Reference</td>
<td></td>
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<tr>
<td>-----------</td>
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<td></td>
</tr>
<tr>
<td>Mitra (2007)</td>
<td>Firm</td>
<td>IT budget of the firm as a percentage of revenue, Free cash flow</td>
<td>Ratio of market value of firm to the replacement cost of its assets (Tobin's q)</td>
<td>N/A</td>
<td>Superior IT infrastructure will help the firm to grow in revenue without greater increase in cost of operations. Secondly, firms with greater free cash flow spend more on IT, also a precursor for growth.</td>
</tr>
<tr>
<td>Mitra &amp; Chaya (1996)</td>
<td>Firm</td>
<td>IT spending</td>
<td>OPEXP/Sales, GM%, SG&amp;A/Sales, Labour/Sales</td>
<td>N/A</td>
<td>Compared to smaller companies, large companies spend a larger percentage of their revenue on IT. Higher IT spenders have lower operating expenses and COGS and higher SG&amp;A.</td>
</tr>
<tr>
<td>Oh &amp; Kim (2001)</td>
<td>Firm</td>
<td>Announcement of IT investments</td>
<td>Stock returns on Days -1 and 0 (where 0 is the date of the IT investment announcement)</td>
<td>N/A</td>
<td>The financial condition of the firm announcing the IT investment also affects the stock market return to IT investments. Price-to-book ratio and variability of daily stock returns play a role in explaining the excess stock returns.</td>
</tr>
<tr>
<td>Oliner, Sichel, &amp; Stiroh (2007)</td>
<td>National/Industry</td>
<td>IT capital</td>
<td>Growth of MFP (nonfarm)</td>
<td>N/A</td>
<td>The aggregate and industry-level results show that IT had a role in product increase in 1995 to 2000. After 2000, IT still had impact on growth even though the effects were not substantial. “These results stand even after accounting for variable factor utilization, adjustment costs, and intangible capital and so provide strong support for the consensus view that IT was a key source of growth for the U.S. economy” over 1995 and 2005</td>
</tr>
<tr>
<td>Park, Shin, &amp; Sanders (2007)</td>
<td>National</td>
<td>Investments in domestic IT and foreign IT</td>
<td>Total factor productivity</td>
<td>N/A</td>
<td>When IT products are transferred internationally, the import partner's productivity increases. The impact is only significant when the import country's production is related to hi-tech.</td>
</tr>
<tr>
<td>Source</td>
<td>Type</td>
<td>IT investment</td>
<td>Labour productivity</td>
<td>N/A</td>
<td>Comment</td>
</tr>
<tr>
<td>------------------------</td>
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<td>-------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
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<td>-------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pohjala (2001)</td>
<td>Country</td>
<td>IT investment shows 80 percent gross returns for OECD countries; nothing significant for developing countries.</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poston &amp; Grabski (2002)</td>
<td>Firm</td>
<td>ERP implementation</td>
<td>SG&amp;A/Sales, COGS/Sales, # of employees/Sales, residual income</td>
<td>N/A</td>
<td>On an interim basis, one year after the implementation SG&amp;A/Sales and COGS/Sales increased. A decrease in COGS/Sales three year after implementation and a decrease in # of employees/Sales all three years after implementation was found. However, control group had superior performance relative to the firms implementing ERP.</td>
</tr>
<tr>
<td>Rai et al. (1997)</td>
<td>Firm</td>
<td>Multiple IT spending (IT capital, IT budget, client/server expenditures, IS staff expenditures, hardware expenditures, software expenditures and telecom expenditures)</td>
<td>Firm output, ROE, ROA, labour productivity and administrative productivity</td>
<td>N/A</td>
<td>There is a positive relation between all IT spending and firm output. There is also a positive relation between IT capital and client/server expenditures and ROA. Labour productivity is positively related to IT capital, IT budget, client/server expenditures, IS staff expenditures, hardware expenditures. Administrative productivity is negatively related to hardware expenditures, software expenditures and telecom expenditures.</td>
</tr>
<tr>
<td>Ramirez et al. (2001)</td>
<td>Firm</td>
<td>IT investment</td>
<td>IT returns</td>
<td>Employee involvement, TQM</td>
<td>Firms which implement employee involvement and total quality management receive higher IT returns.</td>
</tr>
<tr>
<td>Schreyer (1999)</td>
<td>Country</td>
<td>IT investment</td>
<td>Labour productivity and GDP</td>
<td>N/A</td>
<td>IT contributes significantly to productivity growth in all G-7 countries with different magnitudes.</td>
</tr>
<tr>
<td>Shin (1997)</td>
<td>Firm</td>
<td>IT spending</td>
<td>Coordination costs (SG&amp;A minus non-administrative expenses) and output</td>
<td>N/A</td>
<td>IT spending relates negatively to coordination costs. However, increased IT spending and coordination costs positively relate to increased output.</td>
</tr>
<tr>
<td>Authors</td>
<td>Type</td>
<td>IT Spending</td>
<td>Measures</td>
<td>N/A</td>
<td>Findings</td>
</tr>
<tr>
<td>-----------------</td>
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<td>----------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Sircar et al. (2000)</td>
<td>Firm</td>
<td>IT spending</td>
<td>Sales, total assets, shareholders' equity, shares outstanding, market share, stock price, net income before taxes</td>
<td>N/A</td>
<td>Significant correlations between various IT measures and firm performance measures were found. However, no causality was determined.</td>
</tr>
<tr>
<td>Stiroh (2001a, 2001b)</td>
<td>Industry</td>
<td>IT capital (as a share of total capital)</td>
<td>Labour productivity</td>
<td>N/A</td>
<td>IT-using industries show productivity acceleration during 1995-1999. IT intensive industries show larger productivity gains than non-IT intensive ones.</td>
</tr>
<tr>
<td>Stiroh (2002)</td>
<td>Aggregate/Industry</td>
<td>IT Intensity Dummy</td>
<td>Labour Productivity Growth (change in either real value-added or real gross output per full-time equivalent employees (FTE))</td>
<td>N/A</td>
<td>The industries that invested heavily in IT in the early 1990's experienced significantly larger productivity gains than those did not.</td>
</tr>
<tr>
<td>Strassman (1997b)</td>
<td>Firm</td>
<td>IT spending</td>
<td>ROE, sales growth, market share gain, effectiveness, quality, productivity.</td>
<td>N/A</td>
<td>No correlation exists between IT spending per employee and ROE. No correlation in any of the studied industries exists between IT spending and sales growth, market share gain, effectiveness, quality and productivity. Only positive relation was between IT spending on order-entry and back-office operations and sales growth and productivity.</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Type</td>
<td>Measure</td>
<td>Sample</td>
<td>Findings</td>
<td></td>
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<tr>
<td>Subramani &amp; Walden (2001)</td>
<td>Firm</td>
<td>Stock return on days (-5, +5) and (-10, +10), (where day 0 is the date of the announcement)</td>
<td>N/A</td>
<td>E-commerce initiatives lead to positive excess returns for firms' shareholders. Accordingly, 5 day and 10 day returns were found to be 7.5% and 16.7%, respectively. Moreover, positive returns for B2C announcements were higher than those for B2B announcements. Excessive returns of e-commerce initiatives involving tangible goods are higher than those involving digital goods.</td>
<td></td>
</tr>
<tr>
<td>Tam (1998)</td>
<td>Firm</td>
<td>IT Stock (defined as the stock of computer capital)</td>
<td>One year total return to shareholders and Market capitalization</td>
<td>The study only covers the firms in Hong Kong, Malaysia, Singapore and Taiwan. Accordingly, there found to be no relation between the computer capital and one year total return to shareholders. This conclusion also holds true for one year total shareholder return and one year lagged value of computer capital. However, only in Malaysia computer capital was positively related to the market value of the firm.</td>
<td></td>
</tr>
<tr>
<td>Tam (1998)</td>
<td>Firm</td>
<td>IT stock</td>
<td>ROA, ROE, ROS</td>
<td>The study only covers the firms in Hong Kong, Malaysia, Singapore and Taiwan. Accordingly, in Singapore positive relation between IT stock and ROA &amp; ROE; in Malaysia positive relation between IT stock and ROE was found. In Taiwan negative relation between ROA &amp; ROE was determined. In Hong Kong negative relation between IT stock and ROS was observed.</td>
<td></td>
</tr>
<tr>
<td>Tambe, Hitt, &amp; Brynjolfsson (2008)</td>
<td>Firm</td>
<td>IT employment over past two decades</td>
<td>IT productivity (as defined by Cobb-Douglas specification)</td>
<td>&quot;Output elasticity of IT investment is about 8-9% for firms that are both decentralized and externally focused, while IT investments in firms that have one or neither of these organizational assets in place do not significantly increase productivity&quot;</td>
<td></td>
</tr>
<tr>
<td>Triplett &amp; Bosworth (2002)</td>
<td>Industry</td>
<td>IT capital</td>
<td>Labour productivity</td>
<td>IT through capital deepening played an important role in labour productivity both pre- and post- 1995. Labour productivity growth in the services industries has proceeded at about economy-wide rate.</td>
<td></td>
</tr>
</tbody>
</table>
Cost management at a faculty of a Polish university – a case study

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Abstract

In the paper a case study of one faculty of a Polish university is presented. Their costing system is analysed and as it turns out to be not useful from the managerial point of view. A suggestion of its modification is formulated. It is shown that the modification, if it is implemented, will deliver useful cost information for the Faculty and for all their present and potential partners: the Ministry of Education, the European Union, the industry partners etc. The whole context of the problem of university costing system is also presented, showing that the proposed direction of changes is necessary, but it is only a beginning of a long and burdensome process towards an efficient university costing system.

Keywords: university cost, teaching cost, research cost

1. Introduction

Universities are now in a period when they are forced to have a completely new look at their costing system. The European Community is strongly encouraging European universities to introduce a full costing system, in which at each university level, for each activity performed at the university and for each customer, product, supplier, organizational unit, process it will be known exactly how much resources it has consumed. European Union is conducting a project called “EUIMA – Full Costing project”, whose goal is to make European universities to introduce a full costing system. Estermann (2011) gives several reasons for such a strong insistence on full costing at universities. He says that European universities are now functioning in a more and more challenging environment, in the situating of economic crisis. This means that universities of today have to do “more” with “less”. “Less” – because of the economic crisis and the fact that almost ¾ of universities’ funding comes from public funding sources, which are more and more reduced. “More”, because universities have to deal with a growing competition for talent, resources, excellence, they need to deal and find more various funding sources and also, in order to build up their image, they have to perform various social activities for the society, which was not necessary in the past.
As for the funding sources, some universities have more than 100 funding sources (Estermann 2011), more and more of them being private or profit-orientated, and this has become a standard. In order to report to the various donators how their money has been used, universities have to control it, for which they need an adequate costing system. They need it also to be able to get funding, because in the applications for funding they have to budget their cost in a convincing way.

Espinasse (2011) gives a rather negative picture of the current cost understanding and control at European universities. According to him, the universities generally have little or no understanding of the cost of different activities, of the difference between cost and price and of the fact that on most research grants awarded they lose money. If a complete knowledge and understanding of cost is not present at universities as such, it is even less present among academic staff, out of whom only a small portion have sound economic background. That is why academic staff try to win project funding without worrying about financial consequences. They do not worry about those consequences also because they have no clear system to evaluate them – as they in fact cannot know the cost of the projects they are performing or planning to perform, they can only know the price. Also university managers have often not enough economic knowledge and as a consequence they ask questions like (Fürstenbach 2011): “Why should we pay for resources already there?”, referring to e.g. depreciation. They do not understand the notion of cost and the present costing systems of universities do not help them here, as in them the notions of cost, price, cash flow are mixed up and not linked in a clear way to funding sources and products of university activities.

In such a general context, knowing that the situation of Polish universities is not much different for those from other countries (Parkitna 2010), we studied one of faculties at a Polish university. The faculty performs teaching tasks, research work, runs research projects and also accepts orders from the industry. It is running several big European projects. It has a dean office and two institutes. The managers of the faculty and of the institutes are professors of engineering. The three units employ research, administrative and technical staff. Our research aimed at answering the following questions:

- Do the managers of the faculty have access to the detailed cost information about the faculty?
- Do they (being engineers and not finance experts) understand it?
- Do they feel they can influence it through their decisions?
- If the answer to one of the above questions is negative, is there anybody at the Faculty who can help the managers to make decision, having in mind the costs and their management, as confronted with the effects of the faculty activities?

The answer to the above questions has turned out to be overwhelmingly negative. If so, the studied university is still far away from the full costing system – if already at the level of one faculty, without taking into account indirect cost, thus the cost of support processes at the central level of the university, there no clear, understandable and logical cost information system. What is more, we found also other obviously negative features of the present costing system at the Faculty. We present them briefly in the following and suggest a general direction how the
costing system should be improved, so that the cost, at least at the Faculty, become better understood and managed.

2. The unit studied

The unit we studied is one of 12 faculties of a big university of technology. The university altogether has over 40,000 students and employs more than 4000 persons. The structure of the university is as follows: the university, apart from a few extra faculty units (which provide services or customers for the faculties), is divided into 12 faculties, which are, in their turn, divided into institutes, which are further divided into smaller divisions with their own heads.

The structure of the university (like that of most Polish universities) has not changed much for many years, even though the political and economic system and the global situation have changed significantly. The university management system is far from being a process management system (Parkitna 2008). It is only lately that it was started to analyze the university management system and to optimize it (Kuchta 2010). It is bound to be a long and burdensome process, but without it the chance for knowing and controlling the full cost are equal to zero.

As the process of university management system optimization has only started, we have not been able to propose a deep analysis and a significant improvement proposal for the whole university. That is why we chose one of the faculties – one of those whose deans expressed the support for any attempt to improve the faculty management.

3. The present costing system at the Faculty

The Faculty has four principal finance sources:

- teaching subvention from the Ministry of Higher Education
- the financing of projects accomplished by the Faculty, including
  - projects financed by the Ministry of Education;
  - projects financed by the European Union;
  - projects financed by other organizations;
- external orders revenues
- the overhead charged to the project accomplished by the Faculty.

The aim of the teaching subvention is to finance the teaching process. Thus, it should cover:

- the depreciation of the equipment and buildings serving for teaching purposes;
- the consumption of materials and energy for teaching purposes;
- the salaries of the employees performing the teaching process, the corresponding social insurance and other benefits;
services needed for the teaching process, rendered for the university by other organizations;
taxes and fees (e.g. taxes on property and transportation means used for the teaching process);
other prime costs (e.g. cost of business trips performed for teaching purposes).

The amount of the subvention is a function of the number of students and of a coefficient, fixed by the Ministry of Education, which should express the cost of educating one student. This coefficient is different for faculties where the use of expensive equipment and material consumption is higher and different where it is lower (the Faculty in question benefits from the highest coefficient possible).

The financing of projects and of external orders should be used for the accomplishment of those projects and orders, a part of it is separated as overhead and should be used to finance the supporting processes.

For each of the three organizational units of the faculty: each of the two institutes and the dean office, there several prime cost accounts. Let $N$ denote the number of prime cost categories (above we listed 6 categories, the list is in reality a bit longer) and $M$ the number of financing sources (the Faculty takes $M=3$: teaching subvention, all projects and external orders together and the overhead). Then the present costing system can be presented as a matrix $A(i,j,k)$, where $i = 1, \ldots, L$ stands for the organizational unit (in our case the number of organizational units $L=3$), $j = 1, \ldots, N$ for the prime cost category and $k = 1, \ldots, M$ for the financing source.

For each $i=1,2,3$, all accounts $A(i,j,1)$ contain the information what has been paid with the money from the teaching subvention. Similarly, all accounts $A(i,j,2)$ show what has been paid by the overhead and the accounts $A(i,j,3)$ refer to the payments from the different projects and orders. The main problem is that the accounts are source oriented and the information for which purpose the money was used is not easily available. In theory, the money should be used as follows:
- the teaching subvention for teaching purposes;
- the overhead for supporting processes;
- the projects and orders for the very projects and orders.

However, our research has shown that the money is used in a more or less accidental way, according to the principle: “We pay what we have to pay at the very moment with the money we have at our disposal at the very moment”. Like Espinasse (2011) said, short term objectives are the main decision criteria at European, and also Polish universities.

And because the system at the Faculty does not show in a clear way for which how much was spent, we have in fact only one information: about the financing sources. But the financing sources are something which we can call the price paid by someone, who expects certain service or products to be delivered and wants the money to be used for certain activities. Thus the Ministry pays for the teaching and should not (at least in theory, because the way of thinking at the ministries of education is not adequate either (Espinasse 2011)) allow their money to be spend
e.g. on European projects, for which someone else paid, or on administration processes, which should be financed by the overhead. But such things are done almost every day, which has been shown by our research.

Like Espinasse (2011) shown in his research, we found out that at the Faculty there is no clear understanding of the difference between price, cost, resources and products. Fig. 1 shows a lack of equilibrium and even a lack of any clear relationships between the price (financing sources), the use of resources (cost) which takes place while performing activities and the effects, the products the price is destined for.

Table 1. The relations between financing sources, university resource consumption and effects

<table>
<thead>
<tr>
<th>Financing sources</th>
<th>Activities/resources used</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching subvention</td>
<td>Teaching activities</td>
<td>Quality of teaching</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quality of support activities</td>
</tr>
<tr>
<td>Overhead</td>
<td>Support activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• for teaching</td>
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<tr>
<td></td>
<td>• for projects</td>
<td></td>
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<tr>
<td></td>
<td>• for administration</td>
<td></td>
</tr>
<tr>
<td>Projects and orders</td>
<td>Research activities</td>
<td>Quality of project products</td>
</tr>
</tbody>
</table>

In theory in the above table we should have only horizontal division lines going throughout the whole table, from the left to the right hand side. But it is not like this. In some periods the teaching subvention is used for almost everything, in other periods the overhead is used for teaching processes (this is the situation depicted in Table 1). In other cases the money from projects is used for teaching activities. What is a common phenomenon is that if something or someone was paid from one money source in one year (e.g. from a project) and this was even more or less correct (thus corresponded to the momentary use of the resource), but then the person or the piece of equipment started to be partially or totally used for other kind of activities, the payment for this resource continue “forever” to be recorded in the same, original account.

A problem is also another common phenomenon, which is the use of a resource for different activities. E.g. a piece of equipment (above all computers) or software, financed from one source, is very often used for realizing the teaching, the organizational, the commercial and the research activities. However, its depreciation is recorded always in one account, corresponding to the one financing source. Also, all the salaries of the teaching staff (except of the part paid out of projects) are paid completely from the teaching subvention and recorded at the accounts $A(i,j,1)$, which does not show the real cost of teaching: the time, which is
the main resource offered by the academic staff, in reality is used only partially for teaching, it is used for all the other kinds of activities also. Apart from that, the Faculty in question rents several expensive services, surfaces and equipment and uses them for various activities, although they are recorded with connection to only the one financing source used to pay the rent.

The above mentioned depreciation constitutes a problem per se. The Faculty is imposed certain depreciation amounts to be paid by the central university administration, but the Faculty finance experts do not have any information how the depreciation is calculated. There are no official documents at the central level clarifying the depreciation calculation system – it seems to be a “secret knowledge”, reserved to a restricted circle of finance experts at the central university level.

We can take as granted that the depreciation is calculated not with the aim to support the management of university assets, but with the mere aim to comply with some regulations. Thus, the Faculty cannot use depreciation information for management purposes: they do not know how it is calculated and thus they cannot use it as a measure of the actual usage of the assets. If so, they are unable to estimate the true cost of almost any activity performed: most activities do use more or less expensive assets, but if the depreciation is calculated in a “secret” way and what is more, is (what we mentioned above) always linked just to one financing source, it is absolutely impossible to find out the cost of education of a student, of performing a project etc. Let us emphasize again we are talking about cost, not price - i.e. we are talking about the information how much resources are used for a student, a project etc. That is why, e.g.:

- the academic staff may apply for projects on which the Faculty (and the University) loses money, but as nobody knows it, they are motivated to go on (a confirmation of Espinasse (2011) findings);
- if nobody can say how much costs the education of different categories of students, the Faculty in question may benefit from the highest possible teaching subvention coefficient. The Ministry has to means to control it, and the money from the teaching subvention can be used for many non-teaching activities. At the same, another faculty of the same university has been assigned by the Ministry a considerably smaller teaching coefficient, which they find completely unjust – as in their opinion the difference in teaching cost between the two faculties is by far not that high. But they have no means to prove it and have to use other financial sources to finance the teaching activities.

Also, in the present costing system at the Faculty there is no evaluation of the products the organizations paying the prices (the different financing sources) get. In fact, as far as the teaching subvention is concerned, we do to really have a clear definition of the product, of the quality of teaching expected by the Ministry. So, the Ministry pays for something which is not defined, it pays a price calculated on the basic of a coefficient which should reflect the teaching costs, but it obviously does not, as those costs are not known…

Altogether, we have found out that the present costing system used at the Faculty does not help managers to make decisions. It is strongly financing source oriented…
and it seems that its primary aim is to “make everything look OK for the moment” . It serves to make decision only with respect short term goals.

4. A proposal of changes in the costing system at the Faculty

We do not claim here to be able to solve all the problems mentioned in section 3. Those problems can be solved only of the whole university changes the system in cooperation with the Ministry. The process has begun, but the university has still a long way ahead. However, we think that some changes can be introduced on the Faculty level and they will help to manage the cost and understand it at least to a certain degree. And they will prepare the field for the great battle – that of introducing the full cost concept at the whole university.

We propose first of all to change the dimensions of the matrix $A(i,j,k)$. It should be replaced by a matrix $A(i,j,k,l)$, where $i=1,…,L$ will stand for the organizational unit (in our case the number of organizational units $L=3$), $j=1,…,N$ for the prime cost category, $k=1,…,M$ for the financing source and $l=1,…,P$ for the number of identified activities.

As far as $M$ is concerned, in the studied case $M=3$, but we propose to differentiate much more financing sources. There should be at least as many of them as numerous are the various organization who provide money to the faculty. This will assure that each organization paying a price will be able to see what its money went for. The additional matrix dimension, that of activities ($l=1,…,P$), should introduce into the present accounting system the notion of the goal for which resources (paid by someone) are used. Of course, the goals may be defined in various ways, but, according to the most popular full costing method, the Activity Based Costing, the resources are used by activities and we propose to apply this approach here. The question how detailed the list of activities should be is open, but we should at least consider the following categories:

- teaching activities
- organizational activities
- research activities
- external order related activities.

Within each category we should identify subactivities (some proposals of how to do this for teaching and research activities can be found in (Klaus-Rosińska and Kowalski 2010) and (Kowalski and Klaus-Rosińska 2010), but the first step should be to consider at least the above four categories, thus to take $P=4$.

Then each recording of a prime cost position in the accounts should be preceded by answering the following questions (we assume the values of $i$ and $j$ is determined in an obvious way, although even here a deeper reflection would be needed in the future, as to the prime cost categories used):

- where does the money come from ($k=1,…,M$)
- which activities used this prime cost in the period of consideration (here we very often will have to choose not just one element, but a set of several $l=1,…,P$) and in which proportion.
The question about proportions is not easy to answer. Here various tools can be used, like staff surveys, staff interviews, profile creation for individuals performing similar tasks, time sheets etc. (Österber-Dobson 2011). Our observation is that the interviews method may be quite sufficient to start with. In this way we have found out, in an approximated form of course, the proportion of time used by academic and administrative staff of the Faculty for various activities. Other documents (lectures schedules, work sheets etc.), allow to distribute the use of equipment and surface between various activities.

Of course, this approach will not be easy to be implemented, because it changes the way of thinking of the financial staff at the faculty. Also, if the various categories (the four dimensions of the matrix) are not numerous enough and/or if the distribution of the use of resource between activities is not exact, the information got would not be perfect either. However, it will already give a more useful information that the present system does, e.g.:

- if we sum up all the \( A(i,j,k,l) \) for a fixed \( k = 1, \ldots, M \), we will get all the financing we got from the \( k \)-th source;
- if we sum up all the \( A(i,j,k,l) \) for a fixed \( k = 1, \ldots, M \) and a fixed \( l = 1, \ldots, P \), we will see how much money coming from the \( k \)-th source has been used for the \( l \)-th activity;
- if we sum up all the \( A(i,j,k,l) \) for a fixed \( l = 1, \ldots, P \), we will see how much the given activity has cost;
- etc.

If this information is linked to a quality measuring system (some proposals for such a system can be found in (Ryńca and Klaus-Rosińska 2010)), then we (and everybody interested) would be able to see the relationship between the price, the cost and the product. And it seems that without this information no efficient university management is possible.

### 5. Conclusions

In the present paper we proposed a small step towards an efficient costing system for universities: a multi-dimensional cost recording system, based on the critics of the existing systems at the Faculty of one of Polish universities. If our proposal is implemented, the Faculty and its partners will have at their disposal a much more useful cost information than they have today.

Even once our proposal is implemented, this will be only the beginning of a hard road towards a good (from the managerial point of view) costing system. The experience of those universities which have succeeded in implement a full costing system show clearly that it is a very difficult process, both from the technical point of view (it requires expertise and above all time – at a Finnish university two persons had to work full time for one year on the issue (Österber-Dobson 2011)) and from the human point of view. Our research showed clearly that most of the academic staff (the management of the university included) are not quite persuaded as to the need of all these deep changes and they saw our data and
information collecting activities as innocent, but purely theoretical activities, which were time consuming, but rather useless to them. We hope that our experiment at the selected Faculty will contribute a bit to the mentality change, which is absolutely necessary for an efficient costing system to exist and work. As Espinasse (2011) says: “Full costing is a tool, not the solution”. We hope our research fits this scheme.

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Deliberating IS Successes and Failures in Organizational Settings: A Longitudinal Study of a Tanzanian Public Sector Organization

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1. Introduction

The paper argues that it is not possible to develop an informed understanding of computer ‘failure’ or for that matter ‘success’, without reference to the processes of social accounting through which terms such as failure or success ultimately come to be ascribed to particular systems or events. The study of a system’s success and failure, therefore, cannot but also be a study of processes of organizational sense-making. It is precisely such processes that tend to be missed in much of the managerial literature with its endless enumerations of ‘critical success factors’. In going beyond the limitations of this literature the paper draws on work on the Social Study of Technology (e.g. Pfaffenberger, 1992; Pinch, 1993). As is well known, a central strand within that tradition is concerned with the study of the ‘meanings’ which the various technologies have for those social agents with a stake in their development promotion and use. Methodologically, this calls inter alia for a research strategy designed to elicit the meanings held by key agents. One way of investigating ‘success’ and ‘failure’, as Latour (1987) puts it, ‘in the making’, would be to study what claims of success and accusations of failure are made (and un-made) in a particular organizational setting, when, how, by whom and with what consequences.

2. Prior Research

The study of failure has been a longstanding preoccupation of both IS research and organization Studies (e.g. Lyytinen & Hirschheim, 1987; Sauer, 1993; Dutton et al, 1995; Brown & Jones, 1998; Flowers, 1999; Scott, 1999; Wilson & Howcroft, 2002; Fincham, 2002; Bartis & Mitev, 2008; Knights et al, 2008). Lyytinen and Hirschheim (1987) for instance classified failures in terms of Correspondence failure (where the IS fails to meet its design objectives); Interaction failure (where users maintain low or non-interaction with the IS); Process failure (where the IS project overruns its budget or time constraints); Expectation failure (where the IS fails to meet stakeholder expectations). All these forms of failure are still very much in evidence. The Standish Group has since 1994 been collecting data on the success rates of I.T. projects which it publishes, every two years. As the results reported in the 2009 Standish study remind us (see Figure 1), an inordinately large number of IS projects continue to fail. This is even in developed countries with a high availability of IT practitioners; of IT literate users; and of sophisticated
methodologies designed to support the life cycle of a wide range of different applications; and, not least, the accumulated experience of many years of organizational IT development and use (see Lyytinen & Robey, 1999).

<table>
<thead>
<tr>
<th>Year</th>
<th>Successful</th>
<th>Challenged</th>
<th>Failed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>16%</td>
<td>53%</td>
<td>31%</td>
</tr>
<tr>
<td>1996</td>
<td>27%</td>
<td>33%</td>
<td>40%</td>
</tr>
<tr>
<td>1998</td>
<td>26%</td>
<td>46%</td>
<td>28%</td>
</tr>
<tr>
<td>2000</td>
<td>28%</td>
<td>49%</td>
<td>23%</td>
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<tr>
<td>2002</td>
<td>34%</td>
<td>51%</td>
<td>15%</td>
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<td>2004</td>
<td>29%</td>
<td>53%</td>
<td>18%</td>
</tr>
<tr>
<td>2006</td>
<td>35%</td>
<td>46%</td>
<td>19%</td>
</tr>
<tr>
<td>2009</td>
<td>32%</td>
<td>44%</td>
<td>24%</td>
</tr>
</tbody>
</table>

Figure 1: Success and Failure in perspective (Source: CHAOS Summary 2009, Survey by the Standish Group)

Most IS research into ‘failed’ systems has sought to identify the critical technical, organizational and project management factors that ‘cause’ failures to happen or at least significantly contribute to such failures. A typical list of such ‘factors’ will typically include Organizational factors (such as management support and user acceptance/resistance); Project Management factors (such as competence; schedule and budget), and Technical factors (such as requirements, complexity and the maturity of the technology). Studying the factors that have caused, or contributed to, a wide range of information systems’ failures will, it is claimed, enable us to perfect our methodologies and project management tools and thus avoid such failures in the future. However, there are some issues that often make the process of factor identification problematic. A hint is provided by the category “Challenged”, the most significant category (typically hovering at around 40-50%) in the Standish Group surveys (see Figure 1). The classification of systems as successes or failures is not a straightforward process but one that is often heavily contested. As Wilson and Howcroft (2002) note:

“Much of the literature would have us believe that when evaluating IS, organizational members will list a number of factors that then add up to a failure or a success. However, we argue that it is possibly the case that a decision is made as to whether or not a system is a failure and this is then followed by the construction of a list enumerating factors that constitute the failure/ success. In the case of failure, the next step is the attribution of causes once failure is declared. By its nature, this is a rationalization process whereby causes ‘fit’ the failure factors. This means that, contrary to common notions, attribution of failure and the search for causal explanations is in itself a process that deserves examination”
3. Research Methodology

The paper draws upon an ongoing study of an Integrated Financial Management System in a large Tanzanian public sector organization (henceforth - pseudonymously - TPSO) as it becomes the subject of contradictory claims to success and of accusations of failure. There are three main methods of data collection:

i) Participant observation. The first author is a serving IT manager in TPSO and has been a participant as well as an observer from 2003-today.

ii) A review of organizational documentation including memos from 2000-today.

iii) A series of semi-structured interviews and a large number of more informal conversations with individuals identified as key or representative stakeholders. The purpose of the interviews (which were recorded and transcribed prior to the analysis) was to give respondents the opportunity to articulate an reflect upon the meaning(s) of the system, and to give us the opportunity to compare these articulations with those gleaned from informal conversations and from documents and interactions generated in the course of their work.

Integrated Financial Management System (IFMS) is a term used to designate a computerized government financial system (Wynne, 2005). That is to say, “a computer application that integrates key financial functions (e.g. accounts, budgets, etc.)”, promotes efficiency, security of data management and supports comprehensive financial reporting (Peterson, 2006). An IFMS has core and non-core components. Core components are systems and modules for general ledger, budget management, agency budget execution, accounts payable, accounts receivable and cash management. May also include financial reporting, fund and cost management. Non-core modules include inter-alia payroll system, budget development, procurement, project ledger, inventory, asset management, and performance management modules. (Wynne, 2005; Parry, 2005).

The Legend-IFMS emerged out a series of crises that afflicted the Tanzanian public sector at around the turn of this century. The first was anxiety about the potential impact of the Y2K problem (e.g. Knights et al, 2008). This had the effect of bringing together for the first time politicians, IT specialists, and public and private sector decision makers, national and international organizations in the common cause of dealing with the so-called ‘Millennium Bug’. As one commentator put it: “We may therefore be thankful that Y2K revealed our interconnectedness, which we now refer to as “globalization”, while enabling developing countries to begin appreciating the full significance of information and communication technologies (ICT) within their borders” (Sawe, 2005b).

At the same time, another crisis was brewing, this one over concerns regarding the manifest unreliability of financial data provided by extant Government financial systems and the associated lack of Government financial controls. Basic
accounting information was said to be “either unavailable or unreliable and controls over expenditures and public debt were exercised, by default, through the banking system” (Anderson et al, 2000). There was therefore increasing pressure from donor countries and organizations for increased transparency and accountability on pressure from donor government expenditures given that their contribution in direct budget support was expected to cover 22% of the total Government recurrent expenditure in 2003/2004 (ibid).

Against this backdrop, an Integrated Financial Management System (IFMS) was proposed as a part of the solution to both these problems. The main objectives of IFMS were to ensure transparency, accountability and the proper use of public funds. The recommendation came in two related projects: The Government Accounting Development Project (GADP) and The Interim Budget Development Project (IBDP) which commenced in 1994 and 1999 respectively. GADP would support the work of Accountant General's Department (AGD) whilst The IBDP was meant to develop performance-related budget techniques in compliance with IMF Government Financial Statistics recommendations.

Although the IFMS project cross-cut across all ministries, departments, government agencies and Local Government bodies, it was located in the Accountant General's Department (AGD) rather than under the Permanent Secretary of the Ministry of Finance, (who could better facilitate the inclusion of other departments in the project). Indeed, there seems to have been inadequate awareness and little sense of ownership of the system. In retrospect, it appears likely that the Government’s revival of the project in 1998 was a gesture meant to appease donor countries and organizations rather than commitment to the benefits of reform. The ministry still did not ‘own the project’ which remained under the AGD.

The tender for the supply and installation of IFMS was floated in June 1997 (Anderson et al, 2000). A local company, Hi-Tech Consultants (a pseudonym) won the tender and in January 1998 signed a contract with the Ministry of Finance. Anderson et al (2000) give the reasons for the adoption of an off-the-shelf IFMS solution as follows:

(i) Lack of in-house or local consultant with experience in development of tailor made solution;
(ii) the expectation that a good package facilitates good practice in financial management
(iii) it could be implemented quicker than tailor-made solutions;
(iv) Re-engineering around the package appeared an effective method of instituting necessary organizational changes and eliminating “poor work practices”.

The original package was subsequently acquired by the Legend Software Corporation and renamed accordingly. Implementation commenced in June 2000 with a pilot project at Ministry of Finance and another 11 Ministries. The first modules to be implemented were: General Ledger, Accounts Payable, Accounts Receivable, Cash Management, Purchase Order and Multi-Currency with customization specific to a Public Sector cash-based accounting system. By the
end of financial year 2000/2001, 47 ministries/departments were users of the system. All 20 sub-treasuries and 20 regional administrative secretariats started to use IFMS in financial year 2002/2003. To differentiate the Legend-based IFMS implemented for the Tanzanian Government from the general idea of IFMS, from now on, we will refer to it Legend-IFMS.

The Legend-IFMS implementation was pronounced a success and the then Accountant General praised it to be the “most appropriate solution at the best price” (Legend S.C. document, 2005). Indeed, the system came to be considered others as a beacon of success among IFMS developments in Developing countries and many countries sent their implementation teams to visit and learn from the Tanzanian success.

4. Findings

In the course of the research reported upon here however, a much more ambiguous picture began to emerge. For example:

- No business process analysis was conducted prior to the decision to deploy Legend-IFMS. What analysis was done was focused entirely on mapping the chart of accounts presupposed by system to those of TPSO
- Users were therefore not consulted except for purposes of verification of the accounting codes on the accounting Manual. Some spoke of the “imposition of the system” by the Ministry of Finance.
- According to our respondents in the Accountant General’s Department, the Ministry of Finance had not ‘imposed’ the system upon the various agencies. Rather, they claimed, “it suggested” to them that they should adopt Legend-IMFS in the wake of its successful implementation in the ministries.
- According to our interlocutors in the various public sector agencies that were deemed users of the system on the other hand, this ‘suggestion’ of Legend was the proverbial offer you can’t refuse. The Ministry, it was claimed, merely issued a circular instructing various public sector agencies should use Legend thus allowing no leeway to select an alternative package.
- Users complained about the high costs of maintenance, the unreliability of support and what they termed the “arrogant behaviour of the vendor”. (The vendor is still responsible for the support and maintenance of the system).
- Moreover, claims were made that the training provided by the vendor “was planned in such a way that [the] customer does not gain [the] capacity to manage the system themselves”. Legend S.C., they claim, has so far refused repeated requests for “less superficial training”.
- Legend was installed in a separate network and is only used by the Finance Department. Even internal auditors were not given access to the system. Finance staff therefore still have to work on two different, unconnected systems for TPSO collaborations.
- Directors also lacked access to the reports generated by the system. Reports had to be requested from the Director of Finance. Finance in turn typically produced reports in Excel rather than Legend “so that they can be
Users complained that “the system is [still] administered by a Legend Administrator who is also a user of the system. This is contrary to accounting and IS security principles.”

• Budget commitments and controls have not been implemented into the system until now. TPSO is currently preparing for implementation.

• Purchase order, Inventory, and Asset management modules have yet to be configured and are not currently in use although they have been installed. Other functionalities such as Cheque Printing were never configured for use although the printer had been purchased in 2003.

• The system seemed to be the object of inter-departmental infighting. For instance, there was a widely voiced view among IT staff that for three consecutive years the “IT budget was being suppressed by the Director of Finance” with funds approved by management and the TPSO board being withheld. As a result, current IT projects had overrun by “more than three years”. Furthermore, whilst the Finance Department sometimes canvassed the views of the IT department, these were, in the view of many of the latter, usually disregarded. In fact, a member of the IT department spoke of “a cloud of fear” stifling criticism of the system: “Once I as an IT Manager attended the [Legend] annual conference of users, partners and vendors, and I criticized the way Legend was implemented in Tanzania. The Ministry of Finance wrote to my CEO saying that I acted unethically as I am not a Government spokesman [with the right] to comment about it. The vendor also wrote a letter to complain why we did not [take the problems] to them first”.

5. (Preliminary) Conclusions

While the data collection and analysis is not yet complete, it is clear that the Legend system at TPSO is not fully utilized. Currently the organization is in the process of implementing the Asset Management, Purchase Orders, Commitments & Controls, and Cheque Printing at the Head Office, and in 5 other regional offices. Furthermore there is evidence among users of widespread disenchantment with the System. Indeed, some Government agencies are now opting for other systems. For example, the Rural Energy Agency chose Accpac instead of Legend-IFMS. Similarly, the Civil Aviation Authority has awarded a contract to Oracle Financials to replace Legend-IFMS.

Is Legend-IFMS a success or a failure? The ‘facts of the matter’, insofar as they can be agreed upon by the participants can, with enough effort, be fitted to a number of different accountings of the system’s success or failure. TPSO members would, in their memos, interviews and informal conversations, construct their assessments of Legend-IFMS by putting different weightings on the relative importance of different facts. As the paper will show however, more often than not,
such accounts were not uniform but dilemmatic: they contained contrasting themes. These themes were fore-grounded or back-grounded in line with the discursive exigencies that speakers/writers found themselves. The ‘ultimate’ success or failure of Legend-IFMS thus appeared to be as dependent upon the outcome of the various political and discursive struggles currently taking place in TPSO as it is on the ‘technical’ characteristics of the system ‘itself’.

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Activity Based Costing in large scale research projects

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Abstract

In this paper will be proposed Activity Based Costing model for one of the example of large scale research project - the Large Hadron Collider (LHC). Authors would like to focus on the main problems linked to the construction Activity Based Costing model for research projects. Firstly the main problem is scale of these kind of projects - budgets are counting in billions euro and the time of realization takes years. Apart from that it is difficult to define the final products, because it is always to a certain extent unknown what exactly will come out of the research, especially a research which is planned for 20-30 or even more years. It is also hard to identify every single activities and activity drivers, and especially their consumption and allocation rates. In this article Authors would like to answer the question: despite of these problems above is it worth to prepared Activity Based Costing model for large scale research project?

Keywords: activity based costing, large scale research project

1. Introduction

In this paper will be proposed Activity Based Costing model for one of the example of a large scale research project - the Large Hadron Collider (LHC). Authors would like to focus on the main problems linked to the construction of Activity Based Costing model for research projects. The application of Activity Based Costing model in this case may be important, because in large scale research projects huge sums of money are spent and the donator would like to know for what. What is more, in such projects a part of money has to be “lost” – because a part of experiments do not succeed and a part of hypotheses turn out to be false. It should be possible to assess whether these losses are reasonable and justified. Further, in large scale projects there usually occur results which have not been expected – e.g. applications of the invented technology in other domains. It would also be useful to be able to identify these “byproducts” and cost them. Further, it would also be extremely useful to know the cost not only of final products, but also of activities - as similar activities may later be repeated in other products. In short, as large scale projects cost more than much, it seems normal to expect that their cost is adequately planned and controlled. Activity Based Costing is a tool which may help to do this.
2. Activity Based Costing Method

The basis of Activity Based Costing is the assumption that cost objects (products, projects, customers, divisions etc.) consume activities and activities consume resources. First resources are allocated to the activities (through so-called resource cost drivers) and then to the cost objects, through so-called activity cost drivers.

**Figure 1. Illustrations of classical Activity Based Costing**

![Activity Based Costing Diagram]

It is widely assumed in the literature that the ABC allows to determine a much more exact cost of cost objects than any other approach. That’s why it is most advisable to use this method in case large amounts of money is involved. This is certainly the case of large scale research projects. In such projects huge amount of money is spent and it would be good to know what the results are and how much cost they have consumed.

Normally ABC is applied to regular production or to non-research projects (Łada, Kozarkiewicz). The least problematic is the use of ABC in regular production. For this case the corresponding theory is the best developed, there are ready lists or activities, cost drivers etc. In case of regular production the model can be verified throughout several accounting periods and become relatively stable. In projects ABC is used very often for budgeting. There are some problems linked to this use of ABC, but in non-research projects the activities and products are usually well defined and relatively stable.

3. Costing of Research Projects

In research projects, however, there is much more uncertainty than in non-research projects. Very often the products of the projects are only vaguely defined, sometimes the activities as well. In large research projects this variability and uncertainty is still larger – such projects go on for a very long period of time and their products, as well as activities actually performed, are often quite different than the initially planned ones. What is more, in such projects often are created...
completely unexpected products, which can find application in completely different domains, and on the other hand some activities, some resources, often very expensive, are spent in vain – they do not lead to any result. It would be good to know how much various products of the project cost, but also it would be good to know how much money and which resources have been spent in vain.

What is more, the problem of costing has not been solved even for small scale research projects. Authors (Ratnatunga i Waldmann, 2010, Souder 2004, Espinasse 2011) state that not exist well rounded method of planning and controlling costs of research and development projects. Large number of this kind of project generate loss from financial point of view. But this is not observable in accounting system at universities in report from realization of projects (Espinasse, 2011). The big problem is with indirect costs. Well - known methods state that indirect costs is a percentage of direct costs. In this method indirect costs are counted in proportion to direct costs but there is usually no reasonable arguments for using it.

For large research projects the solution of the costing problem will be still more complex than for smaller research projects, and a wrong costing may mean very false information – the same percentage of inaccuracy means much more inaccuracy in absolute sums. And no indication in the literature exists as to how to handle the problem. In the next section we present an attempt to do so.

4. A proposal of application of Activity Based Costing for a large scale research project

There exist no ready models for ABC in research projects and we would like to propose one for one case – a large research project, which has been going on. The following model will have to made precise for the project in question, what is more, for the various phases of its very long duration.

Figure 2. Illustration of the ABC model for large scale research project for a period t
Firstly, the problem is scale of these kind of projects - budgets are counted in billions euro and the time of realization takes years. Large Hadron Collider consist of large amount of different activities. Some activities are the same and do not change from the beginning to the end of projects. Some activities turn out to be performed in vain – they do not lead to any product. These kind of activities consume project’s resources too. Some resources may be even spent without being used for any sensible activity – these resources, spent in vain, do cost as well. What is more, if a product comes into being in period t, in large scale projects it may be the result of activities performed in the same or recent periods, but also of activities performed many periods ago.

Secondly, there is a problem with product’s definition in large scale research project. One of the main product of Large Hadron Collider is laboratory (big infrastructure). It’s cost would be probably fairly easy to determined. The other main product is knowledge. But it is very hard to describe knowledge. And in fact it was knowledge which constituted the main goal of the project, not even the laboratory. Thus one of the main goals of a costing system for large scale research projects would to be asses the cost of knowledge generated.

The topic knowledge management is presented in research projects (Barthes i Tacla (2002), Jayawarnaa i Holtb 2009). It is launched orientation, which is crucial for research projects: methods of evaluation of knowledge generated by research projects. Sugiyama (2007) propose way of evaluation knowledge generated in one project in organization which is used by the other research projects in the same organization. However, he did it for small research projects, and organizational knowledge is certainly not the most important type of knowledge in large scale research projects.

In such projects we can distinguish two types of knowledge. The first one is the knowledge that we have expected to obtain from the beginning of project. For example scientists believe that Large Hadron Collider will help to answer many fundamental questions in physics. The second one is the knowledge that we have not planned to obtain. For example the construction of big infrastructures leads to the invention of new kind of materials or new technology. We would like to be able to determine the cost of all the different products.

Another problem connected with the implementation of activity based costing in large scale research project is the changeability and lack of stability of models like the one from Fig.2. In Large Hadron Collider project it is very hard to precise every resources, activities, activity drivers and products. What is more, these elements can change several times during project realization so it would be useful to prepare for the model form Fig.2, some kind of change management and verification system.

We also have to remember that in large scale projects there will be different phases. Of course, each project is composed of phases, but in case of a large research projects this problem is especially acute. For each phase the approach to the costing might be completely different. Let us suppose the building phase of the project in question, thus the phase when the large laboratory was to be built.

In this phase we can point out three main groups of resources: Buildings with equipment, People, Knowledge.

Equipment is a resource which is fairly easy to cost and allocated to tangible products, like the laboratory. In this phase our project resembles a “normal” construction product and we can used costing techniques designed for
construction projects. Next resources is an extremely huge number of people involved in project: from members of project team to scientist and other specialist from different countries. In this aspect our project differs from a typical construction project, because the persons involved are not just technical and engineering staff, whose competences are fairly easy to measure and allocate to various construction activities, but above all scientists, who are a source of highly specialized knowledge we have thus the third important resource in this project: knowledge. Without people’s knowledge this project would have never existed. But knowledge is not a resource use in normal costing system. Generally it is assumed that the scientist salaries measure the knowledge, but in case of a large scale research project we would like to measure different types of expertise and allocate them to different types of activities and products. It is an unsolved problem how to do it.

The main two groups of activities in this project phase are: a group of activities connected with procurement management and a group of activities connected with project management. In the first group we have activities connected with preparing all specifications of deliveries. Next is conducting a tenders (with choosing supplier, signed contracts). The next one, preparing all environment (service) connected with a delivery phase. Because of the scale of this project and a huge amount of different activities, we are not able and it is pointless to mention them all. So in Figure 3, we present only examples of activities.

The main product at these stage is big infrastructure. Big infrastructure consist of components (like quadropole and dipol magnets, steel collars, networking infrastructures etc.), civil engineering work (like four cavers for detectors) and services that assembly every elements in one big infrastructure.

As for the cost drivers, it would be necessary to make the project team fill in time sheet, so that the use of time of different person can be assigned to individual activities and products. The source of cost drivers will also be the documents (also time sheets) about the equipment usage. The resource knowledge would have to be categorized into various categories and then allocated to activities and products through time sheets or questionnaires.
Resources spent in vain correspond to the cost of specialist who travel to contractors who take part in tender for technological audit. In big tenders representatives of project teams travel to every companies who take part in this tender to make technological audit. This activities occupy them a lot of time. Take into account that every tender won only one performer, traveling to other companies, which loose was activities in vain. In the same time this people who took part in these activities we can called resources in vain.

Some tests during components assembly we can called activities performed for products in next periods because this activities can caused “birth of new knowledge” (one big step in direction to answer on the fundamental question in physics – the main goal of Large Hadron Collider).

It is obvious that the model from Fig. 3 needs much more work to be implemented. However, it is worth noticing that it may deliver us very important information, e.g. what is the cost of the tender procedure. This kind of information would be easier to obtain that the cost of purely research activities, and yet this information may be useful to elaborate a good (thus not too expensive, and yet efficient) procurement system for the project (Niedzielska, Kuchta, 2011)

5. Conclusions

At the beginning of the present paper we formulated the question we wanted to try to answer here: is it worth to use Activity Based Costing in large research projects? At present, we do not feel authorized to answer the question. On one hand Activity Based Costing, at least in theory, is able to deliver us very important information:
about the resource usage, the cost of various activities and products etc. But there is only the question of the cost of getting this information. If the model has to be changed every year, if the measurement of the use of activities (which would have to be done by means of questionnaires, time sheets etc.) would be so annoying for the project team that they would stop taking it seriously, than probably it would not be worth it. On the other hand, in case where such amounts of money are spent, it seems completely illogical to avoid spending a relatively small portion of this money on a costing system. Using Activity Based Costing generate cost, and this cost may be too high for small project or small companies, but our hypothesis is it would be maybe even tiny with respect to total cost of a performing a large scale project. What is more, with this “tiny” cost we might be able, thanks to the information we would get, save not tiny sums of public money or spend them in a more reasonable way.

As to the human resistance and annoyance linked to the problem of collecting data, we think it would be enough to explain to them the system and possible advantages of it. And also it would be useful to place the problem in the context of the European Union attitude – they are starting to require a full cost approach in research projects (Estermann 2011), which in short means that they want to control exactly what the public money is spent for. And there are universities who have implemented Activity Based Costing to measure all their cost and to use it (Fürstenbach 2011). The academic staff was at the beginning also annoyed, but finally a compromise has been found and all the university activities and products of university activities have their full cost, which is a valuable management tool.

As for large research projects, the process of looking for a good costing (and as a result, a good budgeting and budget control) system has only begun. Our next step will be to try to verify the idea at the spot – thus together with the team members of the project itself. It is possible that it will turn out that it is not wise to try to elaborate an ABC system for the whole project, but only for parts of it – for those parts where it would be fairly easy to introduce such a system and where considerable amounts of money are spent. For example, we will start by introducing the ABC system for the procurement process in the project.

References


Jayawarnaa Dilani i Holtb Robin (2009), “Knowledge and quality management: An R&D perspective”, 1, aMMU Business School, Aytoun Street, Manchester M1 3GH, UK The University of Liverpool Management School, Chatham Street, Liverpool L69 7ZH, UK


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Activity-based costing for health care institutions

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Abstract

Situation on global markets, which is changing dynamically, the field of medical services included, makes managers to be forced to constantly seek new and effective methods and management tools. Basic knowledge of the management should be provide by cost information. It is important to apply such a costing model, which would help to provide useful information about the type and amount of used resources and reduction possibilities. The paper presents a proposal of a model accounting for the costs of a selected primary care clinic. The process cost of patient serving will be analyzed, whereas the activity based costing method will be used.

Keywords: Activity-based costing, costs, activities, resources, health care.

1. Introduction

Health care institutions operate in conditions of high volatility environment. The present trend of change is leading to an increase of competitiveness of the health care industry, an increase of health care needs, as well as a rise of expectations of patients and payers.

Situation on global markets, which is changing dynamically, the field of medical services included, makes managers to be forced to constantly seek new and effective methods and management tools. Basic knowledge of the management should be provided by cost information. Information obtained on the basis of traditional models of cost accounting - full cost accounting and variable cost accounting - are now insufficient. It is therefore important to apply such a costing model, which would help to provide useful information about the type and amount of used resources and reduction possibilities.

It is also worth noting that Polish health care system is usually negatively assessed by patients and journalists. Its offer is much less attractive than in most western countries and most people have the feeling the lack of money is only one of the reasons, that a wrong cost management is here much more “guilty”. The nurses and doctors complain that the price offered for certain procedures by the National Care Fund is completely unrealistic. Many anecdotes are repeated, e.g. that if a patient has two diseases which could be healed in one surgery, it is more profitable for hospitals to operate him twice instead of one time. Or patients spend several days in hospitals to undergo some examinations for which a few hours’ visit would be enough, but it is profitable for the hospital to keep the patient several days. Nurses say that nobody counts the cost of computer (in their opinion
overwhelming useless) reports they have to prepare and the cost of the fact that while typing in the data, they are not with the patients. All these discussions and complaints are possible, because the cost of individual activities, procedures, days spent in hospital by patients, hours spent by the nurse in front of the computers is in fact completely unknown.

The paper presents a proposal of a model accounting for the costs of a selected primary care clinic. The process cost of patient serving will be analyzed, whereas the activity based costing method will be used.

2. Methods

The model accounting for the costs of a selected ambulatory care clinic based on activity-based costing (ABC) will be presented. This method was developed in the late eighties of the twentieth century by two American professors, Robin Cooper and Robert Kaplan.

The concept of activity based costing is based on the assumption that the direct cause of the costs action, activities. Implementation of these actions results in consumption of resources, which are a quantitative reflection of the cost (Piechota, 2005). In the literature you can find many examples of cost calculation according to the ABC model. In most of them a two-stage model of cost accounting is used, the idea of it is presented in the following Figure 1. It is required to explain terminology used in it to discuss the rules governing the model. The key notation of the concept of activity based costing is a cost object, which is the object for which the cost is collected and counted. Depending on the needs of decision-maker the object may be a product, order, contract, supplier, customer, etc. Another word or phrase in the presented model is a activity cost driver. Each action has its own unique cost driver. The driver is a cost measure of use of discrete activities by cost objects. It is worth noting that the action is defined as the set of operations performed in the unit, which are useful from the viewpoint of cost accounting purposes. In the model there is also the notion of the resource costs driver (resource cost driver). The resource cost driver is a measure of the amount of resources used or consumed by each operation. This should be the size, which most adequately reflect the commitment of resources in the performance. Resources are defined as economic elements, which are used to perform actions (Gierusz, Cygańska, 2009).

In the first stage of accounting an indirect costs according to the ABC method, costs are assigned to activities using the resource cost drivers. In the second stage, the costs of individual activities (cost pools) are accounted for cost objects using the activity cost drivers.

Figure 1: Resources – Activities – Cost objects
Source: Own work based on (Piechota, 2005).
Application of activity based costing in the healthcare system may be helpful in the planning process, effectively promoting the process of budgetary management. Information obtained under this account may be used, inter alia, for:

- assessing the degree of resource consumption (also in the process of planning the resource consumption),
- dividing resources between organizational units,
- analyzing the variations occurring between plan and reality,
- more effective performance measuring, identification of activities that add value and that do not add value (Cinquini, Miolo Vitali, Pitzalis, Campanale, 2009).

Moreover, the extent of the health care and diversification of the provided services meet the requirements of the application of the concept of activity based costing.

3. Basic features of the proposed model

The costing model proposed for the ambulatory care clinic will be destined only for management purposes, it will not be possible to use it for external reporting purposes, as it will not comply with the Polish law concerning financial reporting. The cost will be calculated for various categories of clients (patients), for different medical procedures, for the treatment of different diseases etc. The results will be compared to the price the National Health Found pays for one patient or for one medical procedure. It will also be analyzed whether the new system will be really helpful to the clinic management ad whether the cost of its implementation and maintenance will not exceed its advantages. The proposed model will also be used to try to indentify inefficient or useless activities. Such results are always a co-product of the construction of an ABC model, as it always involves detailed interviews with the employees of the organization in question (in our case with doctors, nurses, receptionists, administrative staff), close observations of the organization functioning (we have been doing this for a considerable period of time already) and a study of internal documents (which have been put at our disposal).
4. Costing models for health care institutions

In the literature there exist many ABC models for health care institutions. In case of health care institutions the cost objects may be a disease, a homogeneous group of patients, a medical procedure, a doctor etc. However, all the models known to the authors concern hospitals or inpatients clinics. There are no costing models for ambulatory care clinics (i.e. outpatient clinics). And such institutions differ from hospitals as far as the activities and costs objects are concerned. Different cost drivers are also needed. The authors have been investigating an ambulatory care clinic on Poland, who has agreed to try out a new costing system, as the traditional one is no longer adequate to the management needs. The aim of the paper is to propose a costing model based on the ABC method for the ambulatory care clinic in question and to compare it to the present system in terms of management needs.

The next part of this paper presents the calculation of unit cost of internal medicine clinic patients using the method of activity-based costing. At the beginning of work on constructing a model of activity based costing, the items that are subject to calculation procedure were identified, in other words: direct and indirect costs of the analyzed Internal Medicine Clinic were separated (Table 1). Direct costs will not be subjects in the calculation procedure, because they can be unequivocally attributed to the patient. The second group of costs, i.e. indirect costs, will have to be calculated, because it is not possible to unambiguously assign them to patients.

Table 1. Direct and indirect costs of the analyzed Internal Medicine Clinic.
Source: Own work. Monthly data in the Polish currency.

<table>
<thead>
<tr>
<th>Direct cost</th>
<th>59 093,95</th>
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<tbody>
<tr>
<td>Drugs and medical materials</td>
<td>7 751,23</td>
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<tr>
<td>Chemical reagents and diagnostic materials</td>
<td>366,92</td>
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<tr>
<td>Medical equipment used once</td>
<td>238,53</td>
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<tr>
<td>Fuel, oil, gas</td>
<td>226,65</td>
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<tr>
<td>Stationery</td>
<td>262,05</td>
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<tr>
<td>Other materials</td>
<td>19,39</td>
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<tr>
<td>Maintenance and repair – not medical equipment</td>
<td>48,20</td>
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<tr>
<td>Foreign Medical Services</td>
<td>42 623,17</td>
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<td>Postal services</td>
<td>87,81</td>
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<td>Banking</td>
<td>314,55</td>
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<td>Consulting services</td>
<td>5 040,00</td>
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<tr>
<td>Others (such as legal)</td>
<td>260,51</td>
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<tr>
<td>Car Service</td>
<td>42,17</td>
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<td>Court fees and other</td>
<td>200,10</td>
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<td>Other benefits</td>
<td>600,00</td>
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<tr>
<td>Missions</td>
<td>746,24</td>
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<td>Property insurance and other</td>
<td>206,93</td>
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<tr>
<td>Representation and advertising</td>
<td>59,52</td>
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</table>

| Indirect costs                            | 69 868,57 |
| Materials for repairs and other           | 48,81     |
| Prints                                    | 593,82    |
In the next stage of the model, core activities implemented in the analyzed Internal Medicine Clinic were identified, as well as ancillary activities (support) of the Department of Health Care (Figure 2). The next step after the separation of activities was to assign them direct and indirect costs, which is presented in the form of a resources - activity matrix (Table 2). Indirect costs were allocated to individual actions using the resources activity shown in Table 3. Presented model only refers to the process of treating a patient is the basic processes which includes:

- Patient registration
- Interview and physical examination
- Imaging study (e.g. USG)
- Laboratory study
- Diagnostic test
- Perform medical procedures
- Administration of vaccines
- Home visits
- Administrative activities.

![Figure 2](image_url) Cost allocation model for a healthcare institution.

Source: Own work.
Table 2. Resources – activity
<table>
<thead>
<tr>
<th>Activity</th>
<th>Patient registration</th>
<th>Interview and physical examination</th>
<th>Imaging study (eg USG)</th>
<th>Laboratory study</th>
<th>Diagnostic test</th>
<th>Perform medical procedures</th>
<th>Administration of vaccines</th>
<th>Home visits</th>
<th>Administrative activities</th>
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<td>Drugs and medical materials</td>
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</table>

Table 3. Resources cost driver
The final level of costs (after accounting for indirect costs) are presented in Table 4.

**Table 4.** Total costs of activity.
Source: Own work.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Direct cost</th>
<th>Indirect cost</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1: Patient registration</td>
<td>294,53</td>
<td>3 763,56</td>
<td>4 058,09</td>
</tr>
<tr>
<td>L2: Interview and physical</td>
<td>25 038,80</td>
<td>16 680,80</td>
<td>41 719,60</td>
</tr>
<tr>
<td>examination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L3: Imaging study (eg USG)</td>
<td>0,00</td>
<td>13 123,29</td>
<td>13 123,29</td>
</tr>
<tr>
<td>L4: Laboratory study</td>
<td>8 708,07</td>
<td>6 437,22</td>
<td>15 145,29</td>
</tr>
<tr>
<td>L5: Diagnostic test</td>
<td>8 358,50</td>
<td>3 762,27</td>
<td>12 120,77</td>
</tr>
<tr>
<td>L6: Perform medical procedures</td>
<td>1 866,77</td>
<td>5 162,06</td>
<td>7 028,83</td>
</tr>
<tr>
<td>L7: Administration of vaccines</td>
<td>7 627,94</td>
<td>3 724,23</td>
<td>11 352,17</td>
</tr>
<tr>
<td>L8: Home visits</td>
<td>705,03</td>
<td>8 074,71</td>
<td>8 779,74</td>
</tr>
<tr>
<td>L9: Administrative activities</td>
<td>6 494,31</td>
<td>9 140,43</td>
<td>15 634,73</td>
</tr>
</tbody>
</table>
In a further step the cost objects, which include internal medicine clinic patients, were specified. The principle is that the patient may benefit from one action or several actions simultaneously. For example, patient type 2 uses two activities: “Patient registration”, “Interview and physical examination” and “Administrative activities” while patient type 3 uses 4 three activities: “Patient registration”, “Interview and physical examination”, “Imaging study (eg. USG)” and “Administrative activities”. In all types of patient there will always be two actions, labeled L1 and L9. Administrative activities include for example: the patient's disease history, medications taken.

The model distinguishes 15 types of patient, namely:

Type 1: Patient registration + Administrative activities
Type 2: Patient registration + Interview and physical examination + Administrative activities
Type 3: Patient registration + Interview and physical + Imaging study (eg USG) + Administrative activities
Type 4: Patient registration + Interview and physical examination + Laboratory study + Administrative activities
Type 5: Patient registration + Interview and physical examination + Diagnostic test + Administrative activities
Type 6: Patient registration + Interview and physical examination + Perform medical procedures + Administrative activities
Type 7: Patient registration + Interview and physical examination + Administration of vaccines + Administrative activities
Type 8: Patient registration + Interview and physical examination + Diagnostic test + Perform medical procedures + Administrative activities
Type 9: Patient registration + Home visits + Administrative activities
Type 10: Patient registration + Imaging study (eg. USG) + Administrative activities
Type 11: Patient registration + Laboratory study + Administrative activities
Type 12: Patient registration + Diagnostic test + Administrative activities
Type 13: Patient registration + Perform medical procedures + Administrative activities
Type 14: Patient registration + Administration of vaccines + Administrative activities
Type 15: Patient registration + Diagnostic test + Perform medical procedures + Administrative activities
After allocating the costs to activities, the unit costs were calculated. Unit cost has been appointed on the basis of the number of patients who benefit from activity. The activity cost object was the number of patients - within one month (Table 5).

**Table 5.** Unit costs of activity.
Source: Own work.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Total cost</th>
<th>Number of patients</th>
<th>Unit costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1: Patient registration</td>
<td>4 058,09</td>
<td>2298</td>
<td>1,77</td>
</tr>
<tr>
<td>L2: Interview and physical examination</td>
<td>41 719,60</td>
<td>875</td>
<td>47,68</td>
</tr>
<tr>
<td>L3: Imaging study (eg USG)</td>
<td>13 123,29</td>
<td>246</td>
<td>53,35</td>
</tr>
<tr>
<td>L4: Laboratory study</td>
<td>15 145,29</td>
<td>397</td>
<td>38,15</td>
</tr>
<tr>
<td>L5: Diagnostic test</td>
<td>12 120,77</td>
<td>295</td>
<td>41,09</td>
</tr>
<tr>
<td>L6: Perform medical Procedures</td>
<td>7 028,83</td>
<td>177</td>
<td>39,71</td>
</tr>
<tr>
<td>L7: Administration of vaccines</td>
<td>11 352,17</td>
<td>221</td>
<td>51,37</td>
</tr>
<tr>
<td>L8: Home visits</td>
<td>8 779,74</td>
<td>87</td>
<td>100,92</td>
</tr>
<tr>
<td>L9: Administrative activities</td>
<td>15 634,73</td>
<td>2298</td>
<td>6,80</td>
</tr>
</tbody>
</table>

In the next step, it was necessary to develop a activity – cost object matrix. To accomplish this step of calculation, the previously presented information were used (Table 6). The results of these calculations are presented in Table 6. They can form the basis for the analysis of Internal Medicine Clinic.

**Table 6.** Unit cost of treating a patient specific type.
Source: Own work.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cost object</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L1</td>
<td>L2</td>
</tr>
<tr>
<td>Patient registration</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Interview and physical examination</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Imaging study (eg USG)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Laboratory study</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Diagnostic test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform medical procedures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administration of vaccines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home visits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administrative activities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Unit cost 1,77; 47,68; 53,35; 38,15; 41,09; 39,71; 51,37; 100,92; 6,80
Activity based costing can be helpful with calculating the actual unit cost of treating a patient. It also allows to determine the cost of activities which are not directly related to medical activities, such as for example activities made for administrative purposes (patient's medical history follow up). It also provides useful information about the type and quantities of used resources and identifies possible sources of cost reduction, while maintaining the quality of provided services. Model for accounting indirect costs based on activity based costing can provide a stable basis for making managerial decisions in medical subjects.

Implementation of activity based costing in health care institutions requires not only changes so far used by the calculation procedure, but also changes the way of their organizations’ functioning. In order to activate the activity based costing we need a lot of information. The process of collecting data for the system is expensive and time-consuming. Furthermore, during the implementation of new cost accounting system for health care institutions, managers may encounter resistance from employees, which can lead to a slowdown of work.

Problems with using the ABC model may also occur when defining cost objects, for example: groups of patients, ongoing projects, organizational units, etc. A challenge is also the choice of costs drivers, on which depend the result of calculations performed.

Despite the disadvantages of activity based costing this model generates more reliable and more accurate information than traditional costing models. Health care institutions, functioning in the conditions of growing competition and contracting by the National Health Fund of health services, are forced to keep searching for new, efficient management support tools and methods. The cost calculation described in this article reflects the structure of the costs incurred by the healthcare units to a degree greater than the traditional models.
5. Conclusions

Health care institutions operating in conditions of increased competition, rising health care needs, rising expectations of patients and taxpayers, are forced to seek new management methods and reducing costs. One of them could be an activity based costing, which has been gaining an increasing recognition in the world. The use of the possibilities inherent to this method will provide managers with the access to reliable, detailed and necessary cost information. Data obtained on the basis of the ABC model can be used, inter alia, in assessing the degree of consumption of individual resources, their distribution between different organizational units, the analysis of the variations occurring between plan and execution, as well as to a more effective implementation of the activities by identifying those that create the greatest value to the organization (Cinquini, Miolo Vitali, Pitzalis, Campanale, 2009). We hope that the fact the one ambulatory care clinic in Poland has involved itself in the implementation of the method will be of a great advantage to the whole Polish health care system. The Polish health care system has a lot of problems, which in our opinion are partially a consequence of the lack of accurate cost information and management.

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Activity based costing in university library services

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Abstract

Nowadays the problem of efficient costs management affects not only the manufacturing industry concentrated on profits. Many factors, above all the managers awareness, cause that every institution is trying to find solutions which ensure information support in cost area. This is an important issue also for university education institutions. Currently Polish universities start to struggle with increased competition and more and more restrictive state legislatures. However, using such techniques as Activity-Based Costing (ABC), give them the possibility to gain a better understanding of costs, costs optimization, improved quality and a higher student satisfaction. This paper presents a way in which the ABC can be implemented in selected functional division of the university. It shows how the ABC could be implemented in the departmental library. Authors based the proposals on their own experiences related to works conducted at Wroclaw University of Technology (Poland).

Keywords: activity based costing, cost calculation, university, library

1. Introduction

Considerations on the use of activity based costing in universities can be found in many publications from the turn of the XX and XXI century. Several universities in the United States (Cox et al., 1999), Australia (Ellis-Newman and Robinson, 1998) or Europe (Crooper and Cook., 2000) has already attempt to implement ABC. The topic is still valid - there are new sources of literature (Ratnatunga and Waldmann, 2010) about application the ABC into the costs systems of university, this method is also taken into account by the EUA (European University Association), as the destination account for the cost of higher education in Europe.

The aim of the article is to present a trials that have been taken in the Wroclaw University of Technology (Poland) connected with the use of ABC in the departmental libraries.

2. Basic assumption of activity based costing

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Activity-Based Costing (ABC) was created at the end of the eighties of the 20th century as the reply to imperfections of the traditional costing. Traditional costing systems focus on the cost allocation for external reporting purposes and the cost control of each of departments. However, systems of ABC give answers for following questions (Cooper and Kaplan, 1998):
- for what activities have being consumed resources of the organization?
- what is the cost of the activities and processes?
- why the organization must carry out activities/processes?
- what part of each of activity concerns products, services and customers of the organization?

So, it is possible to recognize that the main purpose of ABC is not an allocation of costs but seeking reasons for bearing the cost. The difference between ABC and traditional costing system is illustrated in the Figures 1.

Traditional costing system allocates costs of resources in one step process (directly to products, services or customers) using a several simplistic cost drivers, often produce inaccurate and misleading information. ABC focus on the activities performed to produce or service cost objects. The ABC calculation assigns cost of resources to cost objects in two stages. In the first stage are determined costs of activities/processes of the organization, in the second stage costs of activities/processes are ascribe to cost objects.

3. **Activity based costing in universities**

Analyzing the information currently available regarding the use of ABC in the educational environment, you can replace some basic information related to the conceptual solution of this method:

1. From the viewpoint of the first element of ABC – resources, in university we can extract the resources at two levels of functioning: the level of university and departmental level (Granof et al., 2000), (Klaus-Rosińska, 2009). Table 1 shows examples of the resources marked for level of department.
Table 1 List of resources at the level of department

<table>
<thead>
<tr>
<th>Resources – departmental level</th>
<th>Fundamental processes involving resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Faculty staff</td>
<td>(1) Teaching process</td>
</tr>
<tr>
<td></td>
<td>(2) Research process</td>
</tr>
<tr>
<td></td>
<td>(3) Professional services process</td>
</tr>
<tr>
<td>2. Organizational units of the</td>
<td></td>
</tr>
<tr>
<td>department:</td>
<td></td>
</tr>
<tr>
<td>2.2 Dean’s office</td>
<td>(1)</td>
</tr>
<tr>
<td>2.3 Library</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>2.4 Administration of the</td>
<td>(1), (2), (3)</td>
</tr>
<tr>
<td>department</td>
<td></td>
</tr>
<tr>
<td>2.5 Scientific journal editors</td>
<td>(2)</td>
</tr>
<tr>
<td>2.6 (…)</td>
<td></td>
</tr>
<tr>
<td>3. Space of the department:</td>
<td></td>
</tr>
<tr>
<td>3.1 Didactic and research area</td>
<td></td>
</tr>
<tr>
<td>- classrooms</td>
<td>(1)</td>
</tr>
<tr>
<td>- specialist workshops</td>
<td>(1), (2), (3)</td>
</tr>
<tr>
<td>- laboratories</td>
<td>(1), (2), (3)</td>
</tr>
<tr>
<td>3.2 Circulation area and other</td>
<td></td>
</tr>
<tr>
<td>spaces of general use</td>
<td></td>
</tr>
<tr>
<td>4. Material and laboratory reagents</td>
<td>(1), (2), (3)</td>
</tr>
<tr>
<td>5. Specialized equipment and</td>
<td>(1), (2), (3)</td>
</tr>
<tr>
<td>software</td>
<td></td>
</tr>
<tr>
<td>6. (…)</td>
<td></td>
</tr>
</tbody>
</table>

Each identified resource will be associated with a specific cost pool. For example - cost pools of resources like faculty member (table 1 – pos. 1.) will consist of costs such as salaries and other employee benefits, functional additives and any other costs that are attributable to the employee, such as allowances for travel, the cost of space assigned to him, the cost of IT services rendered in his favor, you can also include the costs of the functioning of organizational units of the department (e.g. libraries)\(^2\).

Resources identified in the general level of university should be related to organizational units of it. The units may include: main library, central administration, the rector, the language center, office level careers, publishing companies, etc. (number of identified target resources at this level will depend on the specifics of the university).

2. Considering the second essential element in the ABC - the activities, we can talk about grouping them in three basic processes performed in university: the Teaching process, Research process, Professional services process (Cox et al., 1999), (DETYA, 2000), (Granof et al., 2000). University during the realization of these processes consume/use its resources. This does not mean

\(^2\) Making settlements between resources in the ABC was described in detail in (Klaus-Rosińska, 2009). The author suggests a separation of resources into two types: “target resources” and „support resources”. Support resource is a resource which costs are settled on the other resources. While, target resource is a resource located on the lowest level of the hierarchy of resources. Its costs are settled by actions on the cost objects.
that all resources will be equally used in individual processes. It is worth noting that can appear situations where resources are consumed for the one process (e.g., resource like a dean's office will be used only during the realization of teaching, the resource like scientific journal editors relates only to the process of research), then the costs associated with the use of such resources will be assigned only to the substantial process. There will also be those resources that do not directly serve any of the fundamental processes (such as circulation area). The Table 1 presents an indication which resources are consumed/used in university by its basic processes.

3. The last element of activity based costing – cost objects, should be considered in terms of three carried out by a university processes. This means that for each process and identified inside of them activities will be separately specified cost objects. So, for the teaching process the cost objects can be: a student, the unused capacity of teaching (Granof et al., 2000), (Klaus and Kowalski, 2007), faculty of study, year of study, etc. In the process of research we can talk about the cost objects such as publication, patent, prototype, etc. In the case of the professional services the cost objects can be: expertise or other specialized service. Examples of cost objects for university have been included in Figure 2.

<table>
<thead>
<tr>
<th>Basic processes</th>
<th>Cost objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching process</td>
<td>Faculty of study</td>
</tr>
<tr>
<td></td>
<td>Level of education</td>
</tr>
<tr>
<td></td>
<td>Semester</td>
</tr>
<tr>
<td></td>
<td>Forms of courses</td>
</tr>
<tr>
<td></td>
<td>Student</td>
</tr>
<tr>
<td></td>
<td>Unused capacity of teaching</td>
</tr>
<tr>
<td>Research process</td>
<td>Publication</td>
</tr>
<tr>
<td></td>
<td>Research project</td>
</tr>
<tr>
<td>Professional services</td>
<td>Consultation</td>
</tr>
<tr>
<td></td>
<td>Expertise</td>
</tr>
</tbody>
</table>

Figure 2 Examples of cost objects for universities

According to the idea of the ABC (see Section 2), each resource (taking into account the proposal of A. Klaus-Rosińska, each target resource) should be settled through activities on objects cost. For the purposes of this article was taken into account the target resource at the department, which is the library. This resource is used in the process of teaching and research process. It could be said that the costs of specified cost objects will be related to the teaching and research costs. The authors of this article will present two case studies of using the ABC in departmental libraries in selected departments of the Wroclaw University of Technology (Poland).

4. Activity based costing in libraries of the university
There are several publications that focus on describing the applicability of activity based costing in selected organizational units supporting university teaching and research such as a library (Ellis-Newman and Robinson, 1998), (DETYA and The University of Newcastle, 2001), (Gerdsen), (Heaney, 2003).

Authors using the information contained in the above literature positions and based on own experiences (Klaus and Kowalski, 2007), (Klaus et al., 2007) propose to introduce activity based costing in the functioning of the departmental libraries what is described in sections 4.1 and 4.2.

**4.1 Case Study No. 1 - teaching and research departmental library**

One of the areas for which a model of the ABC was made is teaching and research departmental library of Wroclaw University of Technology (Poland).

One of the first steps that has been taken, similarly as in the case of ABC model for the dean’s office (Klaus et al., 2007), was download the cost information of the library from the financial-accounting system, later the costs information created cost pools of resources of library. Five resources of library have been identified, which were employees of the library. Each cost pool of the resources contained costs: related to salaries of employees, the derivatives of those workers, the costs of maintaining the surface, the costs connected with equipment (e.g. depreciation of devices) and other costs (e.g., IT services). Additional sixth resource of the library was the “open-space of the library”, cost pool of the resource contained cost of maintaining the surface including: cleaning, depreciation (repair fund), surveillance services, media consumption, energy.

An important task was also to identify processes and activities in the library. This is a key step in the process of developing the ABC model. This identification was based on interviews with employees of the library. The purpose of interviews was to learn the tasks performed on individual jobs and the products of those activities. During the interviews also asked to indicate the percentage of time that each employee spends on the implementation of individual activities. So, the resource driver in the ABC was the time declared by employees, dedicated to perform their activities.

During the interviews recognized the need to clarify the reasons for the talks. This task was necessary because of the large reserve of workers approached to discuss issues, especially those associated with the time necessary to perform the activities. It was feared that the talks have control character. Was therefore important to present the substance of ABC and an indication of the benefits of its use in the departmental library.

During the interviews tried to gather as much information related to the functioning of the library, in order to understand the operations it perform and the dependencies between them. The result of an interview conducted with each employee was a “final report” that contained the identified activities, their products and time spent on activities. Developed reports of the interviews were an important information base for “Dictionary of activities", which included the identified activities in this area and suggested improvement actions and performance measures.

Table 2 shows a sample of report compiled in an interview conducted with the head of the library.
Table 2 Sample of report compiled in an interview conducted with the head of the library.

<table>
<thead>
<tr>
<th>Process/activity</th>
<th>Driver</th>
<th>Activity product/activity cost receiver</th>
</tr>
</thead>
</table>
| **1. Current library service** (current lending and sharing collections, including the implementation of information and scientific functions, searching literature sources, selection of the collection) | % declared time | Readers from outside the Department: \( x\% \)  
Readers of the Department: \( x\% \), including:  
- \( x\% \) of employees of the Department  
- \( x\% \) of students of the Department |
| **2. Collection of literature** (ordering, cataloging and other work related to newly acquired volumes) | % declared time | Maintenance and development of library |
| **3. Prepare lists of literature** (search collections of other libraries, books on Polish and foreign markets) | % declared time | Employees of the Department |
| **4. Support for collections of literature** (transmission library books for binding, selecting books to “retro-conversion” - give main library signatures) | % declared time | Maintenance and development of library |
| **5. Coordinating the work of other employees of the library** (assigning tasks, supervising the work) | % declared time | Maintenance and development of library |

As shown in Table 2 the result of an interview with a head of the library, identified five main activities. The Table 2 also sets out activity products that have become cost objects.

As a result of carried out work has been observed that in the teaching and research library are realized the following activities (including the use of all five human resources):

1. Current library service
2. Loan services among libraries
3. Collection of literature
4. Documentation of faculty staff works
5. Prepare lists of literature
6. Support for collections of literature
7. Monitoring the timely donation of books
8. Coordinating the work of other employees of the library

The above actions are performed by various library staff who spend varied time effort to achieve them. The most time-consuming activities turned out to be: the current library services, the collection of literature and the documentation of faculty.

\( ^{3} \) assumes that the recipient of the activity are all students of the Department, they may equally use the library service
staff works. Because the resource driver was declared time of work, the more time-consuming activity the more costly activity. So, in the presented library the most expensive action is associated with the current library service, which represents more than 50% of the cost structure of the library. It is also the activity for which employees spend a day up to several hours. Next actions are: collection of literature - 16%, and documentation of academic achievement - 13%. Other activities are a small share in the cost structure of the library.

The next step in developing the ABC model in the library was the allocation of cost of activities to cost objects. It was assumed that the recipients of most of the activities carried out in the library were: a student, a graduate student and employee. Figure 3 shows the structure of determined cost objects.

![Figure 3: The structure of determined cost objects of library](structure_of_cost_objects.png)

Based on analysis, found that the recipients of the library activities are: students of the Department and students from outside the Department. The same is in the case of doctoral students and employees. It is also indicated an artificial cost object "Maintenance and development of the library." This object has accumulated costs of activities that were not allocated to the other determined cost objects.

It is worth to highlight that the sixth resource “open-space of the library” has been settled on the cost objects only through the activity "Current library service".

Determining the cost of separate cost objects allowed to obtain information on: How much is the departmental student/PhD student from the viewpoint of the library services? How much is the departmental employee from the viewpoint of the library services? How much are other readers?

4.2 Case Study No. 2 – separate departmental libraries: scientific library and teaching library

Another model of ABC was the model developed for the two separately functioning libraries of the next of Wroclaw University of Technology department. One library was connected with lending books and support reading room (it was called the “teaching library”), the second library had a scientific nature (it was called the “scientific library”).
Way to develop a costing model was similar as was in the case of the library described in chapter 4.1. Namely, it consider the following steps:

1. Analyzing the costs associated with the libraries and creating cost pools of identified resources,
2. Identifying activities of both libraries,
3. Establishing costs of the activities,
4. Identifying in the model cost objects,
5. Establishing costs of the various cost objects.

Settlement of costs for a case study no. 2 is illustrated in Figure 4.

![Diagram](attachment:image.png)

**Figure 4** Settlement of costs for a case study no. 2

In the case of the model, we can speak of two main areas of costs that will be allocated through actions on objects cost. One area is the “teaching library”, the second “scientific library”.

Within the area of “teaching library” identified four human resources (positions). Cost pools of these resources included (similarly, as was in the case study no. 1) all costs, which could be attributed to individual employees, including: salaries, costs associated with the maintenance of areas used by employees, depreciation of equipment assigned to them, the cost of consumables, costs of ICT, etc. Cost pools of resources were allocated to cost objects by one activity (identified during the interview: "Current library service"). The cost objects were: students (departmental and non-departmental), graduate students (departmental and non-departmental) and faculty staff (departmental and non-departmental). Fifth library resource was "open-space of the library", the cost pool of this resource contained all costs associated with maintaining the surface (cleaning, media, energy costs,
etc.). Fifth resource, like the other four (human), was settled by one action (the "Current library service") at the specified cost objects.

Within the area of “scientific library” has identified three human resources and fourth resource "Open-space of the library." Cost pools of human resources were allocated by three selected during the interviews activities of the library: "Current library service", "Collection of literature", "Documentation of faculty staff Works". Resource driver was % declared by the library staff time. The structure of cost objects was developed analogically to the structure of cost objects from a case study no. 1 (Figure 3). It is noteworthy that some of the activity costs in 100% were assigned to the selected cost objects: the cost of activity "Documentation of faculty staff works" have been assigned to cost object “Employee of the Department”, the cost of activity “Collection of literature” was assigned to artificial cost object "Maintenance and development of the library”.

6.Conclusions

This article presents the theoretical basis of activity based costing and presents the possibility of using the ABC in the departmental libraries of one of Polish universities. The benefits of using the ABC seem obvious: to obtain reliable cost information, yet inaccessible. It is difficult to manage an organization well, not really knowing what how much costs. Activity based costing makes that such knowledge is achievable. Of course, its use is not easy: it requires both the university supervisors support and positive attitude of employees. Nevertheless, it seems that in the end it is worth to bear the costs and "lose" time to implement, because it will allow authorities both of the university and its individual units, as well as individual workers, to better understand and control costs they are responsible for.

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Proposed merger of DEA and ABC methods in accounting for the costing of higher education

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Abstract

Current changes affect the expectations of managers who feel the need to have more and better information for decision making. Basic knowledge of the management should be the size of revenues and expenses incurred by the activity of an organization. Activity Based Costing has been implemented more and more often in practice. However, it also has several drawbacks. That is why in the literature it is combined with other methods, e.g. with the Data Envelopment Analysis method. The paper is presenting a modification of this combination, tailored for the needs of higher education costing.

Keywords: activity based costing, data envelopment analysis, costs, activities, resources.

1. Introduction

Modern higher education is functioning in a changing environment, characterized by intense competition, volatile legal, political and social environment and the need for continuous innovation. These changes affect the expectations of managers who feel the need to have more and better information for decision making. Basic knowledge of the management should be the size of revenues and expenses incurred by the activity of an organization. Information provided by traditional costing models are no longer sufficient. That is why Activity Based Costing has been implemented more and more often in practice. However, it also has several drawbacks. One of its drawbacks is the problem of the determination of the consumption rate of cost driver, which is usually taken as equal for all the cost objects, which does not have to correspond to reality. And wrong cost driver consumption rates may lead to wrong conclusions about cost objects, even to rejection of a product which is in fact profitable and promotion of a product which generates a loss. That is why in the literature it is combined with other methods, e.g. with the Data Envelopment Analysis method. The Data Envelopment Analysis allows to judge objects in the most profitable light for them. Thus, if the cost drivers consumption rates are chosen individually, in the most profitable way for each cost object and this cost object still turns out to be non-profitable, then it is sure that it cannot be profitable. Such an approach has been proposed in the literature. The present paper is presenting a modification of this combination, tailored for the needs of higher education costing.
2. Methods

2.1 Activity-based costing methods

Method of Activity Based Costing ABC was developed in 1988 by Robin Cooper and Robert Kaplan. This concept is based on the assumption that the direct cause of the costs are action, activities. Implementation of these actions results in consumption of resources, which are a quantitative reflection of the cost (Piechota 2005). In the literature we can find many examples of cost calculations by ABC method, mostly used as a two-stage model of cost allocation. In the first phase of cost allocation according to the described method, the costs of resources are allocated to separate actions thereby creating a so-called cost pools. To determine the cost of individual pools of activities, the following formula for computing is made (Hamburg, 2004):

$$\pi_j = \sum_{s=1}^{S} c_s \cdot n_{js} \quad for \quad j = 1, \ldots, J,$$

where:

$\pi_j$ – the total cost of the $j$-th action,

$n_{js}$ – consumption rate of the $s$-resource by the $j$-th action,

$c_s$ – consumption of $s$-resource,

$S$ – number of categories of resources.

Identification of the main actions consists of their diagnosis, as well as revealing their sequence and interrelationships. In determining the activities, the level of detail should be chosen in such a way that will show the important links of cause-effect relationship between cost and cost object, and that it will not lead to excessive complexity and excessive costs of the ABC system. This step is certainly a creative and innovative one. It requires a team of representatives from different areas of the business entity. Much of their time in the identification of activities should be devoted to the collection of data that can be gathered from official sources, interviews and discussions with staff, surveys, observation and analysis of historical data. The basic source of information on costs is situated in the system of cost accounting entity, including accounting books (diary, ledger accounts and subsidiary ledgers, trial balance and inventory), as well as all the additional information. From the standpoint of activity based costing the information about the structure of costs is very important.

In the second stage, the costs of individual activities are allocated to the cost objects. Cost object is defined as an object for which we collect and count the cost. For example, an object to the cost of higher education may be a student, graduate student, or different forms of education such as lectures, classes, seminars, laboratories, etc. To allocate the costs of specific actions to cost objects, we use the following formula (Piechota, 2005):

$$C_i = \sum_{j=1}^{J} \pi_j \cdot M_{ij} \quad for \quad i = 1, \ldots, I,$$

where:

$C_i$ – the indirect costs of the $i$-th product,
The problem is that the selection of cost drivers and cost drivers consumption rates for the allocation of resource cost to the activities and of the activities cost to the cost objects is sometimes difficult and what is more, it may change with time. That is why the ABC method is often criticized as too rigid. Also, in the activity based costing there always remains a part of indirect costs, which cannot be applied to cost objects using only a cost causal link between the operation and cost. These cost are allocated somehow, based on some artificially assumed cost drivers, but a big calculation error may occur here (Piechota, 2005). If the cost drivers and the cost drivers consumption rates are not selected and modified properly, the cost information delivered by the ABC method may be misleading (i.e. profitable cost objects may be judged to be non profitable and the other way round). That is why the use of other methods has been proposed to help the decision maker to choose the appropriate cost drivers dynamically, according to the current situation. One of the methods is the Data Envelopment Method.

2.2 Data envelopment analysis methods

Method of Data Envelopment Analysis DEA was first presented by A. Charnes, W. Cooper and A. Rhodes in 1978. It originated from the concept of productivity defined as the ratio of the single effect of a single effort. The above authors have used the relationship to the multidimensional situation where we have more than one effort, and more than one effect (Kazarko, Komuda, Kuźmiacz, Szubzda, Urban, 2008). Measurement of performance in accordance with the presented method can be obtained by using the following formula (Gospodarowicz, 2002):

\[
e = \frac{\sum_{i=1}^{S} \mu_r EFFECTION_i}{\sum_{i=1}^{M} v_i INPUT_i}
\]

where:
- \( e \) – efficiency,
- \( M \) – number of inputs,
- \( S \) – number of effects,
- \( v_i \) – the weight determining the validity of individual effort,
- \( \mu_r \) – the weight determining the validity of individual effect.

In the DEA method of analysis the objects are decision-making units, so called DMU. However, the subject of analysis is the productivity of those units. Determination of the efficiency of DMU using this method for each one of them is the solution of linear programming problem in which the ratio of outcomes to inputs is maximized with given constraints. It makes it possible to identify the strengths of the individual DMU’s and the prior knowledge of weights defining the importance of individual effort and results is not required. Since the DEA method is a nonparametric method, it is also not required to determine the functional
dependence between inputs and outcomes. This method allows to determine the border efficiency curve, which includes all of the most efficient units, and their effectiveness is 100%. Units that are below the curve are inherently inefficient. Their scope of improvement is determined by comparing the results achieved by efficient units (Kazarko, Komuda, Kuźmiacz, Szubzda, Urban, 2008)

Two criteria are important in creating models of the DEA: the orientation of the model and type of scale effects. Depending on the orientation of the model, the technical efficiency of input-oriented or technical efficiencies result-oriented is calculated. The purpose of this first is to minimize expenditures while maintaining the invariant results, while the second one is to maximize results while maintaining the invariant inputs. The second criterion defines the assumptions about economies of scale have been adopted in the model (variables, constants, or not increasing) (Szymańska, 2009). The important thing is that each DMU is shown in the best possible light, thus those DMU’s which are evaluated as poor certainly are so.

3. Costing model based on a combination of ABC and DEA

In this part of the work the way of connecting the concept of activity based costing with the concept of data envelopment analysis is presented. Suppose k is a product, but k=i∈{1,…,I}. In determining the optimal (from the point of view of the product) total consumption rate of the j-th action for k-th product, πkj∗(j=1,…,J), the following objectives seem to be reasonable. First, that the k-th product cost should be covered by the revenues of this product. If this condition is not met its production is not profitable and the product should be eliminated. Secondly, it is important to obtain the highest possible profit. Therefore, when all products are evaluated on the basis of their πkj∗, the difference between the profit from k-th product and the greatest profit potential to reach out to all products should be as small as possible. Thirdly, the optimal size of activity cost drivers is obtained when the profit calculated on their basis is the highest. All the objectives to which we seek must be optimized. You can define them as follows (Homburg, 2004):

\[\text{opt}_{\pi_j,\Delta,\delta} \left\{ \min \Delta_k, \min \delta_k, \max AP_k(\pi_{ij}) \right\}, \quad (4)\]

Restrictive conditions are:
\[AP_k(\pi_{ij}) + \Delta_k \geq 0, \quad (5)\]
\[AP_i(\pi_{ij}) - AP_k(\pi_{ij}) + \delta_k \geq 0 \text{ for all } i = 1,\ldots,I, \quad (6)\]
\[\pi_{ij} \geq \varepsilon \text{ for all } j = 1,\ldots,J, \quad (7)\]
\[\Delta_k, \delta_k \geq 0. \quad (8)\]

where the variables \(\pi_{kj}\) are the product-specific consumption rates of cost driver j, there variable \(AP_i(\pi_{ki})\) represents the product i’s absolute profit on the basis of the cost driver rates \(\pi_{kj}\) and the absolute profits are calculated using the following equation:
\[ AP_i(\pi_{ij}) = R_i - \sum_{j=1}^{J} \pi_{ij} \cdot M_{ij}, \]

(9)

where variable \( \Delta_k \) is used to determine product k’s gap in covering its activity-based cost when being evaluated on the basis of \( \pi_{kj} \), while variable \( \delta_k \) is the difference of the product k’s profit and the biggest profit possible to achieve among other products, when all products are evaluated on the basis of \( \pi_{kj} \). The variable \( \epsilon \) is positive, which is roughly equal to zero (Homburg, 2004).

The goal function means that the three objectives must be optimized in the in the lexicographic order. First, the objective function is to minimize the variable \( \Delta_k \) with given constraints. Then the objective function is to minimize the variable \( \delta_k \) while he minimum value of the variable \( \Delta_k \) obtained in the earlier stage of the counting model is to be kept. At the end, the objective function will be to maximize profit \( AP_i(\pi_{kj}) \), taking into account new restriction, i.e. the minimum value of \( \delta_k \). To determine the optimal product-specific cost drivers rates \( \pi_{kj}^* \), for all I products, the program (4)-(8) must be solved separately for each product (Homburg, 2004).

4. Example

Theoretical assumptions about how to connect ABC and DEA methods are here illustrated with a practical example from the university costing area. Let us suppose the analysis of processes and activities has been carried out in a technical college. In this paper we focus on one of the numerous process – Conducting classes. This process is composed of the following activities:

- implementation of the course in the lecture form (W),
- implementation of the course in workshop form (P),
- implementation of the course in exercise form (C)
- implementation of the course in the laboratory form (L)
- implementation of the course in the seminar form (S).

Cost objects are, for example, students from selected departments, namely:

- students from the Department of Computer Science and Management (IIZ),
- students from the Department of Chemistry (CH)
- students from the Department of Architecture (AR)
- students from the Department of Mechanical Engineering (ME)
- students from the Department of Electronics (EL).

Table 1 shows the results of applying the traditional method of activity-based costing, having five activities, distinguished above, as well as five products. Let us assume activity W is allocated to the cost objects by means of one cost driver (e.g. number of hours), activity P uses another cost driver (number of projects to be performed by the students), activity C has the cost driver “number of groups”, activity L uses the cost driver “number of units of certain type of material used”, activity S uses the cost driver “number of themes to be treated”. We also assume to know drivers consumption, given in Table 1: e.g. IIZ students use 30 number of hours of the lecture, those students had to perform 60 projects, they were divided

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1 Activities describing the process – conducting classes is from – Kuchta D., Ząbek S. (2010), Measuring the cost of activities performer at the University, International Conference of Education, Research and Innovation, Madrid
into 15 groups, they use 30 number of units of certain type of material and those students had to prepare 30 number of topics for discussion.

In the conventional Activity Based Costing the cost drivers allocation rates are supposed to be the same for each cost object, i.e. it is assumed (Table 1) that one lecture hour costs 0.02, one project costs 0.01, one group costs 0.01, one material unit costs 0.05 one theme costs 0.01, no matter which department is concerned. This assumption does not have to true. In some departments groups may be larger or smaller, themes more or less difficult etc. However, this is how conventional Activity Based Costing works. The results are presented in Table 1. Column 7 contains the products (cost object) activity-based cost. Columns 8 give the products (cost object) revenues (from students fees and/or a subvention from the Ministry of Education) and the last column give absolute profits for each cost object.

Table 1. Conventional ABC

<table>
<thead>
<tr>
<th>Product</th>
<th>$\pi_1$=0.02</th>
<th>$\pi_2$=0.01</th>
<th>$\pi_3$=0.01</th>
<th>$\pi_4$=0.05</th>
<th>$\pi_5$=0.01</th>
<th>ABC*</th>
<th>R</th>
<th>AP*</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIZ</td>
<td>30</td>
<td>60</td>
<td>15</td>
<td>30</td>
<td>30</td>
<td>5.85</td>
<td>40</td>
<td>34.15</td>
</tr>
<tr>
<td>CH</td>
<td>30</td>
<td>30</td>
<td>60</td>
<td>15</td>
<td>15</td>
<td>3.75</td>
<td>30</td>
<td>26.25</td>
</tr>
<tr>
<td>AR</td>
<td>60</td>
<td>30</td>
<td>30</td>
<td>15</td>
<td>30</td>
<td>5.55</td>
<td>35</td>
<td>29.45</td>
</tr>
<tr>
<td>ME</td>
<td>30</td>
<td>30</td>
<td>15</td>
<td>15</td>
<td>30</td>
<td>3.30</td>
<td>40</td>
<td>36.70</td>
</tr>
<tr>
<td>EL</td>
<td>30</td>
<td>15</td>
<td>60</td>
<td>60</td>
<td>30</td>
<td>7.35</td>
<td>40</td>
<td>32.65</td>
</tr>
</tbody>
</table>

Table 2 presents the results of calculations based on assumptions derived from a combination of ABC and DEA methods. Products relative profits have been calculated by using equation (4) – (8). We still need the cost driver usages shown in Table 1. However, the consumption rates, i.e. the costs of one lecture hour, of one group, on theme etc. have been calculated separately for each cost object thus for each college department. What is more, they have been calculated using the most favorable assumptions for each department. Thus no department may claim that they have been treated in an unjust way and their cost have been over estimated.

Table 2. Relative profits

<table>
<thead>
<tr>
<th>Product</th>
<th>$\pi_{i_1}$*</th>
<th>$\pi_{i_2}$*</th>
<th>$\pi_{i_3}$*</th>
<th>$\pi_{i_4}$*</th>
<th>$\pi_{i_5}$*</th>
<th>ABC*</th>
<th>R</th>
<th>AP*</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIZ</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>0.165</td>
<td>40</td>
<td>39,835</td>
</tr>
<tr>
<td>CH</td>
<td>$\epsilon$</td>
<td>0.102</td>
<td>$\epsilon$</td>
<td>0.066</td>
<td>0.062</td>
<td>5.053</td>
<td>30</td>
<td>24,948</td>
</tr>
<tr>
<td>AR</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>0.666</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>20.01</td>
<td>35</td>
<td>14,900</td>
</tr>
<tr>
<td>ME</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>0.105</td>
<td>40</td>
<td>39,895</td>
</tr>
<tr>
<td>EL</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>$\epsilon$</td>
<td>0.195</td>
<td>40</td>
<td>39,805</td>
</tr>
</tbody>
</table>

Some products choose cost driver rates of $\epsilon$ for some of the cost drivers, this means that product uses this cost driver extensively. That means the cost driver is critical for the product – if the department, trying to show itself in the most favorable way, set the corresponding allocation rates to almost zero.
Based on the calculation results obtained using the traditional model of activity-based costing, which are presented in Table 1, the best, that is with highest profit, is the students from the Department of Mechanical Engineering (ME). Subsequently, the best are the students from the Department of Computer Science and Management (IIIZ), students from the Department of Electronics (EL), students from the Department of Architecture (AR) and the worst is the students from the Department of Chemistry (CH).

Comparing the results from Table 1 and Table 2, where the costs were calculated using the method of Data Envelopment Analysis we can see that the worst - the least profitable student is the student students from the Department of Architecture (AR).

In the market, new operators and the existing ones derive new forms of education. They provide more up to date courses and specialties. In addition to fixed-cycle programs colleges also offer engineering degree, undergraduate, graduate in full time or part-time. Changing market conditions in higher education mean that they now face the task of competing for students, research projects with universities in Europe and the world, and for the teachers. In the case of universities, to seek the relationship between the cost of doing business and their funding mechanisms, and mechanisms of governance and accountability of the effects of its activities is extremely difficult. The problem of accounting for costs of institutional activity occurs not only in Poland but in many countries. Often there are difficulties due to the limited autonomy of universities in conducting financial management. In some cases the problem may be an accounting system, inappropriate, inadequate actions or lack thereof.

Whatever the difficulties occurring in different countries in accounting for the cost of higher education are, actions are taken to improve existing solutions, to introduce new ones. Colleges and universities are aware of the fact that changes in the financial system will lead to more effective management than ever before. In addition, a new way of costs accounting with greater precision and accuracy make that research funding agencies, through the accrued image of costs, may be inclined to look more favorably on the actions taken by the university and will cooperate with them.

Basic knowledge for the management of organizations should contain the size of their costs and the information about processes in the course of which the cost arises. Information provided by traditional cost models, i.e. the full cost accounting and cost accounting variables are not always adequate to the needs of decision-making process. Managers aware of this fact express a deep conviction about the need to implement such cost models, which will provide complete and accurate information. Currently, the management for institution of higher education is not possible without establishing a competitive range of courses, and its creation is not possible without information about the cost of teaching from the specificity of individual institutions, departments, faculties, curricula. Knowledge of the costs of education bachelor, master, engineer, doctoral student becomes important. Equally important is the knowledge of the cost of courses given in the course of study to demonstrate differences in the cost of various forms of teaching such as lectures, classes, seminars, laboratories and others. The cost of training the student should take into account all the ways through his/her education, starting with the recruitment and ending at the end of education.
Application of activity-based costing for higher education will allow to obtain information such as (Kuchta, Bojnowska, Parkitna, 2010):

- the total cost of the educational process,
- the cost of training the student depending on the individual departments, faculties, specialties, and over time (years, semesters),
- the cost of different forms of education such as lectures, exercises, seminar, laboratory,
- the total cost of implementing educational program,
- calculation of costs used for teaching space,
- the level of unused space teaching,
- the level of unused capacity of teaching staff,
- the cost of research, which is extremely important in the case of grants for these studies,
- cost of services rendered to the industry.

Application of activity based costing in higher education can be helpful in planning the budget, and effectively promoting the process of managing it. Information obtained here can be used in the analysis of variations occurring between plan and reality. Activity based costing contributes to a better understanding of how the service works, because it provides information on the location and cost reasons. However, the implementation of this method may be linked to some difficulties, among others:

- a diversion of courses,
- high complexity of certain activities related to the learning process,
- complicated rules for assigning certain costs to separate actions.

Implementation of activity based costing in universities requires not only changes in the calculation procedure used so far, but also changes in the organization of these units. Activation of the ABC requires collecting and processing vast amounts of data. The entire procedure is time consuming and extremely complicated. Moreover, the process of data collection is cost consuming, because it constantly needs to be updated. In connection with the implementation of new cost accounting system, people responsible for the implementation may encounter resistance from employees, which can lead to a slowdown of work. Resistance to change has a source in, inter alia, the tendency to fear of novelty, lack of knowledge of principles, a reluctance to learn, dislike of the person responsible for the changes made, so it's important to raise awareness of the need for change. Among the problems associated with the introduction of the ABC model in particular, talking about the need to adapt the accounting system, the use of additional activities for measurement, analysis is especially important. All these changes are associated with costs.

Despite the disadvantages of activity based costing, the model generates more reliable, accurate information in relation to traditional models of cost accounting. Activity based costing reflects the structure of costs incurred by operators to a higher degree than traditional models. It provides not only information about the type and amount of resources used, but also allows to investigate factors affecting them. The calculation is based on actions, and inter alia, allows for more accurate determination of the cost of services provided. Modernization of activity based costing methods involving the use of data envelopment analysis to determine allocation rates deserves attention because it eliminates some disadvantages of standard methods of activity based costing and the difficulties in choosing a
suitable cost drivers rate. Both the activity based costing and the method of data envelopment analysis are effective tools not only supporting the management, but also the costs measuring.

5. Conclusions

The functioning of higher education in a changing environment forces us to seek new solutions for cost accounting and cost reduction. Model of activity based costing proposed here will provide information on the type and amount of resources used. It will also enable an analysis of activities performed by the university and cost objects generated by universities, making it possible to eliminate the inefficient ones. But what is most important, it will allow for a more accurate determination of the cost of services provided. The combination of the methods Activity Based Costing and Data Envelopment Analysis deserves attention because it allows a wider and more correct use of the ABC at universities by eliminating the drawbacks of the standard ABC approach.

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Internet Financial Reporting: Environmental Impact
Companies and other Determinants

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Abstract

The purpose of this study is to examine whether intensive environmental impact companies provide a higher level of Internet Financial Reporting (IFR) and if this fact is supported by the legitimacy theory. A check for other determinants which influence the financial disclosures on companies websites is also performed.

The global environmental concerns and the conscientiousness responsibility of intensive environmental impact companies, lead to the disclosure of more environmental information. It is important to verify if those types of companies also disclosure more IFR to justify their environmental impacts, but also to satisfy the expectations of the stakeholders and legitimate the openness and transparency of the financial information.

The evolution of communications and the development of the global market created new financial opportunities in the world. The internet became a user-friendly resource for the disclosure of companies. It is possible, at the same time, to reach users wherever they are, and they can access the financial and not-financial information anytime. The cost and benefits of internet disclosure are important to companies. With the internet disclosure, companies can develop a more efficient information strategy to the stakeholders, which need useful and timely information for making their decisions.

The present empirical work relies on websites of companies listed in the London Stock Exchange belonging to the FTSE 350. The characteristics of companies websites contents is checked using the univariate analysis. The significant determinants of the IFR disclosure are verified using the multivariate analysis.

In the univariate analysis, the contents of companies websites are conferred with a checklist of 12 points subdivided by four characteristics: first page, investor relation, annual report and other information. The results showed the importance of investor relations and the download of annual report.

The multivariate analysis is based on a set of hypotheses relating the extent of Internet Financial Reporting with several variables. The main hypothesis is supported on the legitimacy theory and verifies if the intensive environmental impact companies disclosure more IFR. A set of alternative hypotheses is based on the literature concerning voluntary disclosure of financial information. These hypotheses are used to find other determinants of the Internet Financial Reporting. The findings show that companies with a significant environmental impact are more likely to be disclosed in their websites. The results also
provide empirical evidence supporting the importance of the company size in the
determinants of internet financial report. However, it was found a negative relationship
between the IFR and the leverage and ownership concentration. No significant relationship
was found between IFR, profitability and the auditor (BIG 4).

**Keywords:** Internet Financial Reporting (IFR), Disclosure, Investor Relations, Legitimacy
Theory.

1. Introduction

Not only the global environmental concerns and the conscientiousness responsibility
of companies but also the pressures from investors or others stakeholder to more
transparency in the financial information, may press on greater IFR disclosure.

In this study were considerate two types of environmental impacts: (1) the air impact
– the “ozone pollution intensive” companies and (2) the land impact - the depletion of
natural resources, i.e. the mining and extractive industries.

Some studies consider that environmental impact companies are more likely to
environmental disclosure than other industries. The contribution of this research is to
investigate if those type of companies also disclosure more Internet Financial
Information. This study will also check for other determinants of IFR, normally
significant in several studies.

The evolution of communications and the development of the global market created
new financial opportunities in the world. The internet became a user-friendly resource
for the disclosure of companies. It is possible, at the same time, to reach users
wherever they are, and they can access the information all the time.

The internet is an excellent means to disclose financial and non-financial information.
However, not all companies use the internet report in the same way. To the
companies the cost and benefits of internet disclosure are important to develop a
more efficient information strategy to the stakeholders which need useful and timely
information for making their decisions.

Several studies considered different determinants of internet financial reporting, but
the most referred is the company size. In other words, the largest companies have
more propensity to IFR disclosure.

Using the listed companies in FTSE-350 of the London Stock Exchange the
characteristics of disclosure in these websites will be analysed through a checklist.

Multivariate results are expected to indicate that those industries that have
environmental impact are more likely to disclosure in their websites, and this is
supposed to justify their responsibility and also legitimate the openness and
transparency of the financial information.
As far as other determinants of IFR are concerned, a positive influence on company size, profitability and auditing by a Big 4 is expected; on the other hand, a negative impact on leverage and percent of ownership concentration is expected.

This study is structured in sections as follows. The next section is the review of prior research of legitimacy theory and internet financial reporting and their determinants. Section 3 presents the hypothesis and its theoretical justification. The research design includes the justifications of dependent and independent variables; the sample and the research model, compose the section 4. Section 5 has the results, the descriptive statistics and the univariate and multivariate analysis. The conclusions are presented in section 6.

2. Prior Research

2.1. Legitimacy theory

The legitimacy theory has been widely discussed, and some authors have defined it. (Suchman, 1995:574) has examined several definitions of legitimacy since 1960 and adopted this: “Legitimacy is a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions”.

Those external perceptions about companies could be used by the management of corporate disclosure policies (Deegan, 2002). Then the companies could have a strategic legitimacy and choose and change their legitimacy status and consequently the external perceptions (Aerts and Cormier, 2009).

Normally, the legitimacy theory is used to explain social and environmental reports disclosure. But the legitimacy theory can be used in the corporate report, suggested by Woodward et al. (1996), as one possible legitimacy/accountability reporting framework, to communicate with the shareholders and clarify the importance of this relationship. Tsang (2001) has concluded that the organizational legitimacy is a useful concept to explain corporate report behaviour.

Some studies of legitimacy and annual report are for example: Ogden and Clarke (2005) explore how organizations use annual reporting for legitimacy purposes, particularly the privatised regional water in the United Kingdom (U.K.); Lightstone and Driscoll (2008) examine the symbolic management legitimacy in quality information on the voluntary disclosure by Canadian public companies and Samkin and Schneider (2010) investigate the narrative in the annual reporting and legitimacy of a public benefit entity, in New Zealand.

The internet and the companies websites can be considered a framework of financial reporting disclosure and a resource of promotion of the communication to investors or to other stakeholders. Legitimacy is present also in this type of disclosure and some investigations already exist.

Álvarez et al. (2008:617) studied the voluntary and compulsory information disclosed online in Spain, particularly the industry concentration effect. They concluded that concentrated industries would rather disclose voluntary information to “obtain legitimacy and avoid external interferences”.

3
Internet reporting (financial and social disclosure) in microfinance institutions was analysed by Gutiérrez-Nieto et al. (2008) using the legitimacy theory as a theoretical framework. However, the websites of microfinance institutions are scarce, consequently the levels of disclosure too and differ by country development. That information is addressed to donors and financial analysts, and many of them reside in developed countries. The social disclosure is the most important by the nature of these institutions and to establish legitimacy in the perceptions of their donors. Non-governmental organizations disclosure has less financial information than microfinance institutions "apparently forgetting that their donors are also interested in financial data" (Gutiérrez-Nieto et al., 2008:432).

Legitimacy is considered the external perceptions by the society or the stakeholders. In this study those perceptions could be measured by the disclosure companies mainly by the IFR disclosure.

2.2. Internet Financial Reporting

The internet business users have arisen in the early 90’s and the companies quickly realized their potential. Some authors in the mid 90’s already referred the usage of the internet to disseminate financial information and sometimes specify the annual and quarterly report (e.g. Petravick and Gillett, 1996; Louwers et al., 1996; Koreto, 1997; Booker et al., 1997).

Computer technology and the internet modify the flow of information, the disclosure of corporate financial data to the different users. Then, it is possible to disseminate information to the shareholders and they can be heterogeneous decision makers (Ashbaugh et al., 1999). The internet financial reporting has a more considerable incremental disclosure than the traditional financial reporting (Trabelsi et al., 2004). Then it is not possible to continue to treat the internet and current (physical) ways of corporate reporting like identical distribution channels of disclosure (Lymer, 1999).

The dissemination of accounting information on internet differs from a traditional financial reporting. Williams and Ho Wern Pei (1999) summarized some advantages of internet reporting: information available 24 hours a day, in multiple languages, ability to establish one-to-one relationship with the stakeholders, more speed and interactive communication, flexibility to move the site to another location, lower cost of information dissemination, small companies could have international contacts, could have interactive graphic and audio. And they conclude that “the companies can now address international needs, there is a potential incentive for greater harmonization of accounting disclosure practices”, (Williams and Ho Wern Pei, 1999:394).

Almost all companies present financial information in their websites, and use the technologies for their benefit; with webcast or e-mail alerts they reach the investors (Allam and Lymer, 2003). The internet was used as a resourceful and low-cost distribution of financial corporate information, but it could make innovation possible in reporting practices, using for example dynamic graphics, dynamic updates, downloads or hyperlinks (Hedlin, 1999). The new opportunities to disclosure in the internet financial report and the change of the information make it necessary to
analyze the user information demands and nonlinear consequences of the capital market (Wagenhofer, 2003).

One of the characteristics of corporation websites is the link “investor relation” or “information for investors”. This link normally gives access to accounting reports, stock information, earnings announcement, webcasts and other information of possible interest to the shareholders (Pendley and Rai, 2009).

Deller et al. (1999) consider that investor relations via internet offer a variety of possibilities. The investor relations information disclosures on companies websites is increasing and has achieved great importance. The obligation to register in order to access the site or some information could be helpful to indentify a profile demand. Other companies disclose the annual report in separate parts to analyse the specific sections that are generally requested. The future investor relations function is useful to define the strategy and the investment of website disclosure (Rowbottom et al., 2005). The profile of financial users is characterised by investors, creditors, accounting companies and lawyers requesting considerably more the annual report than the sustainability report or other website information (Rowbottom and Lymer, 2009).

The internet is a mechanism of communication of corporate financial reporting, but the investor relations dialogue remains asymmetrical in this additional medium, and does not have radical changes on its nature (Gowthorpe, 2004). The symmetrical relation investor-company on the internet was tested by Hassink et al. (2007), by the e-mail of the investor relations; but this appears relatively low, then the conclusion is similar to Gowthorpe’s (2004) - the emphasis is on the asymmetrical relation of the company as the information disseminator.

The need for rules to the disclosure on the internet was noticed by the regulatory authorities. Was prepared for the International Accounting Standards Committee (IASC) by Lymer et al. (1999), the document "Business Report on the Internet“ were analysed the internet reporting in 22 countries. And in the year 2000 the FASB1 published the “Electronic Distribution of Business Reporting Information“.

To Xiao et al. (2002) and Lymer and Debreceny (2003) the internet is a rapid resource to corporate report distribution, then the professional auditing, accounting and regulators denote the importance of regulation. The internet is a potential discloser to a better and more useful financial reporting, but this disclosure is diverse (scope, quality, completeness and timeliness) and could be a problem for those who use this information. Khan (2007) suggests some recommendations to improve online financial reporting based on qualitative characteristics2 formulated by the IASB3 and considering different viewpoints: users, regulators and others. These recommendations intend to benefit the process for the different decision makers. To Brown (2007:42), it is necessary to join “the multinational corporations, the elite stock exchanges, the Big Four Accounting groups, the accounting standards boards, the accounting professional organizations and the universities” to the digital participatory emancipation process to define online reporting representatives from all countries.

1 FASB - Financial Accounting Standard Board.
2 Reliability, understandability, completeness, timeliness and verifiability of information.
3 IASB - International Accounting Standards Board
The auditing profession had to adapt to a new way of disclosure of financial information (internet), so it wants to build public trust, foster a culture of integrity, transparency, credibility and accountability in the internet financial report. And in this way, encourage the users’ protection and the quality of internet financial reporting (Khadaroo, 2005).

To the European stock market, the European Commission Directive 2003/6/EC, recommends the dissemination of inside information to the public, as soon as possible, but also recommends publishing the information that they are required to disclose publicly in the website.

In particular, the London Stock Exchange in the “Admission and disclosure standards” contemplates the directive mentioned previously, also called “Market Abuse directive”, and have a specific document - the “Investor relation – a practical guide” - which defines the guidelines for the contents and structure of the investor relations website, as well as some good practices. Only to the AIM (Alternative Investment Market) companies, the rule 26 of “AIM rules” states the obligation to maintain a website with certain information free available. Then we consider analysing inside the voluntary disclosure in the companies’ websites.

2.3. Determinants of Internet Financial Reporting

The contents and determinants of corporate report, still not associated to the internet, have been widely studied (e.g. Lang and Lundholm, 1993; Lang and Lundholm, 1996; Raffournier, 1995; Meek et al., 1995; Patton and Zelenka, 1997; Chow and Wong-Boren, 1987; Botosan, 1997; Botosan and Plumlee, 2002). Some of them used the cost of capital in these analyses and several find as significant determinant the company size.

Oyelere et al. (2003:29) analysed studies in different countries and concluded that the most identified determinants of financial reporting are: “corporate size, size of company’s auditors (e.g., Big 8/6/5 vs. non-Big 8/6/5), listing status, profitability, leverage, and industry”. But there are more determinants with significant influence, like: foreign parent, country, ownership structure and liquidity, for example (Oyelere et al., 2003: table 1).

These studies are quiet varied. Some only analyse one country, others various, the table of contents is sorted in different categories and different items to survey the extent of IFR. To analyse the determinants of IFR, the authors are testing several independents variables, but the most significant is company size. Also noted others determinants of IFR as: ownership structure, auditing by a Big 4, industrial sector or leverage. The table 1 shows the summary of studies of determinants of IFR disclosure.
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<th>Survey</th>
<th>Results</th>
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<tbody>
<tr>
<td>Ashbaugh et al. (1999)</td>
<td>U.S.</td>
<td>290 AIMR (Association for Investment Management and Research), (253 with website)</td>
<td>Existence of website and extent of internet corporate report</td>
<td>Company size (assets) (+), profitability (ROA) (+) and AIMR rating (+)</td>
</tr>
<tr>
<td>Gowthorpe and Amat (1999)</td>
<td>Spain</td>
<td>379 listed companies (70 with website and only 34 with accounting information)</td>
<td>Existence of website and extent of website</td>
<td>Electricity and gas industry (+) and banking (+), but only to existence of website</td>
</tr>
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<td>Pirchegger and Wagenhofer (1999)</td>
<td>2 countries: Austria and Germany</td>
<td>Austria (1997-26 and 1998-20) and Germany (1998-30)</td>
<td>Extent of financial information on the internet</td>
<td>Company size (+). Only to Austria: percentage of free float (+)</td>
</tr>
<tr>
<td>Ettredge et al. (2001)</td>
<td>U.S.</td>
<td>490 companies (402 with website)</td>
<td>Information disclosure for investors at corporate website</td>
<td>Company size (+), Industry group: petroleum (+) and home building (-)</td>
</tr>
<tr>
<td>Bonsón and Escobar (2002)</td>
<td>15 countries of E.U.: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherland, Portugal, Spain, U.K. and Sweden</td>
<td>300 biggest companies EU (20 companies x 15 countries)</td>
<td>Disclosure index (Transparency index)</td>
<td>Company size (+), industrial sector: resources - mining and oil &amp; gas (+) and country: north and central Europe (+)</td>
</tr>
<tr>
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<tr>
<td>Debreceny et al.</td>
<td>22 countries: Malaysia, Mexico, Brazil, Chile, Italy, Spain, France, Germany, Japan, Netherlands, South Korea, Hong Kong, Singapore, South Africa, Sweden, Denmark, Norway, Australia, Canada, New Zealand, U.S. and U.K.</td>
<td>660 companies: 30 x 22 countries (sorted by market capitalization and listed in the Dow Jones Global Index)</td>
<td>Determinants of IFR</td>
<td>Presentation and Content: Size (+) and U.S. listed (+). Only Presentation: level of technology employed (+), environment disclose (+) and foreign list (-). Only content: growth prospects and intangibles (-)</td>
</tr>
<tr>
<td>Ettredge et al.</td>
<td>U.S.</td>
<td>220 AIMR companies (193 with website)</td>
<td>Information disclosure for investors at corporate website</td>
<td>Required and Voluntary: size (+), correlation between earnings and returns (-). Only Voluntary: Equity capital (+) Quality (AIMR measure)</td>
</tr>
<tr>
<td>Larrán and Giner</td>
<td>Spain</td>
<td>144 Madrid Stock Exchange (107 with website)</td>
<td>Disclosure index</td>
<td>Company size (+) (quality and quantity of financial information)</td>
</tr>
<tr>
<td>Lybaert (2002)</td>
<td>Netherlands</td>
<td>188 Listed companies on the Amsterdam Stock Exchange</td>
<td>Existence of website and extent of website</td>
<td>Company size (+) but only to existence of website</td>
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<tr>
<td>Patten (2002)</td>
<td>U.S.</td>
<td>Initial 250 top companies (40 property and casualty insurance - 20 web innovator and 20 matched company)</td>
<td>Financial disclosure and social disclosure</td>
<td>Financial disclosure: company type - publicly traded (+) Social disclosure: Size (+)</td>
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<td>Allam and Lymer (2003)</td>
<td>5 countries: U.S., U.K., Canada, Australia and Hong Kong.</td>
<td>250 companies (50 largest in advanced capital markets X 5 countries)</td>
<td>Extent of IFR</td>
<td>Company size (+) but only in Australia</td>
</tr>
<tr>
<td>Marston (2003)</td>
<td>Japan</td>
<td>99 leading Japanese companies</td>
<td>Existence of website, English website and extent of website</td>
<td>Company size (+) and Industry sector (+) but only to existence of website</td>
</tr>
<tr>
<td>Oyelere et al. (2003)</td>
<td>New Zealand</td>
<td>229 listed companies (123 with website)</td>
<td>Internet financial reporting</td>
<td>Company size (+), liquidity (+), primary industry sector (+) and the ownership spread (+)</td>
</tr>
<tr>
<td>Marston and Polei (2004)</td>
<td>Germany</td>
<td>50 companies (top quartile and bottom quartile of DAX 100)</td>
<td>Extent and information presentation in corporate websites 2000 and 2003</td>
<td>Company size (+) (in 2000 and 2003), the free float (+) (only in 2000) and foreign listing (+) (only in 2003)</td>
</tr>
<tr>
<td>Xiao et al. (2004)</td>
<td>China</td>
<td>300 largest listed companies (sorted by total assets) (203 with website)</td>
<td>Internet-based corporate disclosures</td>
<td>Company size (+) information technology industry (+), legal person ownership (+), leverage (+) and state share ownership (-)</td>
</tr>
<tr>
<td>Debreceny and Rahman (2005)</td>
<td>8 countries: Denmark, Finland, France, Germany, Hong Kong, Norway, Singapore, and U.K.</td>
<td>333 listed companies (Denmark-13, Finland-20, France-54, Germany-46, Hong Kong-42, Norway-16, Singapore-22, and U.K.-120)</td>
<td>Frequency of online reporting</td>
<td>short-windows result: measures of asymmetry (+), earnings flag (profit vs loss) (+) and company’s analyst following (+)</td>
</tr>
<tr>
<td>Laswad et al. (2005)</td>
<td>New Zealand</td>
<td>86 local authorities (61 with website and 30 with financial information)</td>
<td>IFR</td>
<td>Press visibility (+) alternative interpretation: financial leverage (+), municipal wealth (+), and council type - district councils (-)</td>
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<tbody>
<tr>
<td>Bollen et al. (2006)</td>
<td>6 countries: Australia, Belgium, France, Netherlands, South Africa and U.K.</td>
<td>270 listed companies: Australia (40), Belgium (50), France (50), the Netherlands (50), South Africa (40) and the U.K. (40)</td>
<td>Quality index for investor relations websites</td>
<td>Company size (+), level of internationalization (foreign listing and foreign revenue) (+), proportion of shares available to individual investors (+) and disclosure environment (+)</td>
</tr>
<tr>
<td>Bonsón and Escobar (2006)</td>
<td>13 countries of Eastern Europe recently in the UE or in process of joining: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia and Turkey</td>
<td>266 companies: Bulgaria-5, Cyprus-16, Czech Republic-13, Estonia-5, Hungary-13, Latvia-6, Lithuania-14, Malta-3, Poland-74, Romania-23, Slovakia-15, Slovenia-8 and Turkey-71</td>
<td>Disclosure index</td>
<td>Company size (+), been audited for the Big four (+) and if they are in the financial sector (+)</td>
</tr>
<tr>
<td>Momany and Al-Shorman (2006)</td>
<td>Jordan</td>
<td>60 companies listed on the first market on Amman Stock Exchange (27 with website, 19 financial information)</td>
<td>Internet financial information vs not internet financial information</td>
<td>Financial information: Company size (+), leverage (+), concentrated ownership (+), international investors (+), and recent (+)</td>
</tr>
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<tr>
<td>Pervan (2006)</td>
<td>Croatian and Slovene</td>
<td>85 Listed companies: Croatian-55 and Slovene-30 (transactions valued at minimum of 300,000 €)</td>
<td>IFR</td>
<td>Croatian: size (+), profitability (+), number of shareholders (+), amount of traffic on the stock markets (+), majority foreign ownership (+) and sectors (tourism (-) and marine transport (-)). Slovene: official listing (+), proportion of market capitalization (+), ratio of market to book values of shares (+) and sector (transport (-))</td>
</tr>
<tr>
<td>Abdelsalam et al. (2007)</td>
<td>U.K.</td>
<td>110 London listed companies (top quartile sorted by market capitalization)</td>
<td>Corporate Internet Reporting (CIR) Comprehensiveness</td>
<td>analyst following (+), director holding (-), director independence (+)</td>
</tr>
<tr>
<td>Serrano-Cinca et al. (2007)</td>
<td>Spain</td>
<td>70 financial institutions</td>
<td>Internet disclosure by banks</td>
<td>Company size (+), financial performance (+) and internet visibility (+) (high levels of scores disclosure they call e-transparency)</td>
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<tr>
<td>Gandía (2008)</td>
<td>Spain</td>
<td>98 non-financial companies quoted on the continuous Spanish market</td>
<td>Corporate governance disclose index</td>
<td>determinants are different by model but the most common are the analysed following (+), listing age (-) and belong to the communication/information services sector (+-)</td>
</tr>
<tr>
<td>Kelton and Yang (2008)</td>
<td>U.S.</td>
<td>284 listed companies</td>
<td>IFR</td>
<td>Corporate governance (+), block ownership (-), director independence (-), financial experts on audit committee (-), number of audit committee meeting (+), Big 4 (+) and company size (+)</td>
</tr>
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### Author Countries Sample Survey Results

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<tbody>
<tr>
<td>Trabelsi et.al. (2008)</td>
<td>Canada</td>
<td>108 listed companies on the Toronto Stock Exchange</td>
<td>Additional IFR disclosure</td>
<td>share turnover (+), research and development expenditure (+), performance (+), profitability (-), size (+) and degree of information asymmetry (+)</td>
</tr>
<tr>
<td>Cormier et al. (2009)</td>
<td>Canada</td>
<td>300 index (final sample 189 companies)</td>
<td>Web-based performance disclosure</td>
<td>Leverage (-) Beta (systematic risk) (+), access a capital markets (+) short term customer relations (-), concentration ratio (-), capital investment intensity (+), Media exposure (+), market-to-book ratios (+), Registered with the SEC (+), number of employees (+)</td>
</tr>
<tr>
<td>Homayoun and Rahman (2010)</td>
<td>Malaysia</td>
<td>100 top companies listed on Bursa Malaysia (Market capitalization)</td>
<td>CIR - Corporate Internet Reporting</td>
<td>Profitability - ROE (+), Board size (+)</td>
</tr>
</tbody>
</table>

There also some other studies to research determinants in the disclosures in the companies’ websites, as García-Borbolla et al. (2005), specifically in the small and medium enterprises (SME’s) found significant relationships between possesses website and size, sector (services), manager’s education and training, technological tradition and previous contact via the internet.

The determinants of the timelines of corporate internet reporting (CIR) are analysed by several studies. Abdelsalam and Street (2007), associated to corporate governance for U.K. listed companies. The CIR timeliness has negative association to the board independence, board experience (in terms of cross-directorship and length of service for executive directors) but has a positive association with board experience in terms of age directors, positive relation with the audit fees paid and number of analysts. To the Irish listed companies Abdelsalam and El-Masry (2008) show the evidence that board composition, ownership structure and the companies’ size influence the timeliness of corporate internet reporting. But to the Egyptian listed companies, Ezat and El-Masry (2008) found the following significant positive determinants: company size, liquidity, ownership structure, service activity type, board composition and board size.
There are different studies of disclosure on the internet, but we propose in this study to analyse the determinants of IFR, particularly for the intensive environmental impact companies, and other explanatory variables.

3. Research Methodology

3.1. Hypothesis

3.1.1. Environmental Impact Companies

The different types of industry and the IFR disclosure have been analysed by several authors, but not all found a positive association between them, like Craven and Marston (1999). Meek et al. (1995), to the voluntary traditional annual report disclosure, the group of oil, chemical and mining provides more information than the others. In Gowthorpe and Amat (1999) opinion, the electricity and gas industry and the banking sector have the highest aptitude to disclosure on the internet, However Oyelere et al. (2003) concluded that it is the primary industry group (oil and gas, and forestry industries). The division in the different sectors depends on the data used, therefore this comparison becomes more difficult.

Comparatively to environmental disclosure, Dierkes and Preston (1977) cited by De Villiers and Van Staden (2006) consider that the modified environmental companies are more likely to environmental disclosure than the other industries. Campbell (2003; 2004) analysed the 10 U.K. companies and concluded that there are two sectors that have more environmental disclosure: (1) petrochemicals and (2) chemicals and intermediates. De Villiers and Van Staden (2006) analysed the environmental disclosure in South Africa and found that mining industries are more likely to disclose this type of information than the Top-100 industrial industries. Cho and Roberts (2010) set “environmental sensitive industries” by primary SIC\textsuperscript{4} code of 10/14 (mining), 13 (oil extraction), 26 (paper), 28 (chemical, except pharmaceutical, code 283), 29 (petroleum), and 33 (metals), but didn’t find a significant correlation to the environmental disclosure on the internet, however found to the American 100 toxic companies.

These studies demonstrate that there is more environmental disclosure in the environmental impact companies, in some cases justified by the legitimacy theory. In this research it will be tested if that type of companies has additional disclosure in the IFR.

Whereas companies with environmental impacts provide more financial information on the internet for their stakeholders, we analyse the industries that are considered to have a intensive environmental impact.

In this study we consider two environmental impact industries: (1) air and (2) land.

The first are the industries with “ozone pollution intensive” (Greenstone, 2002; List et al., 2004). They are considered in the Standard Industrial Classification (SIC) codes: 2611-31 (pulp and paper mills), 2711-89 (printing and binding), 2812-19 (industrial inorganic chemicals), 2861-69 (industrial organic chemicals), 2911 (petroleum

\textsuperscript{4} SIC - Standard Industrial Classification
refining), 30 (rubber and misc. plastics), 32 (stone, clay, and glass), 3312-3 (steel and electrometallurgical products), 3321-5 (iron and steel foundries), 34 (fabricated metal products), and 371 (motor vehicles and equipment). These industries are considered “ozone pollution intensive” because “they emit at least 6% of the total industrial sector’s emissions of nitrogen oxide or volatile organic compounds, the primary chemical precursors to ozone” (List et al., 2004: 308).

In the second group, we consider the environmental land impact, i.e. the depletion of natural resources, the mining and extractive industries, which by SIC Codes are 10/12/14 (mining) and 13 (extractive).

Is expected in this study to find a positive association between environmental impact industries (air and land pollution) and IFR disclosure, consequently the first hypothesis is:

\[ H_1: \text{There is a positive association between environmental impact industries and IFR disclosure.} \]

Split in two hypotheses to specify the different types of environment impact:

\[ H_{1a}: \text{There is a positive association between air impact environmental industries and IFR disclosure.} \]

\[ H_{1b}: \text{There is a positive association between land impact environmental industries and IFR disclosure.} \]

3.1.2. Other Variables

Company Size

The company size is the most common determinant to explain IFR. Several authors found a positive association between the size and the internet disclosure (e.g. Craven and Marston, 1999; Pirchegger and Wagenhofer, 1999; Debreceny et al., 2002; Bonsón and Escobar, 2002; Larrán and Giner, 2002; Geerlings et al., 2003; Oyelere et al., 2003; Marston and Polei, 2004; Xiao et al., 2004; Pervan, 2006; Bollen et al., 2006; Kelton and Yang, 2008).

The large companies have more incentives to disclosure on the internet, have more visibility and so draw bigger attention from the general public, government, shareholders, other stakeholders or even the competition. The cost and benefits to the large companies are more easily managed because they have more users and it’s easier to communicate by internet. The large companies have further resources to have a more efficient internet information strategy and have additional disclosure on the internet. Therefore, it is expected the large companies to have additional propensity to IFR disclosure, and the second hypothesis is:

\[ H_2: \text{There is a positive association between company size and IFR disclosure.} \]

\[ H_{2a}: \text{There is a positive association between air impact environmental industries and IFR disclosure.} \]

\[ H_{2b}: \text{There is a positive association between land impact environmental industries and IFR disclosure.} \]

3.1.2. Other Variables

To the water pollution is not possible constructed one variable, because the SIC codes repeat by air and land pollution, (water pollution SIC codes available in Wiemhoff, (1999).
Profitability

The profitability is one of the significant determinants of financial reporting disclosure in the compilation of studies by Oyelere et al. (2003) and Pervan (2006) found a positive correlation, too.

Companies with high levels of profitability improved influence in investor decision and have more interesting stakeholders, so there is a higher propensity to IFR disclosure. It is expected a positive association between profitability and disclosure in the IFR, then we show the following hypothesis:

H₃: There is a positive association between profitability and IFR disclosure.

Leverage

To Xiao et al. (2004) the leverage has a positive association with the corporate disclosure, but there could be a negative association, even though leverage can be considered a measure of performance disclosure determinants (Cormier et al., 2009).

Leverage is the amount of debt used to finance a company's assets. Companies with high levels of leverage have more financial costs, and the suppliers of capital (e.g. debtholders) are concerned with their interest in the financial information. A negative relationship is expected between leverage and disclosure of IFR, and has the hypothesis:

H₄: There is a negative association between leverage and IFR disclosure.

Ownership Concentration

Abdelsalam et al. (2007), divided the ownership concentration in (1) percent of stock held by major shareholders (2) percent of stock held by directors, and only in the second did they find a negative association to the corporate internet reporting. But in the other study Ashbaugh et al. (1999) used the percentage of equity shares held by individual investors, but only in the retail industry has a significant influence to the IFR. Pervan (2006) founded correlation between voluntary IFR and number of shareholders and Chang et al. (2008) found correlation with the variable “more institutional shareholders”.

In this study the ownership concentration could be represented by the higher value between the percent of stock held by major shareholders or the percent of director interests. The companies have more ownership concentration, have less probable stakeholders, then the IFR disclosure will be to a fewer users. It is expected when the percent of ownership concentration is greater, the disclosure of internet financial reporting is lower, then we have the following hypothesis:

H₅: There is a negative association between ownership concentration and IFR disclosure.
Big 4 Auditor

This variable is not often used but Bonsón and Escobar (2006) and Kelton and Yan (2008) found a positive association of auditor's companies and internet report disclosure.

The auditor’s company cooperate and supervises the financial reporting process, leading to increased disclosure transparency and good reputation to the financial report (Debreceny and Gray, 1999). The companies audited by a Big 4, will be influenced by a stringent standard financial accounting disclosure. It is expected that companies audited by the Big 4 have additional disclosure in IFR, so the sixth hypothesis is:

\[ H_6: \text{There is a positive association between the companies auditing by the “Big 4” and IFR disclosure.} \]

3.2. Research Design

3.2.1. Dependent variable

The dependent variable is directly observed by visiting and exploring the corporate website. A checklist of characteristics was employed by other authors to analyse the disclosure companies websites (e.g. Pirchegger and Wagenhofer, 1999; Ettredge et al., 2002; Allam and Lymer, 2003; Geerlings et al., 2003; Lymer and Debreceny, 2003; Marston and Polei, 2004; Xiao et al., 2004; Bonsón and Escobar, 2006; Bollen et al., 2006).

The extent of companies website was collected from the checklist of characteristics, prepared own self, but based on others extent internet financial information studies.

In this case the sample is composed by the listed companies using the IASB normative, so is not necessary to check the financial statements contained in the IAS 1\(^6\), consequently the list of characteristic is more simplified.

The companies websites have continuous evolution, so the data collection was done in the shortest time possible, from February to June of 2010.

The characteristics of internet financial report disclosure and their scoring are defined in table 2, and they are classified in four categories:

- Information on the first page of the corporate website (IFR-1P).
- Investor relations on the internet (IFR-IR).
- Annual report on the internet (IFR-AR).
- Other information on the internet (IFR-OI).

The sum of these four categories is the internet financial reporting disclosure in the FTSE-350 (IFR-FTSE), equation 1:

\[ \text{IFR-FTSE} = \text{IFR-1P} + \text{IFR-IR} + \text{IFR-AR} + \text{IFR-OI} \]  

\(^6\) IAS 1 – International Accounting Standard 1 – Presentation of Financial Statements.
Table 2 – Dependent variable definition and measurement

First page

| Link to "Investor Relations" or "Investor" or "Shareholder information" in the 1st page | 1 if there is a link to "Investor Relations" or "Investor" or "Shareholder information" in the 1st page, and 0 otherwise |
|______________________________________________________________________________________|
| Latest News in the 1st page | 1 if there is Latest News in the 1st page, and 0 otherwise |
|______________________________________________________________________________________|
| Total of IFR - 1st page (IFR-1P) | The sum of scores of the above 2 characteristics |

Investor relations (Contacts, E-mail alert and FAQ)

| Investor relations Contacts | 1 if there is an investor relations contacts, and 0 otherwise |
|______________________________________________________________________________________|
| Investor E-mail alert (news) | 1 if is possible subscribe a Investor E-mail alert, and 0 otherwise |
|______________________________________________________________________________________|
| Investor FAQ (frequently asked questions) | 1 if there is FAQ, and 0 otherwise |
|______________________________________________________________________________________|
| Total of IFR – Investor relations (IFR-IR) | The sum of scores of the above 3 characteristics |

Annual report

| Download the annual report of the year | 1 if is possible download the annual report of the year, and 0 otherwise |
|______________________________________________________________________________________|
| Download the annual report of the last 3 years | 1 if is possible download the annual report of the last 3 years, and 0 otherwise |
|______________________________________________________________________________________|
| Download the financial statement separately in PDF format | 1 if is possible download the financial statement separately in PDF format, and 0 otherwise |
|______________________________________________________________________________________|
| Download the financial statement separately in Excel format | 1 if is possible download the financial statement separately in Excel format, and 0 otherwise |
|______________________________________________________________________________________|
| Total of IFR – Annual report (IFR-AR) | The sum of scores of the above 4 characteristics |

Other information

| Financial Calendar | 1 if there is a financial calendar available, and 0 otherwise |
|______________________________________________________________________________________|
| Share price information | 1 if there is a share price information available, and 0 otherwise |
|______________________________________________________________________________________|
| 5 Year Summary (Financial ratios, key statistics, or other information presented apart from the annual report) | 1 if there is a 5 year summary, and 0 otherwise |
|______________________________________________________________________________________|
| Total of IFR – Other information (IFR-OI) | The sum of scores of the above 3 characteristics |
|______________________________________________________________________________________|
| IFR-FTSE | IFR-1P + IFR-IR + IFR-AR + IFR-OI |

3.2.2. Independent variables

The independent variables were collected in the Financial Datastream database for the year 2009.

The explanatory variables are associated to the hypotheses in test. To the hypothesis 1 we have two different variables, because we considered one variable to the air environmental impact industries and other to the land environmental impact industries, to the other hypotheses we have only one explanatory variable.
H1 – Environmental impact companies – were considered two types of environmental impact companies: air and land. The division was based in different types of industry of the Standard Industrial Classification (SIC) Codes.

H1a – Air Intensive Polluter Industries (AIPI) - It was constructed a dummy variable for the air intensive polluter industries based on Greenstone (2002) and List et al. (2004): 1 if the company have the following SIC codes 2611-31, 2711-89, 2812-19, 2861-69, 2911, 30, 32, 3312-3, 3321-5, 34, and 371 and 0 otherwise.

H1b – Mining and Extractive Industries (MEI) - To the land environmental impact companies i.e. the mining and extractive industries, it was constructed another dummy variable: 1 if the company have the following SIC codes 10, 12, 13 and 14, and 0 otherwise.

H2 – Company Size (Size) – Several authors are using the company size and this is the most significant explanatory variable. The most utilized measure is the logarithm of market capitalization and it was used in this study too.

H3 – Profitability (PROF) – For this ratio it is normally used the Return of Equity (ROE) or Return on Assets (ROA). In this study we will utilise the ROA as a measure of profitability.

H4 – Leverage (LEV) – The measure used in this study is the common equity to total assets ratio.

H5 – Ownership Concentration (OC) – Percent of the major shareholder, could be represented by director interests or an external individual investor or a company or a company group.

H6 – Big 4 Auditor (B4AUD). – To analyse the auditor a dummy variable was used: 1 if the companies is audited by KPMG or PriceWaterhouseCoopers or Deloitte Touche Tohmatsu or Ernst & Young, and 0 otherwise.

3.2.3. Research Model

To test the hypotheses and estimate the fixed effects we used the research model specified in the following equation:

\[
\text{IFR-FTSE} = \beta_0 + \beta_1 (\text{AIPI}) + \beta_2 (\text{MEI}) + \beta_3 (\text{Size}) + \beta_4 (\text{PROF}) + \beta_5 (\text{LEV}) + \\
\beta_6 (\text{OC}) + \beta_7 (\text{B4AUD}) + \xi
\]

Where:
\[
\beta_0 - \text{Intercept} \\
\text{AIPI} - \text{Air intensive polluter industries} \\
\text{MEI} - \text{Mining and extractive industries} \\
\text{Size} - \text{Company size} \\
\text{PROF} - \text{Profitability} \\
\text{LEV} - \text{Leverage} \\
\text{OC} - \text{Ownership concentration} \\
\text{B4AUD} - \text{Big 4 auditor} \\
\xi - \text{Residual}
\]
3.2.4. Sample and data

The data was collected from listed companies in FTSE-350, using the official website of London Stock Exchange, in February 2010.

From the original sample the companies that don’t employ the IASB/IFRS normative were removed, (using this information in the Financial DataStream and confirmed in the last annual report available in the correspondent corporate website), or don’t have information on Financial DataStream, in the year in analyse (2009). The final sample is constituted 316 valid companies observation. A list of sample companies is available from the authors.

4. Analysis

4.1. Descriptive Statistic

The table 3 contains the descriptive statistics of the dependent and the independent variables.

<table>
<thead>
<tr>
<th>Table 3 – Descriptive statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable</td>
</tr>
<tr>
<td>IFR-FTSE</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Std. Deviation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Std. Deviation</td>
</tr>
<tr>
<td>PROF</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Std. Deviation</td>
</tr>
<tr>
<td>LEV</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Std. Deviation</td>
</tr>
<tr>
<td>OC</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Std. Deviation</td>
</tr>
<tr>
<td>B4AUD</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Audit by a Big 4 : 305 (96,5%)</td>
</tr>
<tr>
<td>Audit by a Big 4: 11 (3,5%)</td>
</tr>
<tr>
<td>AIIPI</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Air intensive polluter industry: 22 (7%)</td>
</tr>
<tr>
<td>Not air intensive polluter industry: 294 (93%)</td>
</tr>
<tr>
<td>MEI</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Mining and extractive industries: 31 (9,8%)</td>
</tr>
<tr>
<td>Not Mining and extractive industries: 285 (90,2%)</td>
</tr>
</tbody>
</table>

Variable definitions
- IFR-FTSE: Proportion of internet financial reporting in FTSE-350
- SIZE: Company size - Natural logarithm of market capitalization
- PROF: Profitability - Return on Assets (ROA)
- LEV: Leverage - Common equity to total assets ratio
- OC: Ownerships concentration - Percent of major shareholder
- B4AUD: 1 if audit by Big 4 and 0 otherwise
- AIIPI: 1 if is air intensive polluter industry and 0 otherwise
- MEI: 1 if is mining and extractive industries and 0 otherwise

---

8 IASB (International Accounting Standards Board) /IFRS (International Financial Reporting Standards).
The variable size, profitability and leverage are absolute continuous variables; the ownership concentration is continuous percentage variable and the others are dummy variables, (independent variables in table 3).

To the continuous variable in the table 3 we calculated the minimum, maximum, mean and standard deviations; to the dummy variables we calculated the percent on the sample.

The characteristic of IRF-FTSE has value range between 2 and 12 range, being 12 the possible maximum value possible and the mean is 8.43, (dependent variable in table 3).

The table 4 shows the extent of IFR by the four characteristics.

**Table 4 – Frequency of characteristics of internet financial reporting**

<table>
<thead>
<tr>
<th>First page</th>
<th>Abs.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link to &quot;Investor Relations&quot; or &quot;Investor&quot; or &quot;Shareholder information&quot; in the 1st page</td>
<td>291</td>
<td>92.1%</td>
</tr>
<tr>
<td>Latest News in the 1st page</td>
<td>243</td>
<td>76.9%</td>
</tr>
<tr>
<td>Total of IFR - 1st page (IFR-1P)</td>
<td>534</td>
<td>84.5%</td>
</tr>
</tbody>
</table>

Investor relations (Contacts, E-mail alert and FAQ)

<table>
<thead>
<tr>
<th>First page</th>
<th>Abs.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investor relations Contacts</td>
<td>250</td>
<td>79.1%</td>
</tr>
<tr>
<td>Investor E-mail alert (news)</td>
<td>217</td>
<td>68.7%</td>
</tr>
<tr>
<td>Investor FAQ (frequently asked questions)</td>
<td>163</td>
<td>51.6%</td>
</tr>
<tr>
<td>Total of IFR – Investor relations (IFR-IR)</td>
<td>630</td>
<td>66.5%</td>
</tr>
</tbody>
</table>

Annual report

<table>
<thead>
<tr>
<th>First page</th>
<th>Abs.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Download the annual report of the year</td>
<td>315</td>
<td>99.7%</td>
</tr>
<tr>
<td>Download the annual report of the last 3 years</td>
<td>296</td>
<td>93.7%</td>
</tr>
<tr>
<td>Download the financial statement separately in PDF format</td>
<td>124</td>
<td>39.2%</td>
</tr>
<tr>
<td>Download the financial statement separately in Excel format</td>
<td>51</td>
<td>16.1%</td>
</tr>
<tr>
<td>Total of IFR – Annual report (IFR-AR)</td>
<td>786</td>
<td>62.2%</td>
</tr>
</tbody>
</table>

Other information

<table>
<thead>
<tr>
<th>First page</th>
<th>Abs.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Calendar</td>
<td>284</td>
<td>89.9%</td>
</tr>
<tr>
<td>Share price information</td>
<td>307</td>
<td>97.2%</td>
</tr>
<tr>
<td>5 Year Summary (Financial ratios, key statistics, or other information presented apart from the annual report)</td>
<td>123</td>
<td>38.9%</td>
</tr>
<tr>
<td>Total of IFR – Other information (IFR-OI)</td>
<td>714</td>
<td>75.3%</td>
</tr>
</tbody>
</table>

**IFR-FTSE**

<table>
<thead>
<tr>
<th>First page</th>
<th>Abs.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFR-FTSE</td>
<td>2,664</td>
<td>70.3%</td>
</tr>
</tbody>
</table>

The most common characteristic of IFR in the FTSE-350 is the download of the annual report of the year (99.7%), but only 16.1% provide the download of the financial statements separately in Excel format. The relationship to the investor tends to be facilitated in 92.1% of the web companies with a link in the first page. And 250 companies have in the website a specific contact to the investors. In this study there are only listed companies, being normal that the share price information adequate importance, has available in 307 company websites (Table 4).
There are other studies in other countries, but let’s compare with Deller et al. (1999) who used the FTSE 100 in U.K., there is an increase in IFR disclosure. Examples of this increase are, companies with homepage (85% - 100%); download the annual report (35% - 99,7%) and Share price information (29% - 97,2%).

Allam and Lymer (2003) and Bollen et al. (2006) have studies of characteristics of IFR and investor in U.K., but the samples are only of the 50 and 40 largest companies, respectively. And Gowthorpe (2004) examines the voluntary reporting on the internet but to the smaller listed U.K. companies.

4.2. Univariate Analyses

The table 5 has the correlations between the independent variables and the IFR-FTSE variable dependent and their respective four categories of the characteristics, namely the IFR - 1st page; IFR - Investor relations; IFR - Annual report and IFR - Other information.

The independent variable leverage shows a significant relationship to the IFR in the FTSE-350, but to the four categories of characteristics. The variable size has a highly correlation, (0,01 level), with the IFR in the FTSE-350 but to the information of investor relations (IFR - Investor relations) and the disclosure of the annual report on the internet (IFR - annual report). It appears that IFR-FTSE is a highly significant relationship, (0,01 level), to the independent variables: air intensive polluter industries, size, leverage and ownership concentration.

Table 5 – Correlations between characteristics of IFR-FTSE and independent variables

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>IFR-FTSE</th>
<th>IFR-1st page</th>
<th>IFR-Investor relation</th>
<th>IFR-Annual report</th>
<th>IFR-Other information</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIPI</td>
<td>0,147**</td>
<td>0,058</td>
<td>0,116</td>
<td>0,135</td>
<td>0,009</td>
</tr>
<tr>
<td>MEI</td>
<td>0,017</td>
<td>0,130*</td>
<td>0,021</td>
<td>-0,003</td>
<td>-0,064</td>
</tr>
<tr>
<td>SIZE</td>
<td>0,353**</td>
<td>0,103</td>
<td>0,270**</td>
<td>0,358**</td>
<td>0,087</td>
</tr>
<tr>
<td>PROF</td>
<td>-0,005</td>
<td>0,030</td>
<td>0,017</td>
<td>-0,032</td>
<td>0,019</td>
</tr>
<tr>
<td>LEV</td>
<td>-0,316**</td>
<td>-0,143*</td>
<td>-0,248**</td>
<td>-0,177**</td>
<td>-0,221**</td>
</tr>
<tr>
<td>OC</td>
<td>-0,220**</td>
<td>-0,104</td>
<td>-0,081</td>
<td>-0,176**</td>
<td>-0,130*</td>
</tr>
<tr>
<td>B4AUD</td>
<td>0,087</td>
<td>0,007</td>
<td>0,065</td>
<td>0,117*</td>
<td>0,020</td>
</tr>
</tbody>
</table>

Spearman correlation.

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

4.3. Multivariate Regression Analyses

In table 6 there are the multivariate regression results using the equation (2), and estimating the coefficients and corresponding t-value.
Table 6 – Multivariate regression results

<table>
<thead>
<tr>
<th>Hypotheses Variable</th>
<th>Coefficient</th>
<th>t-value</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>6.039</td>
<td>5.760</td>
<td>0.000**</td>
</tr>
<tr>
<td>H1a AIPI</td>
<td>0.821</td>
<td>2.305</td>
<td>0.022*</td>
</tr>
<tr>
<td>H1b MEI</td>
<td>0.872</td>
<td>2.652</td>
<td>0.008**</td>
</tr>
<tr>
<td>H2 SIZE</td>
<td>0.260</td>
<td>3.994</td>
<td>0.000**</td>
</tr>
<tr>
<td>H3 PROF</td>
<td>-0.010</td>
<td>-1.045</td>
<td>0.297</td>
</tr>
<tr>
<td>H4 LEV</td>
<td>-0.027</td>
<td>-6.998</td>
<td>0.000**</td>
</tr>
<tr>
<td>H5 OC</td>
<td>-0.025</td>
<td>-3.361</td>
<td>0.001**</td>
</tr>
<tr>
<td>H6 B4AUD</td>
<td>0.191</td>
<td>0.385</td>
<td>0.701</td>
</tr>
</tbody>
</table>

| R²                   | 0.264       |
| Adjusted R²          | 0.247       |
| F value              | 15.784      |
| Sig.                 | 0.000**     |

** Significant at the 0.01 level.
* Significant at the 0.05 level.

The model is significant (0.01 level) and the adjusted R² is 0.247.

The independent variables most significant results (0.01 level) are size (H3), leverage (H4) ownership concentration (H5) and mining and extractive industries (H1b). The other significant results (0.05 level) is air intensive polluter industries (H1a).

**Hypothesis 1** - There is a positive association between environmental impact industries and IFR disclosure. This hypothesis was accepted.

The environmental impact companies have in general a negative society perception, and probably these companies, whose operations have more impact on the environment, tend to disclose more information, in this case IFR. This fact probable is to justify these impacts, but also to legitimate their openness and financial information transparency. That effect it seems consistent with the legitimacy theory.

Split in two hypotheses to specify the different types of environment impact:

**H1a** - There is a positive association between air impact environmental industries and IFR disclosure. This hypothesis was accepted.

Similar of the results of Ettredge et al. (2001) where the sorted accounting means points by industry and the petroleum are the first. Consists too with the results of Meek et al. (1995), but to the traditional annual report, the group of oil, chemical and mining disclose more financial information than the other groups.

**H1b** - There is a positive association between land impact environmental industries and IFR disclosure. This hypothesis was accepted.

Parallel of the results of Oyelere et al. (2003) refer to the primary industry group as determinant of IFR; and the sort accounting means points by industry in the research of Ettredge et al. (2001), the precious metals – mining is the seventh; also the results
of Bonsón and Escobar (2002) the sector “Resources: Mining and Oil & Gas” have the highest internet disclosure mean.

Similar to environmental disclosure (e.g. Campbell, 2003; Campbell, 2004; De Villiers and Van Staden, 2006; Cho and Roberts, 2010) the environmental impact companies are more likely to IFR disclosure.

**Hypothesis 2** – There is a positive association between company size and IFR disclosure. This hypothesis was accepted.

Consistent to other studies, the largest companies have additional disclosure in IFR (e.g. Craven and Marston, 1999; Pirchegger and Wagenhofer, 1999; Debreceny et al., 2002; Bonsón and Escobar, 2002; Larrán and Giner, 2002; Geerlings et al., 2003; Oyelere et al., 2003; Marston and Polei, 2004; Xiao et al., 2004; Pervan, 2006; Bollen et al., 2006; Kelton and Yang, 2008).

The largest companies normally have more and diversified stakeholders, the IFR disclosure is useful to the management cost and benefits for strategy communications.

**Hypothesis 3** – There is a positive association between profitability and IFR disclosure. This hypothesis was rejected.

In the FTSE-350 was not found a significant result for support this hypothesis. Consistent to Xiao et al. (2004), and who used the same measure (ROA) for the profitability, the results are not significant to the voluntary internet-based disclosure. Probably, different companies have divergent composition of the assets and that can be short or long term.

**Hypothesis 4** – There is a negative association between leverage and IFR disclosure. This hypothesis was accepted.

The leverage has a negative and significant association to the IFR disclosure. These indicate that higher levels of leverage consequence in lower IFR disclosure, it is possible that companies who have more financial cost and increase interest for debtholders. Consistent to Cormier et al. (2009) leverage has negative and significant to the corporate websites disclosure.

**Hypothesis 5** – There is a negative association between ownership concentration and IFR disclosure. This hypothesis was accepted.

The ownership concentration has a negative and significant association to the IFR disclosure. Ownership concentration in the FTSE-350 is the percent of stock held by major shareholder or percent of director interests, it shows a higher level of percent of ownership concentration and a lower IFR disclosure. Probably because, if the percent of major shareholder is higher the dispersion of capital is lower, so the disclosure has less potential users. Consistent to Abdelsalam and Street (2007) who find a negative and significance relations to block ownership (number of major shareholders).
Hypothesis 6 – There is a positive association between the companies auditing by the “Big 4” and IFR disclosure. This hypothesis was rejected.

In the FTSE-350 was not found a significant result for support this hypothesis. Consistent to Trabelsi et al. (2008), who didn’t find a significant association with companies audited by one of the Big 4 and incremental voluntary disclosure on corporate websites. This result may be justified by de fact that the sample has only has 3,5% of the companies not auditing by Big 4.

5. Conclusions

This study analyses the characteristics and the determinants of the IFR disclosure, by the listed companies in FTSE-350, London Stock Exchange.

From one checklist of 12 points subdivided by: first page, investor relation, annual report and other information examined in the companies websites extent. We verified the importance of investor relations and the download of annual report in the companies websites.

In the analysis of the determinants of IFR it was considered the intensive environmental impact companies and some of other determinants that are normally tested in such studies.

The multivariate analyses shows that companies having environmental impact are those which disclosure more financial reporting in their websites. This fact is consistent with the legitimacy theory. This fact also tries to justify the impacts and legitimate their openness and transparency of the financial information.

In relation to other determinants, we verified that larger companies disclosure more IFR, but in relation to leverage and ownership concentration we found a negative significant association.

Some limitation should be considered, for example, the 12 points of the characteristics websites could not be enough to define some companies and we only analyse U.K. companies. In future research we can increase the number of characteristics of websites or perform the same type of analyses in order to compare different countries.

References


Accounting Benefits and Satisfaction in an ERP Environment

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Abstract

Over the past decade, organizations all over the world have adopted Enterprise Resource Planning (ERP) systems. There has been little research at a global scale regarding the accounting benefits of adopting enterprise systems. Moreover, there are almost no studies that examine in detail the relation between accounting benefits and ERP user satisfaction. Sutton (2006) addressed the need for empirical research on the impact of ERP in terms of accounting advantages and disadvantages. The principal aim of our study was to investigate the accounting benefits that the adoption of an ERP system by companies in Greece may entail in relation to ERR user satisfaction. This study explored the impact that the ERP system has had on accounting information and practice. This study also examined whether differences exist between accountants and IT professionals concerning how each group assesses ERP accounting benefits and ERP user satisfaction. The participants of this study consisted of 175 accountants and 96 IT professionals from 193 companies in Greece. The empirical evidence confirms a number of accounting benefits derived from ERP systems particularly for accounting process. Furthermore, this research identifies factors related to accounting which affect the level of ERP user satisfaction. Implications of these results for practice and research are provided. The findings of this study will be of value to any companies that are considering the inclusion of their accounting techniques and operations in an ERP system. Furthermore, the results of this study will provide stimulus for consequent research in the field in order to further examine and account for the accounting benefits that can occur from an ERP system implementation and their effect on ERP user satisfaction.

Keywords: ERP, accounting, benefits, accountants, IT professionals, satisfaction, Greece

1. Introduction

A new research topic has been developed concerning the interaction between Enterprise Resource Planning Systems (ERP) and Accounting. There has been little research at a global scale regarding the accounting benefits of adopting ERP, how these benefits are measured by different groups such as managers, accountants, IT personnel, CIOs, etc and the interaction of such accounting benefits with ERP user satisfaction. Sutton (2006) addressed the need for empirical research on the impact of ERPs in terms of accounting advantages. The principal purpose of our study was to investigate the accounting benefits that the adoption of an ERP system by companies in Greece may entail and their
interaction with ERP user satisfaction level. Another objective of the present study was to examine whether differences exist between accountants and IT professionals concerning how each group measures ERP accounting benefits and user satisfaction.

The findings of this study will be of value to any companies that are considering the inclusion of their accounting techniques and operations in an ERP system. Furthermore, the results of this study will provide stimulus for consequent research in the field in order to further examine and account for the accounting benefits that can occur from an ERP system implementation.

The remainder of this paper is organized as follows. In Section 2 the previous research and research questions presented. In Section 3, the methodology analysed. Section 4, the analytical results are reported. Finally, the study concludes with a summary, limitations and further research.

2. Previous research

2.1 ERP and accounting benefits

Information technology (IT) has brought about many changes in recent years. Companies have begun to adopt enterprise resource planning (ERP) systems, which integrate several business procedures/departments while sharing one database (Rom and Rohde, 2006). The emergence of enterprise resource planning systems has signified the beginning of a new era in the business environment, where companies can integrate business processes/applications and respond to real-time information (Stefanou, 2002; Nicolaou, 2003; Spathis, 2006). This has resulted in the replacement of a major number of information systems (IS) by one single ERP system. ERP systems have significantly changed the way business data is collected, stored, disseminated and used. This change in information processing orientation affects the accounting process (Sutton, 2006). Nevertheless, the focus of the relevant literature has been on ERP systems in general and there is limited published scientific evidence on the ERP implementation processes and their effects on accounting in particular (Granlund and Malmi, 2002; Sutton, 2006). Nicolaou and Bhattacharya (2008) pointed out that “firms which implement an ERP system must be conscious of and circumspect enough to realize that ERPs are different from other IT systems. They bring about global changes to firms’ business processes and as such their deployment presents not a finale but the start of post-implementation activities”.

Overall, it seems that there is a positive relationship between ERP implementation and operational efficiencies (Matolscy et al., 2005; Nicolaou and Bhattacharya, 2008).

According to recent studies, the implementation of ERP systems affects the accounting processes and the accountants’ role (Granlund and Malmi, 2002; Scapens and Jazayeri, 2003). Booth et al. (2000) examined to which extent the application of an ERP system can lead to the adoption of new accounting practices by an enterprise. It was found that ERP systems constitute sources of data for new accounting practices and are able to support these practices. More specifically, Rom and Rohde (2006) found that ERP systems seem to be of assistance in terms of the collection of data and the organizational breadth of management accounting. This was further confirmed by Javernpaa (2007), who noted that such systems lead to the adoption of new management accounting
practices and accountants are able to carry out routine activities more effectively, to handle large databases more quickly and to report in a faster and more flexible way. The findings of another study (Hyvonen et al., 2008) which presented the development of a management accounting control system, suggested that IT accounting solutions in general force accountants to not only study the logic of the solution, but also to invent ways of combining accounting and management rationalities. Newman and Westrup (2005) also, using empirical evidence, demonstrated that even though the relationship of accountants and technologies such as ERPs has become increasingly intertwined, accountants continue to use their position to reshape and advance their professional expertise. As a conclusion, we are in the position to argue that ERP systems have impact on the accounting processes and on the accountants’ role.

Spathis and Constantinides (2004) examined the reasons behind enterprises’ decision to replace the traditionally information systems (IS) with completed ERP systems and explored the changes that occur in terms of accountant applications due to the adoption of these systems. The results illustrated that the three most important motives that led to ERP adoption were: increased demand for real-time information, information generation for decision-making and need for integration of applications. The most important benefits for accounting due to ERP implementation were: increased flexibility in information generation, increased integration of accounting applications, improved quality of reports – statement of accounts, improved decisions based on timely and reliable accounting information and reduction of time for closure of annual accounts.

Research that has focused on the benefits derived from ERP adoption has shown that the implementation of these systems is usually followed by improvements of the decision-making process and enterprise integration (Colmenares, 2009). Kelton et al. (2010) noted that information presentation format effects are pervasive and affect the decision making process in various contexts. In the literature there are also additional studies which indicate that ERP systems improve the decision making process in an organization (Spathis, 2006; Spathis and Kanellou, 2007). Other benefits derived from ERP implementation are: more accurate reports - statements of accounts and improved service of accounts in accounting tasks (Velcu, 2007; Colmenares, 2009). Furthermore, Brazel and Dang (2008) pointed out that ERP implementation appears to reduce reporting lags.

O’Leary (2004) tried to analyse and measure ERP system benefits and whether or not they vary across different industries. The benefits list that he used and the classification of benefits in tangible and intangible that he adopted were developed by Deloitte Consulting (1998) study. O’Leary (2004) added some additional benefits on the list. Some benefits under investigation were: inventory reduction, financial close cycle reduction, personnel reduction, management improvements, IT cost reduction, on-time delivery, information/visibility, integration, flexibility, better decisions, financial controls, new reports - reporting capability.

In a study by Shang and Seddon (2002), a comprehensive framework for assessing the benefits derived from ERP systems is proposed. This framework tries to classify ERP benefits into five dimensions: operational, managerial, strategic, IT infrastructure and organizational. Esteves (2009) based on this classification in order to develop a benefits realization road-map for ERP usage in
the context of small and medium-sized enterprises (SMEs). His analysis suggests that ERP benefits realization dimensions are interconnected and that managers should perceive this realization as a continuum cycle along the ERP post implementation period. Some of the benefits that were examined by Esteves (2009) were: cycle time reduction, cost reduction, quality improvement, improved decision making, support organizational changes, increase IT infrastructure capability and business flexibility.

Spathis (2006) adopted also Shang and Seddon’s (2002) benefits classification in order to classify and examine accounting benefits derived from ERP adoption. Spathis (2006) classified ES benefits into organizational benefits, operational benefits, managerial benefits and IT benefits. In his analysis he hypothesized that perceived accounting benefits could be explained by the following independent variables: the number of reasons for ES implementation, the number of ES modules, ES cost as a percentage of sales and the company’s total asset. According to this survey the most important accounting benefits that occur for a company due to the inclusion of the accounting department in the ERP system are: increased flexibility in information generation, increased integration of applications, improved quality of reports – statements of accounts, improved decisions based on timely and reliable accounting information and reduction of time for closure of annual accounts. These results are consistent with these of Spathis and Ananiadis (2005) and Kanellou and Spathis (2007) studies.

Nicolaou (2004) also tried to measure financial performance after the implementation of an ERP system using a set of eight different financial indicators, such as ROA (Return on Assets), ROI (Return on Investment), ROS (Return on Sales) and OIS (Operating Income over Sales). He also measured four ERP implementation indicators and one of them was the “type of module implemented”. He classified modules into two categories: primary modules and support modules. The results of his study indicated that the type of modules implemented had an effect on financial performance after ERP implementation. Although ERP benefits have been examined in the past, their direct impact on the accounting process has not yet been explicitly examined.

We can conclude from the relevant literature that enterprise resource planning systems’ implementation has an impact on the accounting department of the enterprise. More specifically, ERP systems seem to increase flexibility, integrate accounting applications and processes and improve gathering and processing of data. Nevertheless, there is a need for empirical research on the impact of ERP in terms of accounting advantages (Sutton, 2006).

As a theoretical foundation for our research, we adopted Shang and Seddon’s (2002) benefits classification and we compiled an accounting benefits list based on the ERP benefits lists adopted or developed by Deloitte Consulting (1998), O’Leary (2004), Spathis (2006) and Esteves (2009). Thus, the present study examines particularly the accounting benefits that the implementation of an ERP system may entail. More specifically the first research question of our study in relation to ERP system and accounting benefits is as follows:

**RQ1:** What are the accounting benefits derived from the adoption of ERP systems and which are the main factors in which these benefits could be categorized?
2.2 Differences in perspectives related to ERP performance

We will now take a look at research studies which tried to examine differences in perspectives related to ERP performance between different groups of users. Chang (2006) compared IS integration in high-tech organizations from the IT and general management perspectives. All the organizations that participated in the study had implemented an ERP system. The results showed that IT and general management perceptions of IS implementation were very similar. Furthermore, ITs’ overall important assessments of business functions were more strongly correlated with their overall level of implementation and they tended to rate system benefits and system reliability more highly.

Sayed (2006) focused on the mechanisms and dynamics of expertise constitution where it is understood as an accomplishment or achievement. He tried to study the interrelation of accountants and ICTs in a modern technology environment. He found that there is no dilution of expertise in relation to ICTs. Rather, some accountants are promoting themselves as a group of relevant experts in deriving benefits from these systems. The results of this study indicate that accountants see ERPs as a chance for them to expand their skills and knowledge. The objective of another study was to determine whether differences exist in perceptions related to ERP performance between two organizational stakeholder groups: business managers and IT professionals. The results indicated that no significant statistical differences exist between the two groups with the exception of one dimension: ERP success, i.e. vendor/consultant quality (Ifinedo and Nahar, 2007). Esteves (2009) also, tried to examine the differences in the perceptions of ERP benefits - related to the point of ERP post-implementation time - between business managers and MBA students with work experience in SMEs. The results showed that the difference between the two data samples was not very significant in any ERP benefits dimension.

On the other hand, there are previous studies which tried to measure ERP satisfaction level among users from different departments and found some statistically significant differences. Holsapple et al. (2006) tried to determine ERP success, in terms of user characteristics, ERP fitness factors and user satisfaction. This study indicated that ERP user satisfaction among management users was greater than among non-management users. Longinidis and Gotzamani (2009) also, found that users from network department are less satisfied with ERP than are users from other departments (sales and supportive). In their study they stated that ERP users from different departments use different functional modules and interact with different interfaces of the main ERP system. Although previous studies have examined differences in perceptions concerning benefits and user satisfaction, there are no academic studies that assess any differences in the perceptions between accountants and ITs particularly in terms of accounting benefits and ERP satisfaction level related to ERP performance. Thus, our study which investigates the accounting benefits and user satisfaction associated with the ERP application by the accounting department of an enterprise, is based on empirically researched evidence. To this end, the second research question that the present study tries to investigate is as follows:

RQ2: Are there any differences in the responses between accountants and IT professionals concerning how each group estimates ERP accounting benefits and ERP user satisfaction?
2.3 ERP and user satisfaction

In the literature there are studies which tried to assess user satisfaction related to ERP performance and operation. Somers et al. (2003) argue that the realization of benefits from ERP systems depends on supporting effective use of information technology and the satisfaction of IT users. They note that user satisfaction with information systems is one of the most important determinants of the success of those systems. Wu and Wang (2007) agree that user satisfaction is an evaluation mechanism for determining system success and thus their study looked at key-user satisfaction as a means of determining system success. Their study took place in Taiwan and 205 questionnaires were completed by key-users of ERP systems in a large number of companies. The results indicated that there is a relationship between key-user satisfaction and perceived system success. Their research identified that user’s satisfaction evaluation for ERP system is multidimensional and is related to “ERP product”, “contractor service” and “knowledge and involvement”. Longinidis and Gotzamani (2009) also, identified three factors which seem to affect satisfaction of ERP users: Interaction with the IT department, pre-implementation processes and ERP product and adaptability. Calisir and Calisir (2004) claim that while much money has been spent on the implementation of ERP systems, previous research has demonstrated that potential users may not use them. They conducted a survey, which aimed at examining various usability factors affecting end-user satisfaction with ERP systems. Data were gathered from 51 end-users in 24 companies. The results showed that perceived usefulness as well as learnability are determinants of end-user satisfaction with ERP systems. Additionally, perceived ease of use and system capability affect perceived usefulness, while users’ guidance influences both perceived usefulness and learnability.

Koh et al. (2006) investigated ERP adoption by Greek companies and explored the effects of uncertainty on the performance of these systems through six case studies. They found that there were major differences between ERP adoption in Greek companies and companies in other countries. In Greece, the internal enterprise’s culture, resources available, skills of employees and the way ERP systems were perceived, treated and integrated within the enterprise and in the supply chain play a critical role in determining the success / failure of the adoption of ERP systems. Saatcioglu (2009) tried to identify the effects of benefits, barriers and risks on user satisfaction in ERP projects. He found that the five most important benefits which determine user satisfaction are “better management and controlling functions”, “financial flow controls”, “information flow controls”, “increased IT infrastructure capability” and control of flow of goods”.

Floropoulos et al. (2010) also, conducted a survey in Greece, concerning the success of TAXIS (The Greek taxation information system) from the perspective of expert employees, who work in public taxation agencies. The model developed included the constructs of information, system and service quality perceived usefulness and user satisfaction. The findings indicated that information and service quality are significant determinants of employees’ satisfaction.

There are almost no academic studies which examine ERP user satisfaction particularly in relation to accounting benefits derived from ERP systems. Furthermore, there are almost no studies which examine ERP user satisfaction in relation to the modules that companies operate in an ERP environment and in
relation to the ERP cost. In order for ERP systems to be effectively used in the business environment, a better understanding of accounting benefits and user satisfaction need to be developed. As mentioned above, Spathis (2006) used the number of modules implemented and ERP cost as independent variables in order to measure accounting benefits.

In the present study we use the accounting benefits, the number of modules implemented and ERP cost (as percentage of annual sales) as independent variables in order to measure ERP user satisfaction. We have already pointed out that Nicolaou (2004) classified the modules and used them as ERP implementation indicators to measure financial performance. However, this modules classification was not feasible in our dataset, because 90% of the companies that participated in our study had implemented both module categories and thus, direct comparisons could not be done. Based on the previous review of the literature, this study was conducted to answer the following specific research question:

**RQ3:** Is there a relation between ERP user satisfaction and accounting benefits, number of modules implemented and ERP cost?

### 3. Methodology

A quantitative approach was adopted in terms of the collection and analysis of the data. Using a probability sample design, systematic sampling was applied and a sample of 420 companies in Greece was drawn that had adopted an ERP system. After liaising with the employees in charge of accounting and ERP systems in those companies, the final sample was reduced to 193 companies (those that agreed to take part in the study). The participants were 175 accountants and 96 IT professionals. All the companies that participated in the survey implemented an enterprise system at least one year ago. The data were gathered with the questionnaire method. The questionnaire forms were returned to us by fax or e-mail and some were completed in person. Responses range from “not at all” (1) to “perfect” (7) on a 7-point Likert type scale. Previous studies have indicated satisfactory reliability for these variables (Spathis and Constantinides, 2004; Spathis, 2006). The tests such as α-Cronbach and factor analysis have been taken to ensure the reliability and validity of the scale obtained. We used t-test to measure any statistically significant differences in the responses between accountants and IT professionals and we also used regression analysis to identify relationships between satisfaction and independent variables.

<table>
<thead>
<tr>
<th>Table 1. Demographic characteristics</th>
<th>Frequency</th>
<th>%</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Respondents</strong></td>
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<tr>
<td><em>Position in the firm</em></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Accounting</td>
<td>175</td>
<td>64.6</td>
<td></td>
</tr>
<tr>
<td>IT (ERP)</td>
<td>96</td>
<td>35.4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>271</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td><em>Gender</em></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>196</td>
<td>72.3</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>----------------</td>
<td>--------</td>
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<td></td>
</tr>
<tr>
<td>Female</td>
<td>75</td>
<td>27.7</td>
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</tr>
<tr>
<td>Total</td>
<td>271</td>
<td>100.0</td>
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**Age and experience**

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<td>40.1</td>
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<table>
<thead>
<tr>
<th>Years at current position</th>
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<tbody>
<tr>
<td>8.4</td>
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<table>
<thead>
<tr>
<th>Total work experience (years)</th>
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</thead>
<tbody>
<tr>
<td>15.6</td>
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<td></td>
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</table>

**B. Companies**

**Type of industry**

<table>
<thead>
<tr>
<th>Type of industry</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacture</td>
<td>82</td>
<td>42.5</td>
</tr>
<tr>
<td>Services – Research &amp; Development</td>
<td>54</td>
<td>28.0</td>
</tr>
<tr>
<td>Commerce</td>
<td>57</td>
<td>29.5</td>
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<tr>
<td>Total</td>
<td>193</td>
<td>100.0</td>
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**Type of company**

<table>
<thead>
<tr>
<th>Type of company</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>S.A.</td>
<td>155</td>
<td>80.3</td>
</tr>
<tr>
<td>Other</td>
<td>38</td>
<td>19.7</td>
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<tr>
<td>Total</td>
<td>193</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Company size**

<table>
<thead>
<tr>
<th>Number of employees</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>686.2</td>
<td></td>
</tr>
</tbody>
</table>

**C. ERP**

**Type of ERP**

<table>
<thead>
<tr>
<th>Type of ERP</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Greek ERP software (SAP, NAVISION, JD EDWARDS, etc.)</td>
<td>54</td>
<td>29.7</td>
</tr>
<tr>
<td>Greek ERP software (ATLANTIS (ALTEC), ENTERSOFT BUSINESS SUITE, etc.)</td>
<td>136</td>
<td>70.3</td>
</tr>
<tr>
<td>Total</td>
<td>193</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The empirical evidence presented in this study was solely obtained via the questionnaire that was answered by employees from companies that had adopted the ERP system for at least 1 year in Greece. As can be seen in Table 1, accountants constituted 64.6% of the sample, while ITs constituted 35.4% of the sample. The mean age of the respondents was 40.1 years and the respondents’ mean total work experience was 15.6 years. The mean years at current position was 8.4 years. According to the “type of industry”, 42.5% of the companies were from the manufacturing sector, 28% were from the service sector and 29.5% were from the commerce sector. 80.3% of the companies were S.A.s, as far as “type of company” is concerned and the mean number of employees was 686.2. Moving on to the “type of ERP”, it was decided to divide the ERP software packages into two main categories: “Local-greek ERP software packages” (such as ALTEC ATLANTIS ERP, ENTERSOFT BUSINESS SUITE ERP, etc.) and “International ERP software packages” (such as SAP ERP, NAVISION ERP (MICROSOFT), JD EDWARDS ERP, etc.). 70.3% of the companies that participated in the study had adopted a local ERP system. It seems that companies which operate in Greece, tend to adopt local software packages. Further information on demographic characteristics is provided in Table 1.

4. Results

Prior to the presentation of the research findings, we would like to refer to the modules that the companies operate in the ERP environment (see Appendix A).
Almost all companies that participated in the study operated the financial accounting module. Additionally, the majority of the companies operated stock-purchases, a fixed asset register, costing, sales-marketing and management accounting modules. The operation of such modules demonstrates that the companies that operate an ERP have a primary concern to integrate their accounting processes into that system. This is due to their expectation that ERP will have a positive impact on their accounting processes. Paradoxically, the payroll module, which forms an integral part of the accounting system, is only operated by 57.5 percent of the companies that participated in the study.

The survey findings are divided into three main sections and each section corresponds to a specific research question. The first section explores the accounting benefits derived from the ERP system implementation. The second section provides information about the opinions of both accountants and IT personnel and discusses whether or not there are statistically significant differences concerning how each group measures accounting benefits and ERP user satisfaction. In the last section we try to examine ERP user satisfaction in relation to accounting benefits, modules implemented and ERP cost.

Empirical evidence showed that the respondents have quoted a number of benefits in accounting practice derived from ERP systems. The variables related to accounting benefits of ERP systems were factor analyzed using principal component analysis (PCA) with varimax rotation as a commonly used technique for summarizing a set of variables into independent subsets. The results are presented in Table 2.

PCA highlighted five dimensions (named after Shang and Seddon’s (2002) and Spathis (2006) classification) involving:

1. IT accounting benefits: ERP gathers data more quickly and easier, ERP produces results more quickly and easier.
2. Operational accounting benefits (time): reduction of time for closure of monthly, quarterly and annual accounts and reduction of time for issuing financial statements.
3. Organizational accounting benefits: increased flexibility in information generation and integration of accounting applications, improved decision-making, improved internal audit and improved quality of reports – statements of account.
4. Managerial accounting benefits: improved working capital control, increased use of financial ratio analysis and reduction of time for issuing payroll.

These factors clearly reflect the main accounting benefits that follow ERP implementation and their impact on accounting processes. The factors explain 66.338% of the variance and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is high suggesting that factor analysis is appropriate for this data set. Bartlett’s test of sphericity is large and the associate significance level is small (zero), therefore it is unlikely that the population matrix is an identity. Furthermore, the factors have high alpha values (between 0.933 and 0.726) confirming their high reliability. PCA results further confirm that the adoption of ERP systems has successfully fulfilled its purpose demonstrating a significant impact on accounting information and practice, in terms of accounting benefits.
Table 2. Validity and reliability analysis of ERP system accounting benefits

<table>
<thead>
<tr>
<th>Factor 1: IT accounting benefits</th>
<th>Factor loadings</th>
<th>% of variance</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>It gathers data more quickly</td>
<td>0.811</td>
<td>18.369</td>
<td>0.895</td>
</tr>
<tr>
<td>It produces results easier</td>
<td>0.799</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It processes results more quickly</td>
<td>0.763</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It gathers data easier</td>
<td>0.762</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is more flexible in general</td>
<td>0.664</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor 2: Operational accounting benefits (time)</th>
<th>Factor loadings</th>
<th>% of variance</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of time for closure of monthly accounts</td>
<td>0.880</td>
<td>17.032</td>
<td>0.933</td>
</tr>
<tr>
<td>Reduction of time for closure of quarterly accounts</td>
<td>0.856</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction of time for closure of annual accounts</td>
<td>0.792</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction of time for issuing of financial statements</td>
<td>0.703</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor 3: Organizational accounting benefits</th>
<th>Factor loadings</th>
<th>% of variance</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased flexibility in information generation</td>
<td>0.769</td>
<td>14.184</td>
<td>0.809</td>
</tr>
<tr>
<td>Increased integration of accounting applications</td>
<td>0.666</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved decisions based on timely and reliable information</td>
<td>0.562</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved quality of reports – statements of account</td>
<td>0.550</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved internal audit function</td>
<td>0.548</td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Factor 4: Managerial accounting benefits</th>
<th>Factor loadings</th>
<th>% of variance</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved working capital control</td>
<td>0.783</td>
<td>10.356</td>
<td>0.726</td>
</tr>
<tr>
<td>Increased used of financial ratio analysis</td>
<td>0.740</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction of time for issuing payroll</td>
<td>0.506</td>
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</table>

<table>
<thead>
<tr>
<th>Factor 5: Operational accounting benefits (cost)</th>
<th>Factor loadings</th>
<th>% of variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of personnel of accounting department</td>
<td>0.902</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Total variance explained (%)</th>
<th>66.338</th>
</tr>
</thead>
</table>

KMO 0.869
Bartlett’s test of sphericity
Approx. Chi-square 1928.590
Df 210
Significance 0.000

The next section presents results about the perceptions of accountants and IT professionals concerning accounting benefits and ERP user satisfaction level. Details are displayed in Table 3. Respondents have quoted a number of benefits and advantages in accounting information and practice derived from ERP systems. The most highly-rated perceived benefits achieved following ERP implementation involve: IT accounting benefits, organizational accounting benefits and operational accounting benefits (time). Each of the above perceived benefits was given a mean score between “5 = high degree” and “6 = very high degree” by the respondents. Such findings prove that the inclusion of accounting processes in the ERP system lead to the emergence of various accounting benefits that receive high scores. “Managerial accounting benefits” also received a high score “mean = 4.649 = high degree”.

369
On the other hand, the variable “operational accounting benefits (cost)” is the benefit that received the lowest rating (mean = 2.39 = very low degree). It seems that ERP adoption in the accounting department does not have an important effect on personnel reduction. This finding is also consistent with the results of O’Leary (2004), who found that only 12% of the companies which participated in his study and had implemented an ERP system, had also seen a reduction of personnel due to this implementation.

There are no statistically significant differences concerning the measurement of the accounting benefits between accountants and IT professionals. It seems that the respondents of our study (both accountants and ITs) viewed ERP as beneficial for the accounting processes in their organizations. However, it seems that there is a statistically significant difference concerning ERP user satisfaction in the way that accountants and ITs estimate this variable (t = -2.046, p < 0.042). Even though accountants and IT professionals rated ERP user satisfaction highly, the results show that there is a statistically significant difference in their perceptions concerning this variable. Overall, accountants seem to be more satisfied with ERP performance compared to IT professionals.

The perceived accounting benefits that we examined, suggest that ERP systems have an important impact on accounting information and practice compared to traditionally used systems. Moreover, it is obvious that ERP adoption as far as the accounting department is concerned leads to flexibility and integration of business applications in general and accounting applications in particular. The evidence shows that ERP systems have a positive impact on accounting process. Furthermore, these systems affect positively the whole enterprise; that is because increased flexibility in information generation, improved internal audit function, improved decisions based on timely and reliable information and increased integration of applications do not only have a positive effect on accounting practice but also on the business operation in general.

**Table 3. Benefits and satisfaction of ERP system in relation to group of users**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Acc</th>
<th>IT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. dev.</td>
</tr>
<tr>
<td>IT accounting benefits</td>
<td>5.632</td>
<td>0.975</td>
</tr>
<tr>
<td>Operational accounting benefits (time)</td>
<td>5.11</td>
<td>1.246</td>
</tr>
<tr>
<td>Organizational accounting benefits</td>
<td>5.353</td>
<td>0.979</td>
</tr>
<tr>
<td>Managerial accounting benefits</td>
<td>4.666</td>
<td>1.451</td>
</tr>
<tr>
<td>Operational accounting benefits (cost)</td>
<td>2.480</td>
<td>1.652</td>
</tr>
<tr>
<td>ERP user satisfaction**</td>
<td>5.350</td>
<td>1.103</td>
</tr>
</tbody>
</table>

Scale: 1= not at all, 2= very low degree, 3= low degree, 4= average, 5= high degree, 6= very high degree, 7= perfect

** Significant at the 0.05 level (two-tailed)**

The last research question concerns satisfaction of ERP adoption and its relation to accounting benefits, number of modules implemented and ERP cost. As shown in Table 4, the mean of the perceived ERP user satisfaction is 5.240. The average number of modules implemented is almost seven out of eleven and the average cost of ERP is 2.432% of annual sales. The mean of perceived IT
accounting benefits is 5.640, the mean of perceived operational accounting benefits (time) is 5.052, the mean of perceived organizational accounting benefits is 5.354, the mean of perceived managerial accounting benefits is 4.649 and the mean of perceived operational accounting benefits (cost) is 2.390. Statistically significant correlations exist between the dependent variable “ERP user satisfaction” and the independent variables “IT accounting benefits”, “operational accounting benefits (time)”, “organizational accounting benefits”, “managerial accounting benefits” and “ERP cost”. These findings further confirm the strong link between these variables within this context. However, perceived “operational accounting benefits (cost)” and “modules” are not correlated with “ERP user satisfaction”.

Table 4. Means and Correlations

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>ERP user satisfaction</th>
<th>IT accounting benefits</th>
<th>Operational accounting benefits (time)</th>
<th>Organizational accounting benefits</th>
<th>Managerial accounting benefits</th>
<th>Operational accounting benefits (cost)</th>
<th>Modules</th>
<th>ERP cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERP user satisfaction</td>
<td>5.240</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT accounting benefits</td>
<td>5.640</td>
<td>0.593**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational accounting benefits (time)</td>
<td>5.052</td>
<td>0.464**</td>
<td>0.506**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational accounting benefits</td>
<td>5.354</td>
<td>0.481**</td>
<td>0.635**</td>
<td>0.552**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managerial accounting benefits</td>
<td>4.649</td>
<td>0.373**</td>
<td>0.488**</td>
<td>0.524**</td>
<td>0.596**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational accounting benefits (cost)</td>
<td>2.390</td>
<td>0.048</td>
<td>0.045</td>
<td>0.184**</td>
<td>0.174**</td>
<td>0.207**</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modules</td>
<td>6.660</td>
<td>0.028</td>
<td>0.066</td>
<td>0.077</td>
<td>0.054</td>
<td>0.108</td>
<td>0.048</td>
<td>1.000</td>
<td>-0.081</td>
</tr>
<tr>
<td>ERP cost</td>
<td>2.432%</td>
<td>0.246**</td>
<td>0.111</td>
<td>-0.045</td>
<td>0.116</td>
<td>0.086</td>
<td>0.115</td>
<td>-0.081</td>
<td>1.000</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (2-tailed)

Notes: Modules = Number of modules implemented; ERP cost = ERP acquisition and installation cost as a percentage of annual sales

The results of OLS regression are presented in Table 5. The univariate tests provide valuable information regarding a large number of variables over a sample. This study used the multivariate regression model with seven variables for the dependent dimension of ERP user satisfaction. The model is significant ($F = 11.303; p < 0.000$) for ERP user satisfaction. The adjusted R square explains up to 33.1 percent for ERP user satisfaction, while R square explains up to 36.3 percent for ERP user satisfaction. The independent variables with significant and positive coefficients on ERP user satisfaction are “IT accounting benefits”,...
“operational accounting benefits (time)” and “ERP cost”. “Operational accounting benefits (cost)” and “modules” have a negative contribution to ERP user satisfaction. In general, the results indicate that accounting benefits and ERP cost are important and significant parameters that affect ERP user satisfaction level.

**Table 5. Coefficient estimates of ERP user satisfaction**

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Coefficient</th>
<th>t-values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.672</td>
<td>3.143</td>
<td>0.002</td>
</tr>
<tr>
<td>IT accounting benefits</td>
<td>0.311</td>
<td>3.141</td>
<td>0.002</td>
</tr>
<tr>
<td>Operational accounting benefits (time)</td>
<td>0.153</td>
<td>1.872</td>
<td>0.063</td>
</tr>
<tr>
<td>Organizational accounting benefits</td>
<td>0.154</td>
<td>1.409</td>
<td>0.161</td>
</tr>
<tr>
<td>Managerial accounting benefits</td>
<td>0.075</td>
<td>1.033</td>
<td>0.303</td>
</tr>
<tr>
<td>Operational accounting benefits (cost)</td>
<td>-0.083</td>
<td>-1.576</td>
<td>0.117</td>
</tr>
<tr>
<td>Modules</td>
<td>-0.005</td>
<td>-0.126</td>
<td>0.900</td>
</tr>
<tr>
<td>ERP cost</td>
<td>0.027</td>
<td>2.838</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Model $R^2$ = 0.363

Adjusted $R^2$ = 0.331

F-value = 11.303  0.000

5. Conclusions

The aim of the present study was to investigate the accounting benefits derived from ERP application in the accounting department and whether differences between accountants and IT professionals exist concerning the measurement of accounting benefits and ERP user satisfaction. Moreover, this study tried to evaluate the effect of accounting benefits, number of modules implemented and ERP cost on ERP user satisfaction. Companies that operate in Greece and have adopted an ERP system provided the data presented here. This study explored the impact that the ERP system has had on accounting information and practice. The studies conducted by Spathis and Constantinides (2004), Spathis (2006) and Kanellou and Spathis (2007) explored the accounting benefits of adopting enterprise systems in Greece and our study can be seen as an extension of those studies, as it also explored ERP user satisfaction and its relation to accounting benefits. Thus, our study is currently one of the first complete sets of data available on Enterprise Resource Planning Systems in Greece in relation not only to benefits but also to ERP user satisfaction. The present study highlighted five dimensions of accounting benefits: IT accounting benefits, operational accounting benefits (time), organizational accounting benefits, managerial accounting benefits and operational accounting benefits (cost). The results we obtained regarding the benefits that result from using the ERP system are in line with those of Spathis and Constantinides (2004), Spathis (2006), Kanellou and Spathis (2007) and Esteves (2009). Furthermore, the findings regarding the gathering and processing of data through the ERP system agree with the findings of Granlund and Malmi (2002). Such results confirm the fact that data are gathered and processed easier and more quickly with the assistance of the ERP system. Thus, ERP systems seem to provide an enterprise, and more specifically the accounting department, with a greater degree of flexibility. Velcu (2007) examined the effects of ERP systems on
organizational performance and found that companies who had implemented an ERP perceived “improved service time in accounting tasks”. These findings agree with the results of the present study, which show that the reduction of time for closure of accounts and the time for issuing payroll is significant after an ERP implementation. Brazel and Dang (2008) also, found that ERP implementation seems to reduce reporting lags. Our results also confirm the results of a case study (Colmenares, 2009) which showed that ERP implementation is followed by improvements of decision-making process, enterprise integration and accurate financial statements. At this point it is important to note that the only benefit that received a very low rating was the “reduction of personnel of the accounting department”. This result agrees with the results of another study (O’Leary, 2004) which showed that only 12% of the companies which had implemented an ERP system had a reduction of personnel as well. Even though many benefits occur in the accounting department after an ERP implementation, it seems that these benefits are not always followed by a reduction of personnel which would lead to significant cost benefits for the enterprise.

No significant statistical differences exist between the perceptions of accountants and IT professionals concerning ERP accounting benefits. The fact that for all variables there were no significant statistical differences in perceptions between the two groups is in line with the findings of Chang (2006) and Ifinedo and Nahar (2007).

As far as satisfaction with ERP performance is concerned, there is a significant statistical difference between accountants and ITs. Accountants seem to be satisfied at a higher degree with ERP performance than ITs are. This finding further confirms the results of Longinidis and Gotzamani (2009) who found that users from the IT department are less satisfied with ERP than are users from other departments.

Moreover, our research indicates that “IT accounting benefits”, “operational accounting benefits (time)”, “organizational accounting benefits”, “managerial accounting benefits” and “ERP cost” are related with ERP user satisfaction. Saatcioglu (2009) also found a relation between benefits and ERP satisfaction. However, our study referred particularly to accounting benefits. On the other hand, the “number of modules implemented” and “operational accounting benefits (cost)” do not seem to have a significant effect on ERP user satisfaction. Overall, we found that the benefits that result from the application of an ERP in the accounting department are great in number and most of these are rated very highly. Thus, we are in the position to argue that it is worthwhile for an enterprise to include accounting in its ERP system. Finally, we point out that ERP user satisfaction level is related positive with accounting benefits and ERP cost.

5.1 Limitations
Some limitations exist. These are as follows: not all possible accounting benefits, advantages and disadvantages have been examined in this study. Also only companies located in Greece have participated in the present empirical research. Furthermore, the number of the accountants that participated in the study was larger than that of the IT professionals.
5.2 Further research
It is important to note that further research is needed in terms of the accounting benefits that the adoption of an ERP system may entail and their interaction with ERP user satisfaction. There is even a greater need for research in terms of investigating the corresponding accounting problems or disadvantages that may emerge from the adoption of an ERP system. Studies that investigate the positive aspects of ERP system implementation and those that investigate the negative ones contribute to a better understanding of the factors related to ERP user satisfaction and accounting benefits.

References


Appendix A. Operating modules in ERP environment

<table>
<thead>
<tr>
<th>Modules</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial accounting</td>
<td>95.9%</td>
</tr>
<tr>
<td>Stock-purchases</td>
<td>88.6%</td>
</tr>
<tr>
<td>Fixed asset register</td>
<td>80.3%</td>
</tr>
<tr>
<td>Costing</td>
<td>74.1%</td>
</tr>
<tr>
<td>Sales-marketing</td>
<td>72.5%</td>
</tr>
<tr>
<td>Management accounting</td>
<td>65.3%</td>
</tr>
<tr>
<td>Payroll</td>
<td>57.5%</td>
</tr>
<tr>
<td>Production</td>
<td>53.9%</td>
</tr>
<tr>
<td>Logistics</td>
<td>40.9%</td>
</tr>
<tr>
<td>Quality management</td>
<td>19.2%</td>
</tr>
<tr>
<td>E-commerce</td>
<td>13.5%</td>
</tr>
</tbody>
</table>
Insolvency Prediction: Evidence from Greek Hotels

Mihail Diakomihalis
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Abstract

This study examined insolvency predictions for the hotel sector in Greece. The objective was to realise and estimate bankruptcy predictions for different hotel categories for 2005-2007, or the three consecutive years following the 2004 Olympics in Athens and just before the economic crisis that began in 2008 in Greece. The sample selected included 146 hotels and 438 financial statements from the 3 years studied. This paper aimed to determine the zone of discrimination classified as “certainty” for bankruptcy, by using three random values of the Z score to eliminate the number of firms that went bankrupt in three different zones.

The Altman model was used to predict bankruptcy and its accuracy assessed by comparing its results to the number of hotel enterprises that actually filed for bankruptcy. About 40% of all firms evaluated were deemed to be in the “distress zone” for bankruptcy, having a Z score below 1.8.

The results of this study revealed that the number of firms with Z scores below 0.8 were certain to file for bankruptcy, with an accuracy rate of 83.3% for 2005 (15 out of 18 predicted firms), 3 years before bankruptcy; 100% for 2006 (15 out of 15 firms), 2 years prior to bankruptcy; and 88.2% for 2007 (15 out of 17 predicted firms), 1 year before bankruptcy. Bankruptcy risk was higher for 5- and 3-star hotels than for 4- and 2-star hotels.

This paper has implications for the ascertainment of insolvency among hotels from different categories. It also fulfils the need to predict the certainty of bankruptcy among enterprises within the distress zone.

Key words: Bankruptcy prediction, Financial analysis, Altman model, hotel sector, Greece.

1. Introduction

The hotel sector constitutes an idiomorphic tourist product, offering some of the most fundamental services in the tourism industry. Hotel accounting is a special field of accounting, aimed at the accounting organization of hotels.

The bulk of capital in the hotel sector is invested in fixed assets. The financing needed for fixed assets, in combination with the financing needed for continued hotel activities, considerably increases fixed costs, which must be covered irrespective of the rate of hotel turnover (Mattimoe, 2008).
Financial accounting is especially important to hotel development, because it provides data that are an essential part of executive financial decisions. It also provides information to such other interested parties as the state, credit organizations, and tourist enterprises. However, the special characteristics of hotel accounting management are also the source of many particular problems, such as the sorting of income and expenses by sector, the direct and accurate registration of economic transactions, and the implementation of proper pricing methods for services and material goods.

A review of the literature reveals that little research has been done on the role of accountants in the hospitality business and even less on their role in the hotel sector, compared to surveys of traditional manufacturing industries (Burgess, 2006 and 2007; Drury and Tayles, 2006; Dugdale et al., 2006; Mattimoe, 2008).

Technological development has accelerated and improved accounting functions. This has led to the segregation of accounting from the processing of data and compilation of financial reports and has made analysis and planning the objective of financial management (Scapens και Jayazeri, 2003).

Modern enterprises require that the role of accountants as financial advisors who analyse statements and register numerical data evolve. Financial managers must develop their business analysis and problem solving skills, rather than simply providing information (Mattimoe, 2008; Scapens, 2006; Burns 2003; Burns and Balvinsdottir, 2005). Inevitably, the duties of financial analysts should not be limited to the verification of enterprises’ accounting data, but should extend to the use of indices to determine the real dynamics and prospects of an enterprise.

The implementation and interpretation of financial indices is important to the development of modern frameworks for financial management (Papadopoulos, 1986:167-168). Besides, the use of such indices contributes to the evolution of strategies for identifying alternative investment options, including strategies for evaluating managerial executives whose responsibilities are related to a company’s growth (Chew 1997: 183). In today’s economic environment, the picture of prosperity and financial robustness that every enterprise presents is affected by the estimation of its position formed by investors, creditors and stakeholders (Lazaridis and Papadopoulos 2002: 422; Ryu and Jang 2004).

A great deal of the financial analysis research carried out on an international level deals with the investigation of precognition of economic failure (Vranas, 1991:431). A firm or corporation is considered to be in a state of bankruptcy when and if it is unable to pay off its debts and, thereafter, being under constraint, legally declares its inability to continue business. The ability to predict bankruptcy may be important for financial users, but it also may be crucial for such groups as investors, creditors, stakeholders, credit rating agencies, auditors, and regulators (Lifschutz and Jacobi, 2010). Predicting bankruptcy as early as possible is always important, but it is considered especially vital in periods of financial and economic crisis.

The present research deals with the analysis of financial statements from hotels and aims to contribute to understandings of the imminent bankruptcy distress area within the hotel industry. The specific objective of this study was to determine the zone in which bankruptcy becomes a certainty.

This study examined the three-year period of 2005-2007, which was selected because it followed an exceptional expansion of the hotel industry that began in 2004, when the Olympic Games were held in Greece, and ended with the economic crisis that began in 2008, when “Greece start to crack the eurozone” (The Telegraph, December 10, 2008). The study aimed to answer the question of how accurately the
Altman model could predict bankruptcy in the hotel sector and to reveal any differences attributable to hotel categorization.

The results should contribute to estimations of the risk of bankruptcy for hotel enterprises in Greece, enhancing precision and length of forecast and improving opportunities for advisable interventions that could deter bankruptcy.

The research was limited by the fact that it required evaluation of such factors as hotel size and geographic location, the estimation of which could lead to different results for different hotel enterprises.

2. Literature Review

Apart from the data published on financial reports such as balance sheets and profit and loss statements, which provide information about hotels’ economic positions, financial ratio analysis contributes significantly to the drawing of conclusions concerning the robustness and prospects of hotel enterprises. Ratio analysis provides insight into the financial and operating status of an enterprise.

Financial ratios are used extensively and diachronically by investors, creditors, and managerial executives to assess the financial operations of enterprises (Ryu and Jang, 2004). Solvency ratios are used to evaluate an enterprise’s ability to meet its long-term liabilities. Among the most-used is the market value of equity/book value of total liabilities, which is calculated for specific time periods on balance sheets. The working capital/total assets ratio covers a single period of time and, moreover, overcomes the insufficiency of market value of equity/book value of total liabilities, which ignores fluctuating capital liquidity and covers various levels of debt by focusing on cash flow (Coltman and Jagels, 2001; Schmidgall et al., 1993; Mills and Yamamura, 1998).

In every enterprise, independent of its size, the possession and maintenance of cash is considered important, not only for the success of business activity, but mainly as an essential condition of survival (DeFranco and Schmidgall, 1998). The great importance of cash flow has been stressed in many studies of enterprises in different sectors (Bohannon and Edwards, 1993; Casey and Bartczak, 1985; DeFranco and Schmidgall, 1998; Epstein and Pava, 1994; Mills and Yamamura, 1998; Schmidgall, et al., 1993; Sylvestre and Urbancic, 1994), to the extent that it has been considered to determine the difference between successful management and bankruptcy (Beck, 1994).

Insolvency prediction has long attracted the interest of researchers. The difficulty of making precise calculations using insolvency prediction models is one reason why these models have not gained greater use. As technology develops, the utilisation of bankruptcy prediction models has become practical and accessible to everyone.

The difficulty of collecting data on corresponding sets of failed and successful enterprises constitutes one of the main problems in developing and testing bankruptcy forecasting models. In all cases, the techniques used to develop predictive models are considered tools of analysis that are not intended to replace personal evaluations based on experience and information. Properly used, each model is a filter for the localisation of enterprises that need further investigation or have presented a concrete tendency toward bankruptcy for several years. The prompt detection of problematic enterprises with downward tendencies can ward off bankruptcy if essential corrective adjustments are made.
Several researchers have raised questions about the influence of factors like hotel category on financial ratios. Min et al., in “Evaluating the financial performances of Korean luxury hotels using data envelopment analysis” (2009), have suggested that “multiple outputs and different categories of hotels” should be considered in future studies. Pavlatos and Paggios (2009) included in their sample five-, four- and three-star hotels from six geographical areas of Greece. The role of hotel category in “financial support to small and medium hotel companies in Serbia” has been stressed by Barjaktarovic and Barjaktarovic (2010) as one of the factors determining “the exact amount of investment costs,” since “hotels with higher category achieve higher price and better occupancy rate” (pp. 9-10).

Among the many predictive models that have been developed, the most well-known is that of Edward I. Altman (1968 and 1983). The first to successfully develop a multiple discriminate analysis prediction model with a 95.0% rate of accuracy, Altman is considered the pioneer of insolvency predictors (Altman, 1968). Gordon Springate, adopting procedures introduced by Altman, developed another model in 1978 that achieved 92.5% accuracy for the 40 companies he tested. Of 19 financial ratios, he selected 4 and used multiple discriminate analysis to distinguish between enterprises that had filed for bankruptcy and enterprises that remained robust (Springate, 1978; Sands et al., 1983).

The Springate Model has been tested by Botheras (1979), with an accuracy rate of 88.0%, and by Sands, with an accuracy rate of 83.3% (Botheras, 1979). Using multiple discriminate analysis, Fulmer (1984) also developed a model that, with 98% accuracy, identified failed companies one year before bankruptcy and, with 81% accuracy, identified failed companies more than one year before bankruptcy (Fulmer et al., 1984). In 1984, William Blasztk developed the Blasztk system to predict business failure without applying multiple discriminate analysis. The main strength of Blasztk’s method is that it compares enterprises being evaluated with other enterprises in the same sector. In 1987, Jean Legault developed the CA-Score, applying step-wise multiple discriminate analysis and 30 financial ratios to a sample of 173 manufacturing businesses in Quebec, each of which had annual sales of between $1-20 million. This model reached an average reliability rate of 83% and is restricted to the evaluation of manufacturing companies (Legault, 1987).

3. Methodology

Altman introduced the Z-score formula for bankruptcy prediction in 1968, when it was used to predict the probability of bankruptcy within two years. The Z-score formula is a linear combination of five financial ratios, concerning multiple corporate income and balance sheet values that can measure the financial health of a company, weighted by coefficients.

The discriminant analysis initially applied by Altman was based on data from public manufacturing companies but has since been applied to private industrial and non-industrial companies, as well as to service-sector companies.

The linear multivariable model developed by Altman was applied to the bankruptcy prediction of hotel enterprises.

The model has the following form:

\[ Z = k_1x_1 + k_2x_2 + \ldots + k_nx_n \]
where \( k1, k2 \ldots kn \) are the differentiation variables and \( X1, X2 \ldots Xn \) are the hotels’ financial ratios. \( Z \) estimation reveals the limit of differentiation between bankrupt and non-bankrupt enterprises.

The \( Z \)-score discriminant formula developed by Altman is:
\[
Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5
\]
Below are the definitions of \( X1, X2, X3, X4 \) and \( X5 \):

- \( X_1 \) = Working capital/total assets. This variable measures the relation of liquid assets to the total assets of a company. Working capital is measured by subtracting current liabilities from current assets.
- \( X_2 \) = Retained earnings/total assets. Retained earnings, or earned surplus, is the total amount of earnings and/or losses of a company during its lifetime. The ratio is also used to measure the leverage of an enterprise – that is, the portion of assets financed through retained earnings, compared to debt financing.
- \( X_3 \) = Earnings before interest and taxes/total assets. Earnings before interest and taxes measures the real productivity of a firm, independent of taxes and interest. This is an exceptionally suitable ratio for business failure prediction.
- \( X_4 \) = Market value of equity/book value of total liabilities. Measurements of market value of equity are based on the market value of all stock shares and on the current value of short- and long-term liabilities.
- \( X_5 \) = Sales/total assets. Capital turnover ratio measures the degree of utilisation of an enterprise’s total assets, in connection with realised sales.

Zones of discrimination:
When the overall index \( Z \) is over 2.99, an enterprise is consider to be in the “safe” zone, with a very low risk of bankruptcy. When a \( Z \) score > 1.80 and < 2.99, a company is considered to be in the “grey” zone, since there is no strong indication of bankruptcy risk level. A \( Z \) score index < 1.80 indicates strong possibility of failure and placement in the “distress” zone (\( Z < 1.80 \)).

4. Results and Discussions
The main limitation of this research concerns the differentiation of the \( X4 \) variable, because market value of equity was not given for all the firms in the sample. Instead, equity value was calculated for all businesses.

Placing the corresponding financing indicators for each of the years examined, the model yielded the following results by hotel category and financial year:

<table>
<thead>
<tr>
<th>HOTEL CATEGORY / YEAR</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>3-YEAR PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Z Score</td>
<td>STDEV</td>
<td>Average Z Score</td>
<td>STDEV</td>
</tr>
<tr>
<td>5 STAR</td>
<td>2,562</td>
<td>3,480</td>
<td>2,442</td>
<td>2,900</td>
</tr>
<tr>
<td>4 STAR</td>
<td>2,981</td>
<td>2,120</td>
<td>4,201</td>
<td>4,680</td>
</tr>
<tr>
<td>3 STAR</td>
<td>4,851</td>
<td>5,900</td>
<td>4,727</td>
<td>5,290</td>
</tr>
<tr>
<td>2 STAR</td>
<td>5,984</td>
<td>9,590</td>
<td>8,231</td>
<td>12,560</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>4,095</td>
<td>1,605</td>
<td>4,900</td>
<td>4,246</td>
</tr>
</tbody>
</table>
The standard deviation showed that the dissemination of Z-score prices was much smaller between hotels in the same category and in different years than between hotels in different categories and in the same year. Consequently, categorical differentiation of hotels considerably influences probability of bankruptcy.

The following Diagrams 1 – 4 depict the Z-score bankruptcy model by hotel category for each year, with the projection of the logarithmic trendline equation and its corresponding \( R^2 \).

**Diagram 1. Z-Score Bankruptcy Model, 2005 / Hotel Category**

\[ y = 1.6581 \ln(x) + 2.5069 \]
\[ R^2 = 0.5745 \]

**Diagram 2. Z-Score Bankruptcy Model, 2006 / Hotel Category**

\[ y = 2.4403 \ln(x) + 2.5635 \]
\[ R^2 = 0.5449 \]

**Diagram 3. Z-Score Bankruptcy Model, 2007 / Hotel Category**
\[ y = 2,9729 \ln(x) + 2,0713 \]
\[ R^2 = 0,5254 \]

Diagram 4. Z Score Bankruptcy Model, 2005-2007, All Hotel Categories

Table 2. Z - Scores of Altman’s model

<table>
<thead>
<tr>
<th>Year 2005</th>
<th>Z - cutoff score 1,8</th>
<th>Z – cutoff score 1,0</th>
<th>Z – cutoff score 0,8</th>
<th>Z – cutoff score 0,5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel Category</td>
<td>Numbe r</td>
<td>% to total</td>
<td>Numbe r</td>
<td>% to total</td>
</tr>
<tr>
<td>5 star</td>
<td>20</td>
<td>66,67%</td>
<td>14</td>
<td>47,62%</td>
</tr>
<tr>
<td>4 star</td>
<td>13</td>
<td>45,0%</td>
<td>1</td>
<td>3,4%</td>
</tr>
<tr>
<td>3 star</td>
<td>19</td>
<td>37,3%</td>
<td>7</td>
<td>13,7%</td>
</tr>
<tr>
<td>2 star</td>
<td>10</td>
<td>27,8%</td>
<td>3</td>
<td>8,3%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>62</td>
<td>42,5%</td>
<td>25</td>
<td>17,1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2006</th>
<th>Z - cutoff score 1,8</th>
<th>Z – cutoff score 1,0</th>
<th>Z – cutoff score 0,8</th>
<th>Z – cutoff score 0,5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel Category</td>
<td>Numbe r</td>
<td>% to total</td>
<td>Numbe r</td>
<td>% to total</td>
</tr>
<tr>
<td>5 star</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 star</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 star</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 star</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Applying the Altman model to hotel enterprises in Greece for 2005, 2006, and 2007 revealed that the number of enterprises that were highly likely to go bankrupt was 62, 58, and 58 respectively.

Of the 146 enterprises included in the sample, 15, or 10.3%, filed for bankruptcy.

Afterwards, three different cutoff prices were selected – 1.0, 0.8 and 0.5 – to determine the “zone” that approaches enterprises bankruptcy with certainty.

As seen in the above Table 2, for 2005, the total number of enterprises that could be expected to file for bankruptcy, provided that the overall Z-score of the model was below 1.0, was 25. Respectively, for overall Z scores below 0.8, the number of bankrupted enterprises should have been 18 and, for prices below 0.5, only 7.

Comparing the results with the number of enterprises that actually went bankrupt shows that the price nearest the real number of bankrupted enterprises was < 0.8. The number of enterprises with overall Z scores under 0.8 was 18, while the number that went bankrupt in 2008 was 15. Considering the number of enterprises that, according to the model, presented bankruptcy “certainty” with those that really went bankrupt, it was evident that real bankruptcies constituted 83.3% (15/18) of forecasted bankruptcies.

The corresponding results, in Table 1, for 2006 show the total number of enterprises that should have filed for bankruptcy, provided that their Z scores were below 1.0, was 22. For Z scores less than 0.8, the number of bankrupted enterprises was 15, while, for Z scores less than 0.5, it was 7.

Comparing the results with the number of enterprises that actually went bankrupt, it is obvious that the price that more closely approached the real number of bankrupted enterprises was Z < 0.8. The number of enterprises with an overall Z
score below 0.8 was 15. Considering the number of enterprises that, according to the model, presented bankruptcy certainty with the number that really went bankrupt, it was evident that the forecast absolutely identified 100% (15/15) of real bankruptcies.

The results for 2007 reveal the total number of enterprises that should have gone bankrupt, provided that their Z scores were less than 1.0, was 26. For Z prices less than 0.8, the number of enterprises that should have filed for bankruptcy was 17, whereas, for Z prices less than 0.5, this number was only 4.

Comparing the results with the number of companies that went bankrupt, it was evident that the price that more closely approached the real number of bankrupted enterprises was < 0.8. The number of enterprises for which Z scores were smaller than 0.8 was 17. Considering the number of enterprises that, according to the model, presented bankruptcy certainty with the number that actually went bankrupt, it was evident that the number of real bankruptcies constituted 88.2% (15/17) of the number of forecasted bankruptcies.

5. Conclusions

The objective of this study was to examine the possibility of forecasting the bankruptcy of hotel enterprises in Greece and to determine the precise percentage of enterprises for which accurate predictions could be made using the Altman model. Estimates concerned forecasts in the three years before bankruptcy realisation.

After dividing the distress zone into three fields, it became clear that for the three years under study, a cut-off Z score of below 0.8 most closely approached the number of enterprises that went bankrupt, among those for whom bankruptcy was forecasted.

Enterprises that actually filed for bankruptcy in 2008 were predicted with 100% (15/15) accuracy in 2006 – that is, 2 years ahead of actual bankruptcy filing. In regard to 2005, three years before bankruptcy filing, the number of actual bankrupt enterprises constituted 83.3% (15/18) of those forecasted, and finally, in 2007, 1 year prior to bankruptcy, bankrupted enterprises constituted 88.2% (15/17) of predicted bankruptcies.

The general conclusion that can be drawn from the results is that the Altman model can be applied with considerable success (i.e. a high degree of reliability and accuracy) to the bankruptcy forecasting of hotel enterprises. It was proved that 1/4 of all enterprises located in the distress zone for bankruptcy would certainly file for bankruptcy. The price of the Z score model for these enterprises was found to be below 0.8. The divergence of calculated forecasts of bankruptcy from the number of enterprises that actually went bankrupt varied from 16.7% to 0.0%.

The conclusion to be drawn regarding the categorisation of hotel enterprises is that the ascertainment of bankruptcy risk differs between hotel categories. Specifically, the risk presented by five- and three-star hotels is greater than the risk presented by four-star hotels, while, for two-star hotels, the risk is considerably smaller.

Future research should include such criteria as hotel size or geographic location, so that the degree of these variables’ influence on future bankruptcy can be appraised.
References


Examining the extent to which the implementation of IFRS has affected the financial and narrative reporting. Evidence from the Greek banking sector.

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Abstract

The financial system consists without hesitation one of the most important determinants of the national economies worldwide. The changes and challenges that the financial institutions face have a great impact on the economic growth of a country as well as in the configuration of the economic environment of each market. A healthy market needs a stable financial system in order to convey capitals from the "surplus economies to the deficits ones" in order funds to be invested in the productive process. The structure and the function of the financial sector are differentiated from country to country and, as a result, there is a wide range of forms that financial institutions comprise. However, the main source of the economic growth and stability plays the banking sector. The latter goes at the very heart of the financial system and its influence in national economies is critical as it deploys effectively the funds in the economic cycle. The purpose of the current paper is to investigate the extent to which the implementation of International Financial Reporting Standards (IFRS) in the Greek banking sector has affected their financial and narrative reporting between the periods prior (2002-2004) and after (2005-2007) the implementation of the IFRS. The study analyses the most important Greek commercial banks and is regarded to present the effects of this alternation.

Keywords: IFRS, financial reporting quality, management commentary, Greek banking sector
1. Introduction

The European Community Regulation No. 1606/2002 required all European Union listed companies to prepare their consolidated financial statements in accordance to IFRS as from 1 January 2005 (Pagletti, 2009). The main purpose of the introduction of IFRS in EU is the comparability and the quality improvement of the firms’ financial statements. In the framework of the improvement of the amount and the quality of the information provided to investors, lenders etc the importance of the narrative portion of the financial statements has been recognized by practitioners and researchers. This narrative portion in the financial statements is referred as “Management Discussion & Analysis - MD&A” in the US and “Operating and Financial Review – OFR” or “Business Review” in the UK. However, in most countries is called “Management Commentary (MC)”. The IASB (2009) defines the notion of MC as “the information that accompanies financial statements as part of an entity’s financial reporting. It explains the main trends and factors underlying the development, performance and position of the entity’s business during the period covered by the financial statements. It also explains the main trends and factors that are likely to affect the entity’s future development, performance and position”.

This paper studies the impact of the IFRS mandatory adoption in a typical code-law European country such as Greece and focuses on the comparison between the periods prior (2002-2004) and after (2005-2007) the implementation of the IFRS regulatory accounting framework focusing on the effects on the financial and narrative reporting of eleven (11) Greek commercial banks. The research is separated in three parts. The first part explores the impact of the adoption of IFRS in the Greek Banking sector by addressing the hypothesis of how the value relevance of earnings and book value has changed between the two periods. To answer this question the Ohlson model is utilized, presenting a linear relationship between price, earnings and book value (BV).

The second part compares the amount and type of narrative information disclosed in Management Commentary. The purpose of the latter investigates how and whether the narrative information quality of financial reports has changed between the pre IFRS period (2000-2004) and post IFRS period (2005-2007). Management Commentary (MC) reports were analyzed using a question checklist of 50 questions in 5 categories, proposed by the International Accounting Standards Board (IASB) in 2005. In addition, the mean of the main financial figures and ratios (ROE, ROA, etc.) of the two periods are compared in order to examine whether there is improvement or not.

Finally, the third part uses the Spearman’s rank correlation coefficient, a non-parametric measure of statistical dependence between two variables, in order to assess the relationship between the key financial figures and the quality of the MC.
The paper is organized as follows: Section 2 makes a brief introduction in the relevant literature considering the banking sector and the quality of narrative reporting. Section 3 describes the methodology, the data sets and the research structure of the study, while setting the research questions. Section 4 analyses and interprets the outcomes of the examined questions, explicitly presenting the results. Section 5 summarizes the main implications and conclusions of the study, making meaningful assumptions.

2. Prior Research

2.1 The Banking Sector

The financial sector includes all the financial institutions which are an important constituent of all economies worldwide. Banks, as part of the economic cycle are the main source of the market’s liquidity addressing financing and funding opportunities covering a great amount of the required capital for investment purposes of numerous organizations (Allen & Carletti, 2008).

During the last decades, the financial environment has been rapidly changed while it is characterized by the fierce competition, the release and the market internalization and integration, the technology expansion, the development of new specialized financial products as well as the growth of derivatives of the financial goods (Jiga, 2005). These challenges have led banks in the transformation of their operational context in order to deploy effectively all their prospects in the financial markets (Iatridis, 2010). As suggested by Bernanke and Blinder (1992) there is a strong linkage between the loans that banks provide and the measures of the economic activity. As a result, changes in the monetary policy and strategy of banks have a great impact to the Gross National Product (GNP) and other fundamental macroeconomic indicators which portray an economy’s activity and wealth. As it becomes obvious, the strength and economic stability of the financial institutions plays a critical role in national economies. On the one hand, a healthy banking sector accelerates the economic growth of a nation and, on the other hand, the financial instability in financial institutions causes numerous deficiencies in the macroeconomic level of a country (Kashyap & Stein, 1994).

The ultimate mission of the financial institutions is the achievement of profitability as well as the increase of the shareholders’ value. Even if Banks address numerous flexible and remarkable alternatives to individuals and enterprises, their incentive is to make profits in order to survive in the long – term (Drehmann & Tarashev, 2011). Attempting to investigate the factors which will differentiate the financial institutions, Tarawneh (2006) mentions that the banks’ performance is examined by their financial sustainability which determines their effectiveness and efficiency. Taking into consideration the obstacles of the entrance of new institutions in the banking sector and the fierce competition of the existing ones, the financial institutions have to focus on their financial results. Earnings and profitability goes at the very heart of their existence, as they are used by the financial institutions to cover numerous necessitates of the banks’ image such as
to “pay dividends to shareholders, to increase equity, to finance activities which improve the social profile and the brand name in the market share” (Gilbert & Wheelock, 2007; Iatridis, 2010).

A report of 2010 conducted by The European Central Bank assumes that the effectiveness of the banking system is an area of great importance. However, during the process of examining the efficiency and competitiveness of the banking sector, obstacles arise from the intangible nature of the products and services which financial institutions address to the market (Kosmidou & Zopounidis, 2008). Numerous scholars have mentioned a great diversity of bank performance measurement variables including costs and efficiency factors. In the early of 80’s Revell (1980) introduced interest margin as an important dimension of accessing U.S. commercial banks performance, calculating the interest income minus expenses and dividing it with total assets. In addition, Arshadi and Lawrence (1987), examined bank performance using a correlation analysis model which includes indexes of profitability, loan market share and the pricing policy of the bank services. Moreover, Miller and Noulas (1996) investigated the technical efficiency of large banks. Their research indicated that larger banks place a greater level of technical efficiency while they operate under a diminishing amount of returns of scale. Finally, a research conducted by Miller and Noulas (1997), emphasizes on the banks’ size, concluding that it affects their efficiency.

El-Gazzar et al. (2006), compared the regulated and deregulated markets, highlighted that in both type of markets, book value and earnings were strongly related with cost recovery, ROA, and security prices. As a result, both the “asset capitalization” (BV) and “operational efficiencies” (earnings) are tending to be key indicators in the market evaluation of the firm’s future prosperity and security price.

In a research conducted by Gilbert and Wheelock (2007), they observed a wide range of performance measures applied by scholars and practitioners in banks, making a distinction between “traditional, economic and market-based” measures of performance. The most important traditional measures of assessing financial performance are ROE and ROA. In addition, the study mentions that ROE and ROA are considered as important determinants of profitability and reflect the banks’ performance. The Return on Assets (ROA) indicator represents how effectively a business has been using its operating assets while the Return on Equity (ROE) indicator is a measure of how well a company “reinvested earnings to generate additional earnings”.

The study of Watts (2003) highlights another dimension of the banks’ financial operating scheme where the debt holders deal with asymmetric information hazards when they are going to lend enterprises and to evaluate their forthcoming forecasts. In this light, Barth et al. (2008) clearly state that the increase in the information quality in the financial reports as well as the information provided in the financial statements after the adoption of IFRS, has a strong impact on debt financing. In conjunction, Florou and Kosi (2009) point out that after the changes on the financial reporting system with the development of IFRS, the financial
institutions are likely to increase debt “from a larger pool of capital at a lower cost”. In addition, as they stated, there is a strong relation between the quality of narrative reporting and Debt which has been strengthened after the implementation of IFRS.

Besides the banks’ financial performance, Tarca (2004) highlights the financial statements analysis as an important tool of presenting the financial position of an organisation. Their analysis and valuation is essential as there is a great diversity of groups (investors, public authorities, shareholders) who are interested in the stated financial results and the management comments about the prospects of banks’ growth and vision. According to its application, each group analyses financial statements for different purposes and emphasizes in different aspects of the presented annual or quarterly outcomes. As mentioned by Lundstrum (2003), the accounting strategies that managers utilize, may affect the reported financial results of an enterprise. The latter, in conjunction with financial reporting disclosures, may raise opportunistic situations about the future forecasts of financial performance. “The banks are disposed in liquidity and monetary fluctuation risks, changes in the interest rates and the danger of bankruptcy of the counterparties”. Even if those risks are reflected in the financial reports, the external parties have a clearer point of view of how banks present the way in which they are going to manage the stated risks linked with their operations through their management vision. These risks are reflected in the financial reporting disclosures where the management of banks states how is going to surpass the stated threats. As a result, the external parties have a clearer point of view about how banks will restructure (nǐ adjust) their operations to avoid future hazards. (Rochet & Vives, 2004; Goldstein & Pauzner, 2005; Iatridis, 2010; Jiga, 2005).

2.2 The Greek Banking Sector

The Greek banking sector composes a basic mechanism of exercising economic policy in the Greek economy as the latter is characterized as bank – based. Banks are able to vary the offer and demand of funding prospects in the Greek economy, as well as to affect on the buyers purchasing power. The Greek banks, operating as meditative institutions, offer a wide range of services extending from portfolio management and suitable saving opportunities to exceptional funding prospects not only to individuals but also to enterprises leading to modernization and growth alternatives (Zopounidis et. al., 1995).

During the last decade, the growth of the Greek financial sector has been characterized by a dynamic and rapid development. The growth of Greek economy was steadily above the European average growth rates. In addition, the remarkable decrease of the interest rates as well as the privatizations in the Greek financial sector changed the competition variables, while engendered multiple benefits for the economy and the shareholders. Evidence from the Greek stock market highlights the performance of the banking sector, as the rates of growth were double in comparison with the other sectors (IMF, 2006).
The Greek financial institutions through their effort to take upon the opportunities engendered by the changes in the global and national financial sector, led in strategic co-operations basing on Mergers & Acquisition in order to strengthen their position in the market, by developing large financial corporations. These actions have reinforced their capital structure, expanded their networks while the services they offered were more attractive to the potential customers (Eichengreen & Gibson, 2001).

The performance and profitability of Greek banks was of great importance and various scholars have focused on the study of these factors diachronically. In 1995 Alexakis et al. conducted a research for the period 1989-1991 related to the release and performance of the Greek banking sector, concluding that the lead indicators of profitability were quite different from other countries because of the strong regulation in Greece. In addition, Zopounidis et al. (1995) performed a multi-criteria analysis in order to estimate the performance of banking sector using ratios analysis techniques during the period 1989-1992 basing on a utility model of Greek commercial banks in order to rank them. Furthermore, Hardy and Simigiannis (1998) investigated the competitiveness and effectiveness of the Greek financial institutions and they highlighted that during the decade of 1990 the most of the medium sized financial institutions succeed in a consistency of their profitability levels.

### 2.3 IFRS and the quality of financial reports

In current years, the financial markets were in command of a diffusible and strict control where the state interference on the banks’ property and operations was potent. Some of the most important influence factors were the exogenous determination of rates, the binding commitments on deposits, and the credit control (Jiga, 2005). The mean of the asymmetric information between the interested parties concerning the banking sector was introduced by Campbell and Kracaw (1980). As they mentioned, the production of satisfactory information presented to the involved associates is critical in order to avoid the problem of moral hazards in the banking sector. Campbell and Kracaw conducted a research based on the efficient information and how the latter adds value to the enterprises. According to the outcome of this research, the satisfactory presentation of critical information in the narrative portion of the financial statements drives the increase of the banks’ profits and liquidity (Jiga, 2005).

In 2005, International Accounting Standards Board (IASB) introduces the IFRS reporting standards framework proposing the transition from the domestic accounting principles of European countries to the International Accounting Standards. One of the main reasons of the implementation of IFRS, as pointed out by Armstrong et al. (2006), was the achievement of capital market integration. Florou and Kosi (2009) noted that the benefits of the adoption of IFRS include “higher comparability data, lower transaction costs and greater international investment”. In addition, Iatridis (2010) points out that IFRS also assists investors
in making “informed financial decisions and predictions of firms’ future financial performance and giving signal of higher quality accounting and transparency”. Therefore, IFRS would tend to decrease “earnings manipulation and improve stock market efficiency”, while they would also tend to positively impact on firms stock returns and stock-related financial performance measures.

Worldwide, this fundamental change in the quality of corporate reporting will be achieved by using further the narrative communication in annual reports and regulators placing attention on the management discussion and analysis statement in the annual report. In some jurisdictions for example, the regulators are extending and revising the guidelines, while in others disclosures are becoming mandatory. In the US, post-Enron, MD&A regulations are being strengthened (e.g., SEC, 2003). In Canada, the Canadian Institute of Chartered Accountants (CICA) issued more detailed MD&A guidelines and six disclosure principles are set out as well as a five-part integrated disclosure framework is developed that covers strategy, key performance drivers, capabilities, results and risks (CICA, 2002). In the UK, the Accounting Standards Board issued revised OFR guidance which draws upon the Jenkins framework (ASB, 2003). Finally, consideration of MC statements was put on the IASB agenda in 2002. An exceptional case between the countries mentioned above is Greece, because its financial reporting system does not follow a recognized structure of Standards related to the presentation of narrative information. However, the last five years Greece has started to adjust its local accounting standards to the IFRS principles.

In addition, several and different studies attempt to evaluate the narrative reports with different methods. A great number of practitioners base this evaluation on a ‘disclosure index’. Botosan (1997), in a wide-known study, proposes an index to measure the voluntary disclosure level in 122 businesses in the machinery industry. Botosan’s study was based on the narrative disclosures’ analysis. The Canadian Institute of Chartered Accountants introduced the Jenkins Report (AICPA, 1994) which sets, principally, the guidelines for the selection of items included in the analysis, and the study of the annual report. The categories of information were five: background information; summary of historical results; key non-financial statistics; projected information; and management discussion and analysis. This study included 35 major elements spread across the five categories.

3. Research Methodology

3.1 Sample and Data

The current study analyses the quality of the narrative reports of 11 Greek commercial banks between the periods prior (2000-2004) and after (2005-2007) the implementation of the IFRS in Greece, according to EU directive from the European Community Regulation No. 1606/2002.

The financial institutions which are included in the analysis are required to prepare their financial statements in accordance to IFRS. We excluded from the sample the
commercial banks operating in Greece for which the data were not covering all the period under investigation (2002-2007). In order to conduct the financial examination, the consolidated financial, profit and loss and cash flow statements were acquired from Datastream.

3.2 Methods

The study explores the following research questions:

**Q1:** Does the value relevance of earnings and book value have changed the stock price in Greek Banking Sector after the mandatory adoption of IFRS?

**Q2:** Does the quality of Narrative Reports and the Key Financial Figures have been improved after the mandatory adoption of IFRS?

**Q3:** Does exist a relation between the key financial figures and quality of MC?

In order to answer the first research question we examine the hypothesis of how the IFRS adoption has changed the value of earnings and book value. In order to answer this question, the Ohlson model is utilized, proposes a linear relation between price of a share ($P$), earnings per share ($E$) and book value per share ($BV$). The dependent variable is considered to be price per share, while the explanatory variables include BV and earnings, both measured on a per share basis, feeding the price-levels regression as follows:

$$P_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 E_{it} + \epsilon_{it}.$$  \hspace{1cm} (1)

where:

- $P_{it}$: is the price of a share of firm $i$ six months after the fiscal year-end $t$;
- $\alpha_0$: is the intercept term’
- $BV_{it}$: is the book value per share of firm $i$ at the end of the year $t$;
- $E_{it}$: is the earnings per share of firm $i$ for time period $t-1$ to $t$;
- $\epsilon_{it}$: is the error term.

The value relevance of book value and earnings of Greek Accounting Standards (GAS) and IFRS, suggesting that IFRS facilitates higher narrative quality accounting information for investors in comparison to GAS (Pagletti, 2009). Specifically, IFRS propose that under these principles, the use of fair value measurements present more accurate not only a company’s current thesis but also its future performance. As Barth et al. (2008) argue, accounting amounts which reveal better a firm’s underlying economics grant investors with important information assisting them in the decision making process. In this light, IFRS is considered to be a more investor-oriented regime. On the other hand, GAS is principally oriented in the direction of stakeholders, with particular awareness to
creditors. Thus, they tend to have a preference on traditional accounting practices in order to maintain capital upholding during the time.

In order to investigate the second research question we compare the amount of narrative information disclosed in MC based on a ‘Management Commentary Scoring Sheet’ proposed by the International Accounting Standards Board (IASB, 2005). The checklist of the Management Commentary Scoring Sheet includes 50 items in 5 categories that makes reference to Management Commentary discussion paper.

- Category 1: the nature of the business,
- Category 2: objective and strategy,
- Category 3: key resources, risks and relationships,
- Category 4: results and prospects and
- Category 5: performance measures and indicators.

Based on a scoring system devised by Robb et. al. (2001), Beattie et al. (2004) and Seah and Tarca (2006) each item disclosed in the MC report was measured giving a score using the binary method, where for each item, the score is 1 if included and 0 if omitted. The total score of the MC quality is calculated as follows:

\[
\times \\
MC\text{score} = \frac{\text{(sum of items rated as 1 with the binary method)/total items}}{100} \quad (2)
\]

The MC\text{score} presents the quality of MC in terms of amount of information included in the narrative portion of the financial statements. In addition, the mean of the main financial figures and ratios (ROE, ROA, etc.) of the two periods are compared in order to examine whether there is any change or not (Noulas, 1999; Staikouras and Steliaros, 1999)

For the third research question, we assessed the statistical dependence between the key financial figures (ROE, ROA, Equity, Debt and Assets) and the narrative reporting quality utilizing the Spearman’s rank correlation coefficient a non – parametric index. The scale of the Spearman’s index \( r \) lays in a range between \(-1\) and \(1\). If \( r = -1\) the two variables examined are considered to be uncorrelated while \( r = 1\) stipulates complete correlation. The upper financial figures where selected because Equity, Debt and Assets are integral parts of Financial Statements and present the financial position of an organization while ROE and ROA evaluate the profitability and performance.

4. Analysis

4.1 Ohlson Model

The outcome of the research indicates that BV and E have a positive correlation not only with \( P \) but also with each other during the examined period. In addition, it highlights that the correlation between the three variables of the study tend to increase after the implementation of IFRS. Besides that, it can be noticed that
there is a greater amount of correlation among earnings and the other two variables.

Table 1 presents the results of the regression model for the period 2002 – 2004 prior the adoption of IFRS. Analyzing the results for this period it can be observed that the earnings per share have positive relation with the price of a share six months after the fiscal year and the probability is 0.00 in contrast with the BV which has negative relationship with the price and the probability of BV is 0.08, that is greater than 0.05 (α=5%). The value of t-Statistic related to E is greater than 2 and as a result the factor b is statistically significant in contrast to BV. The $R^2$ is equal to 0.58 therefore the total variability of share is interpreted in just 58% from the regression line which is adjusted relatively well to the data. The Durbin-Watson criterion is equal to 1.69, approaching the value of 2. However this value is not included in the limits of $d_L = 1.321$ and $d_U = 1.577$. Also, $d_U < d < 4 - d_U = 2.423$, which indicates the existence of correlation in the model.

Table 1: OLS Model 2002-2004

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
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<tbody>
<tr>
<td>C</td>
<td>3.429484</td>
<td>0.352504</td>
<td>9.728932</td>
<td>0</td>
</tr>
<tr>
<td>LEPS</td>
<td>0.801901</td>
<td>0.154883</td>
<td>5.177476</td>
<td>0</td>
</tr>
<tr>
<td>LBV</td>
<td>-0.068011</td>
<td>0.038029</td>
<td>-1.78837</td>
<td>0.0869</td>
</tr>
</tbody>
</table>

Table 2 presents the results of the regression model for the period 2005 – 2007 where IFRS principles have been adopted. Exploring the results of the regression model it can be noticed that the E and the BV positively affect the change of the price six months after the fiscal year as well as and the probability of the two variables is 0.00 and 0.03 respectively, which are lower than 0.05 (α=5%). The value of t-Statistic related to E and BV is greater than 2 and as a result the factor b is statistically significant in both cases. In addition, $R^2$ is equal to 0.71, thus the total variability of the share interpreted in 71% from the regression line which is adjusted relatively well to the data. The correlation and the reliability of the estimates of our model are examined below.
As the results produced in Table 1 are not consistent to answer our hypothesis therefore we investigate the validity of the model presenting in Table 2 which assumes a linear relationship between price, book value and earnings after the adoption of IFRS. Some diagnostic tests were performed to establish goodness of fit and appropriateness of the model. First, it was examined if there is multicollinearity in the model.

The Variance Inflation Factor (VIF) is equal to \(1 / (1- R^2) = 1 / 0.282947 = 3.534\) smaller of the value 10. Also \(TOL = 1 / VIF = 1 / 3.534 = 0.28\) which does not appear to approach the value of 0 and \(VIF / k = 3.534 / 2 = 1.767\) is greater than 1. Examining the results there are three indications of non multicollinearity. Durbin-Watson index is equal to 1.49, which is close to the value of 2 and is included in the interval between \(d_L = 1.321\) and \(d_u = 1.577\) while \(d_u < d < 4 - d_u = 2.423\). As a conclusion, there is absence of correlation in the model.

Finally, it was examined whether the standardized residuals and squared standardized residuals of the estimated model are free from serial correlation. Table 3 presents the LB test for residuals and squared residuals from the regression estimation and shows that the LB statistics for the standardized residuals and standardized squared residuals are not significant (Ljung – Box, 1978). In addition, the independence of the standardized residuals is confirmed by the Durbin-Watson statistics 1.87 (Durbin and Watson, 1950). Also, Table 4 presents the ARCH–LM Test for squared residuals concerning two lags in the residuals showed that the variance does not exhibit heteroskedasticity which is confirmed by the application of the White test \((N*R^2 = 4.94)\). Finally, with the application of the Jarque-Bera test (0.943) it was found that the normality of the residuals \(u_i\) cannot be rejected (Jarque and Bera, 1987).
Table 3: LB test for residuals and squared residuals from the regression estimation

<table>
<thead>
<tr>
<th>Lags</th>
<th>Auto-correlation</th>
<th>Partial Correlation</th>
<th>LB(n)</th>
<th>Lags</th>
<th>Auto-correlation</th>
<th>Partial Correlation</th>
<th>LB(n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.146</td>
<td>0.146</td>
<td>0.6847</td>
<td>1</td>
<td>-0.178</td>
<td>-0.178</td>
<td>1.0166</td>
</tr>
<tr>
<td>2</td>
<td>0.008</td>
<td>-0.014</td>
<td>0.6867</td>
<td>2</td>
<td>0.116</td>
<td>0.087</td>
<td>1.4671</td>
</tr>
<tr>
<td>3</td>
<td>0.119</td>
<td>0.123</td>
<td>1.1785</td>
<td>3</td>
<td>-0.256</td>
<td>-0.23</td>
<td>3.7297</td>
</tr>
<tr>
<td>4</td>
<td>0.105</td>
<td>0.072</td>
<td>1.5758</td>
<td>4</td>
<td>0.445</td>
<td>0.398</td>
<td>10.851</td>
</tr>
<tr>
<td>5</td>
<td>-0.048</td>
<td>-0.073</td>
<td>1.6607</td>
<td>5</td>
<td>-0.175</td>
<td>-0.07</td>
<td>11.999</td>
</tr>
<tr>
<td>6</td>
<td>0.183</td>
<td>0.199</td>
<td>2.9723</td>
<td>6</td>
<td>0.103</td>
<td>-0.014</td>
<td>12.415</td>
</tr>
<tr>
<td>7</td>
<td>0.033</td>
<td>-0.05</td>
<td>3.0168</td>
<td>7</td>
<td>-0.085</td>
<td>0.138</td>
<td>12.712</td>
</tr>
<tr>
<td>8</td>
<td>-0.241</td>
<td>-0.247</td>
<td>5.51</td>
<td>8</td>
<td>0.233</td>
<td>0.011</td>
<td>15.027</td>
</tr>
<tr>
<td>9</td>
<td>-0.015</td>
<td>0.044</td>
<td>5.5198</td>
<td>9</td>
<td>-0.034</td>
<td>0.114</td>
<td>15.079</td>
</tr>
</tbody>
</table>

Note: LB(n) are the n-lag Ljung-Box statistics for the residual series. LB(n) follows chi-square variable with n degree of freedom; the series of residual contains 9 observations.

Table 4: ARCH–LM Test for squared residuals

<table>
<thead>
<tr>
<th>Squared Residuals lag(-1)</th>
<th>Squared Residuals lag(-2)</th>
<th>F-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.22124</td>
<td>0.261784</td>
<td>0.385051</td>
</tr>
<tr>
<td>(0.81916)</td>
<td>(-0.43173)</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Figures in parentheses are t-statistics

4.2 Quality of Narrative Information

The Table 5 presents the descriptive statistics of the MC quality score based on the Management Commentary Scoring Sheet. For the financial reports of the 11 banks the narrative reporting quality has been considerably improved. To be more specific, the mean of the MC score of the narrative part of the financial reports prepared under GAS was 49% while under IFRS has reached 68%, that is a growth of approximately 39% in the mean MC score narrative information. In addition, the maximum level of narrative reporting quality for the period 2002 – 2004 was 0.81 while during 2005 – 2007 increased to 0.90. Conversely, the minimum amount of narrative reporting quality after the adoption of IFRS is 0.32 while during the pre IFRS period declined to 0.02 which points out the enhancement of the reporting quality in greater levels. The latter is depicted on the decrease of the standard deviation from 0.244 to 0.165, which indicates that the data points tend to be very close to the mean. Finally, according to the outcomes, the asymmetry of the probability distribution (skewness) has been decreased as well as the kurtosis has been extremely regularized from 2.5 to 2.04, which means that the quality of financial reporting has been normalized between the 11 banks, attaining higher levels.
Table 5: Descriptives statistics of MC quality

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.487879</td>
<td>0.676061</td>
</tr>
<tr>
<td>Median</td>
<td>0.58</td>
<td>0.68</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.81</td>
<td>0.9</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.02</td>
<td>0.32</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>0.244576</td>
<td>0.165358</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.819579</td>
<td>-0.430442</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.500333</td>
<td>2.042475</td>
</tr>
</tbody>
</table>

In Table 6 the frequencies of MC scores are analysed. The rows of the table present the number of the narrative quality reports for the period before the adoption of IFRS while the columns present the equivalent numbers for the period after the IFRS adoption in Greece. The total of the narrative reports, that is 3 years’ reports for each of the 11 banks before and after the IFRS implementation are categorized according to their MC scores.

Firstly, during the GAS period, the MC scores of the 33 reports have been spread out from very low levels of MC score (approximately 0) reaching a peak of 0.81. The accumulation is observed between 0.30 and 0.80 with the higher percentage to be included in the intervals [0.4, 0.60) and [0.6, 0.8).

On the contrary, in the period after the implementation of IFRS, there is normalization of the differences between “good” and “bad” narrative quality information disclosed, while the mean has been displaced in higher levels of quality information outputs with an increasing dispersion in the intervals [0.6, 0.8) and [0.8, 1) which indicates improvement of narrative reporting quality and an alternation of the financial reporting orientation of the banks.

Table 7 presents the improvement of management commentary quality and in Figure 1 diagrammatically compare the MC quality score of the 11 banks between the two periods. Analyzing more extensively the results, three are the institutions with the highest positive impact on their financial reporting quality: ATE Bank increased its reporting quality from 24.67% to 60.67% a growth of 146%. In addition, Marfin Egnatia Bank raised its reporting quality by 125% despite the fact that it has the lowest level of reporting quality in comparison with the other banks. Finally, Attica Bank improved its MC by approximately 106%. Banks with the highest percentage of MC prior the implementation of IFRS (2002 – 2004) had a steadily progress, such as Piraieus Bank (6.49%), Emporiki Bank (29.03%), General Bank (14.62%) and Eurobank (44.44%) reaching in reporting quality outputs over 80%. The lowest amount of MC of the period 2005 – 2007 has been observed in the Bank of Cyprus and NBG with a percentage of 49.67% and 53% respectively, without significant improvement between the two periods.
Table 6: Analysis of frequencies for the MC scores

<table>
<thead>
<tr>
<th>0.2, 0.4</th>
<th>0.2, 0.4</th>
<th>0.4, 0.6</th>
<th>0.6, 0.8</th>
<th>0.8, 1</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>[0.2, 0.4)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>[0.4, 0.6)</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>[0.6, 0.8)</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>[0.8, 1)</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>4</td>
<td>11</td>
<td>12</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 7: MC scores of the Greek banks for the pre- and after- IFRS implementation periods

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ALFA</td>
<td>56.67%</td>
<td>81.67%</td>
<td>44.12%</td>
</tr>
<tr>
<td>2 ATE</td>
<td>24.67%</td>
<td>60.67%</td>
<td>145.95%</td>
</tr>
<tr>
<td>3 ATTICA</td>
<td>32.00%</td>
<td>66.00%</td>
<td>106.25%</td>
</tr>
<tr>
<td>4 CYPRUS</td>
<td>46.03%</td>
<td>49.67%</td>
<td>7.89%</td>
</tr>
<tr>
<td>5 EMPORIKI</td>
<td>62.00%</td>
<td>80.00%</td>
<td>29.03%</td>
</tr>
<tr>
<td>6 ETE</td>
<td>45.67%</td>
<td>53.00%</td>
<td>16.06%</td>
</tr>
<tr>
<td>7 EUROBANK</td>
<td>60.00%</td>
<td>86.67%</td>
<td>44.44%</td>
</tr>
<tr>
<td>8 GENERAL</td>
<td>70.67%</td>
<td>81.00%</td>
<td>14.62%</td>
</tr>
<tr>
<td>9 MARFIN</td>
<td>21.33%</td>
<td>48.00%</td>
<td>125.00%</td>
</tr>
<tr>
<td>10 RIRAIEUS</td>
<td>77.00%</td>
<td>82.00%</td>
<td>6.49%</td>
</tr>
<tr>
<td>11 T BANK</td>
<td>40.67%</td>
<td>55.00%</td>
<td>32.54%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>48.79%</td>
<td>67.61%</td>
<td>38.56%</td>
</tr>
</tbody>
</table>

Moving forward to our analysis, we attempted to inspect whether or not there is improvement in some important ratios and figures of the two periods. The factors which were analyzed are extended from ROE and ROA to Equity, Debt and Assets, where we used the mean of the 11 banks. We examined the trends of ROE and ROA ratios between the two periods (Figure 2), which Noulas (1999) and Staikouras and Steliaros (1999) examined in previous researches as important factors of assessing the performance of Greek banks. The results shown that ROE improved approximately 219%. At the same time, there is a positive change of ROA from 0.433 to 1.058 which is translated into a growth of 144.47%. The ROA indicates that the banks’ management deploys effectively its assets while ROE depicts the banks’ efficiency at generating profits from every unit of shareholders’ equity using investment funds to generate earnings growth.
Turning now to the trend analysis of DEBT, Equity and Assets between the two periods (Figure 3), the Equity of the 11 Greek banks between the two periods, it appears to be increased from 906.52 to 1.685.58, a raise of 85.94%. Besides that, there is an increase in Debt from 2.172.64 to 3.657.03. Finally, it becomes visible that after the IFRS adoption, banks tend to invest considerably in assets, as their figure increased from 17.190.855 to 27.499.640, which consists an increase of approximately 60%. As we probably conclude, the main financial figures of the 11 banks have been noticeably improved, assuming a positive impact after the transition from GAS to IFRS Standards.
4.3 Spearman's Correlation Coefficient

Having observed a positive impact of IFRS adoption on the major financial figures, the study focused on the assessment of which of these indicators affect mainly the narrative reporting quality of the two periods (2002-2004) and (2005-2007). The sample size used was the eleven banks (n=11). Table 8 examines the correlation of financial figures with MC before and after the implementation of IFRS, testing the following variables: Equity, Debt, Assets, ROA and ROE. During the Greek Accounting Standards period none of the five indicators seem to have strong correlation with MC.

Table 8: Correlation of financial figures with MC

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ROA - MC</td>
<td>-0.10</td>
<td>0.15</td>
</tr>
<tr>
<td>2 ROE - MC</td>
<td>-0.06</td>
<td>0.15</td>
</tr>
<tr>
<td>3 ASSETS - MC</td>
<td>0.26</td>
<td>0.28</td>
</tr>
<tr>
<td>4 EQUITY - MC</td>
<td>0.32</td>
<td>0.26</td>
</tr>
<tr>
<td>5 DEBT - MC</td>
<td>0.27</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Conversely, under the IFRS principles it has been observed that Debt has a strong correlation with MC with a correlation coefficient of 0.69 which indicates a satisfactory level of significance between 5% and 1% according to the Spearman's scoring. Basing on the analysis of Florou and Kosi (2009) the changes on the financial reporting system with the development of IFRS, the financial institutions are likely to increase debt “from a larger pool of capital at a lower cost”. Thus, as they stated, there is a strong relation between the quality which enhances the IFRS
implementation in the narrative reports and Debt. The improvement of narrative reporting quality after the adoption of IFRS shows that banks are tending to provide an increasing amount of loans, as they have better information provided by their potential customers.

5. Conclusions

The purpose of the current research examines the periods prior and after the implementation of the IFRS focusing on the effects on the financial and narrative reporting of eleven (11) Greek commercial banks. Firstly, the present study investigates how the value relevance of earnings and book value has changed between the two periods. The Ohlson model has been utilized proposed a linear relationship between price, BV and EPS measured on a per share basis. The regression model point out that price has been positively affected by BV and EPS after the implementation of the IFRS principles, in contrast with the period before IFRS where there was not linear relationship between price, BV and EPS. Secondly, the current paper examines the change of the narrative reporting quality of the 11 banks while inspecting the trends of the key financial figures between the two periods. The results clearly show that MC has been considerably improved under the IFRS principles as well as there is a positive impact in the financial figures (ROE, ROA, Assets, Equity and Debt) of the two examined periods. Finally, the research assesses the correlation of the financial figures of the banks in relation with MC. Evidence indicates that Debt with a level of significance 0.69 tends to be the most important indicator of MC quality after the implementation of IFRS, while the other financial figures of the study do not seem to have a strong relation with MC during the examined periods.

Considering the limitations of the study, we have to take into serious consideration that the research has analysed 11 banks which means that the number of observations may not be convenient. In addition, an examination of a 5-year period before and after the adoption of IFRS would probably export more reliable results. Apart from these limitations, we propose some implications for future research. The examination of a larger sample of banks would compare the quality of financial reports of European banking sector. Finally, another important issue is the improvement of the Management Commentary Scoring Sheet adding a 5-scale assessment criteria of amount of quality.
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Investigating the link between motivation, work stress and job performance. Evidence from the banking industry.

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Abstract
This empirical paper focuses on employee Job Performance to study its relationship with employee perceptions regarding job Motivation and work Stress in a services context. Based on a sample of 143 respondents drawn from private (n=71) and public banks (n=72) in Greece, the paper uses Alderfer’s (1967) theory of motivation (ERG) to examine the impact of multiple needs’ satisfaction (namely, Existence needs-pay, Existence needs-fringe benefits, Relatedness needs-supervisors, Relatedness needs-peers and Growth needs) on employees’ perceived job performance. More, it examines the impact of work stress and also such variables as gender, age, bank type, work experience, position and income on job Performance. Unlike the four (out of five) motivation dimensions studied it is the Growth needs element (only) that is found to have a positive impact on employee job Performance. The analysis also supports a negative relationship between Stress experienced at work and employee job Performance while the latter does not seem to be influenced by any of the control variables examined. The findings shed light into key drivers of job Performance and may contribute to the development of HR strategies, bank policies or practices aiming at enhancing the human capital potential and thus, individual employee performance outcomes thereby assisting ultimately banks’ competitiveness in a period of economic recession.

Keywords: Job motivation, work stress, job performance, Banking, Greece.
1. Introduction

Competitive advantages stemming from human resources are vital for firms’ success in the contemporary, dynamic, business environment (Boselie and Wiele, 2002, Vouzas, 2006). It seems that various problems manufacturing and service firms encounter nowadays, could be attributed to an extent to the inadequate alignment between a firm’s strategies and its human resources thereby resulting into an ineffective response to the continuous changes taking place in the international and complex, environment where firms nowadays operate (Kotabe and Helsen, 2001). By implication, the strategic management of human resources is considered crucial for the achievement of the various organizational and individual outcomes including job performance (Ooi et al., 2007).

The attainment of organizational outcomes and the performance construct in general have been very popular issues among researchers in the business field while employee job performance in particular is considered to be a key individual outcome (and a driver of success) in a given context including the financial and banking services context (Gabbott and Hogg, 1997). In this context, frontline bank employees were found to play a decisive role in delivering high quality services, promoting the corporate image and improving customer satisfaction (LeBlanc and Nguyen, 1988; Lewis and Gabrielsen, 1998; Yavas et al., 2003; Karatepe and Tekinkus, 2006). Here, the notion of employee job performance becomes indeed even more vital particularly because in a service context the quality of the services offered cannot be always equally standardised across all its customers (Kotler and Keller, 2006). Particular attention needs to be paid therefore, to the notion of human capital’s “well being” leading to performance in any given service organisation. By implication, the issues of motivation and work stress become important aspects of service employees’ well being and performance (as explained below). Indeed, this is also reflected in the findings of a large-scale survey undertaken by the Gallup Management Consulting Group showing that intrinsic motivation is one of the key talents best salesmen (front-line employees) possess (Brewer, 1994).

Having acknowledged the above along with the fact that the motivation literature has been mainly dominated by theoretical vagueness (Arnolds & Boshoff, 2002; Miao et al., 2007), the need motivation theory of Alderfer (1967, 1969) has been adopted here to investigate the impact of employee need satisfaction on individual outcomes such as job performance. In addition to exploiting the advantages of Need theory’s robustness and job specification orientation, the former theory has been attracting attention because it is perceived to be one of the most enduring ways to understand motivation (Aram and Piraino, 1978). The assumption is that the satisfaction of certain needs is the main driving force for employees’ motivation in order to improve their job performance. The identification (and satisfaction) of these specific needs and the understanding of their nature offers insights into work-related behaviours that promote job performance and also loyalty (Stein and Hollowitz, 1992; Arnolds & Boshoff, 2002; Miao et al., 2007). In addition earlier research (unlike Alderfer’s theory suggesting a multi-dimensional perspective) relied on global internal and external motivation aspects failing so to highlight key relationships among motivation and performance according to social psychology (Amabile et al., 1994; Miao et al., 2007). Also, few scholars only, have explored causal linkages between dimensions of motivation theory and work behaviours grounded on sound theoretical foundations.
Moreover (and related to the fact that particular emphasis has to be paid to the notion of human capital’s well being leading to performance in any service organization), it is unclear what effect management practices used by banking organizations to achieve their goals have on their human capital’s overall well-being as reflected particularly, on employee work stress levels experienced, motivation and job performance. While it is acknowledged that stress is an inseparable part of everyday life (Certo, 2003), common management practice often assumes the need of a reasonable amount of pressure, anxiety or fear in the environment to motivate employees to achieve higher performance; besides motivating employees, pressure may also have side effects such as the creation of employee dissatisfaction or even mental alienation (Sdrolias et al, 2005) which in turn, may compromise individual and/or organizational performance thereby affecting customer satisfaction, too. Indeed, high quality service delivered to customers is rather more likely to be achieved if employees are viewed and treated as internal customers (Gummesson, 1991). Understanding the link between job motivation, imposed work stress levels and employee job performance becomes vital particularly for firms experiencing the adverse effects of the recent crisis affecting the world’s various industries. For example, given that many countries (including Greece) have been lately subjected to the effects of this crisis, employees in general (and those currently working in the Greek banking sector in particular), may well face the challenge of remaining competitive in their industries and jobs (or even forced to experience a likely merger or acquisition situation) where they are required to meet higher performance standards in a period of economic recession and uncertainty while watching the rising unemployment levels along with their own disposable income shrinking due to the harsh economic measures taken.

In light of all the above coupled with the fact that few studies (only) on employee motivation provide robust empirical evidence in a more integrated perspective while most attempts seem quite theoretical in terms of adopting global constructs and linking work motivation to employee outcomes leading thus, to inconclusive findings, this empirical study aspires to bridge the former gap. This study investigates the relationship between stress employees experience at work, job motivation (as conceptualized by Alderfer, 1967) and job performance in the banking sector. In fact, this research seeks to generate evidence on the determinants of employee job performance in Greek banks and more specifically on the link between: (1) employee job motivation and job performance and (2) the perceived work-stress and job performance. Also, this paper explores the impact of various demographic and organizational characteristics on employees’ perceptions about work-stress, job motivation and job performance. Furthermore, it brings evidence on (3) the role of bank-type, age, gender, work experience, monthly income and working position in the perceived amount of total stress, job motivation and employee job performance.

To serve the above aim, a survey was undertaken based on a sample of 143 employees drawn from two Greek banks (one public and one private). The findings identify the levels of work-related stress and job motivation in the banking sector’s work environment while the study’s theoretical contribution derives from appreciating better the link between job performance and the former antecedents (see (1), (2), (3) above). Such empirical knowledge on specific needs causing certain behaviours can be also useful from a practitioner’s point of view as the findings may assist the development of HR strategies for improving individual (and ultimately Greek banks’)
performance outcomes and/or offer managers guidance towards the development of motivation practices fitting to specific individual (or groups of) employee needs.

2. Theoretical Background

The following review of the literature focuses on job motivation, work stress and employee job performance of which, the latter constitutes the dependent variable and the former two, the independent variables of this study (see more in section 2.3).

2.1 Motivation

The key role of employee motivation in organisations has long been acknowledged in the relevant organizational behaviour literature (O'Reilly, 1991). While it is generally better for people's mental health to work (rather than not) because unemployment has been linked to depression, anxiety and even suicide (Blakely et al., 2003), it is also clear that organisations (and employers) need motivated employees to achieve in any given goals set (Smith, 1994). Motivated employees are productive employees and help organizations to survive and prosper. In this context, one may define the notion of motivation as a psychological process that gives behaviour purpose and direction (Kreitner, 1995), or as an internal drive to satisfy an unsatisfied need (Higgins, 1994), or as “internal processes and external forces that direct behaviour” (Naylor, 1999, p.538). It is actually one of the management's key tasks to constantly motivate their employees, something difficult at times, as what motivates one person may not motivate another and certainly what motivates one do not necessarily remain static over time. For example, it has been argued that as income increases money becomes less of a motivator, or when employees get older, interesting work becomes more of a motivator (Kovach, 1987).

While the benefits individuals may gain from a job are numerous (e.g. income, resources, social status, structure, moral satisfaction, self-esteem and social support) and help them achieve balance in their lives whereas their absence can even damage their mental health (Murphy and Athanasou, 1999), the existing literature focusing on the link between motivational elements and job performance is mainly dominated by theoretical vagueness and inconclusive empirical results (Arnolds & Boshoff, 2002; Miao et al., 2007). Nevertheless, the notion of motivation and the factors that determine it has long been an issue of concern in the relevant literature and several motivation theories have been advanced in this respect, which have been grouped into three main categories namely, Content, Process and Reinforcement theories of motivation (Naylor, 1999). Tables 1 summarises the first two categories of motivation theories while the third category is discussed below.

More specifically: (i) Content theories (see table 1) facilitate managers’ thinking about how to understand and satisfy employees’ innate needs through employment. An example is Alderfer’s ERG theory discussed below; (ii) Process theories (see table 1) place more emphasis on the process of motivation rather than its content and tend to view employees as conscious individuals seeking to maximise benefits from work; (iii) Reinforcement theories link desired behaviours to rewards thereby encouraging employees to act in a way that can benefit the organization (Naylor, 1999). A prominent example is Skinner’s (1969) theory.
Table 1: Summary of Content and Process theories of motivation

<table>
<thead>
<tr>
<th>Content Theories</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maslow's need-hierarchy theory (1943)</strong></td>
<td>Ranks human needs hierarchically in a five level pyramid where people seek to satisfy their needs from bottom to top starting from Physiological, Safety, Belongingness, Esteem, and moving to Self-Actualization needs</td>
</tr>
<tr>
<td><strong>Alderfer's modified hierarchy of needs ERG (1967)</strong></td>
<td>Groups Maslow's needs into 3 levels: (E) existence, (R) relatedness and (G) growth. Satisfaction at one level leads to progression to the next level, while dissatisfaction at one level drives regression to the previous one.</td>
</tr>
<tr>
<td><strong>Herzberg's two-factor theory (Herzberg et al. 1959)</strong></td>
<td>Distinguishes between factors preventing dissatisfaction and affecting motivation: the hygiene and the motivation factors. Hygiene factors are needed to ensure an employee is not dissatisfied. Motivation factors are needed to motivate one to higher performance.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process theories of motivation</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equity theory (Adams, 1963)</strong></td>
<td>Motivation is influenced by the sense of “fairness” that workers possess, after comparing their efforts and rewards ratio with others, which are in the same situation. Adams used the terms “inputs” and “outputs” instead of efforts and rewards to describe as “inputs” the qualifications, effort and competence and as “outputs” the pay, prospects, benefits and recognition.</td>
</tr>
<tr>
<td><strong>Expectancy theory (Vroom, 1964)</strong></td>
<td>It advances that motivation is the product of an individual’s “expectancy” that a certain effort will lead to the intended performance, the “instrumentality” of this performance to achieve a certain result and “valence” which is the desirability to achieve that result.</td>
</tr>
<tr>
<td><strong>Job characteristics (Hackman and Oldham, 1980)</strong></td>
<td>A theory based on the assumption that a job’s characteristics are independent of individuals - employees. These key job characteristics that are likely to influence the motivating potential of a job are: skill variety, task identity, task significance, autonomy and feedback.</td>
</tr>
<tr>
<td><strong>Goal-Setting Theory (Locke, 1984)</strong></td>
<td>According to this theory, individuals’ goals must be aligned with the overall goals of the organization. Individual goals must be realistic and mutually agreed. The more difficult a goal is the more motivation it produces. Motivation through goals is influenced by such factors as: Clarity, Challenge, Commitment, Feedback, Task complexity.</td>
</tr>
</tbody>
</table>
Skinner’s term “reinforcer” refers to any stimulus that, when contingent to a response, serves to increase the rate of responding. A “reinforcer” controls behaviour. Skinner’s theory downplays the role of punishment in changing behaviour and contradicts with the existing Law of Effect by stating that a desired behaviour increases with either a positive or a negative type of reinforcement. More specifically, a Positive reinforcer relates with a reward after a desired behaviour, which increases the possibility for that behaviour to reoccur. The desired behaviour can also increase by using negative reinforcement, which involves steps designed to lead someone to the correct action in order to avoid an unwanted consequence. Negative reinforcement should not be confused with Punishment; the latter is an event that decreases (undesired) behaviour either by an aversive stimulus contingent on a response or by taking away a rewarding stimulus contingent on a response. Extinction is a form of punishment including a withdrawal of intrinsic rewards (or pay), pressing one to avoid an undesired behaviour (Naylor, 1999).

This study however, places emphasis on Content theories and more specifically on Alderfer’s (1967) modified hierarchy of needs (ERG) theory. ERG expands further Maslow’s widely acknowledged hierarchy of needs theory by categorizing needs into three groups, Existence, Relatedness and Growth needs. The lower order needs (physiological and safety) are grouped into the Existence category, the levels of love and esteem needs into the Relatedness category, while the Growth category contains the self-actualization and self-esteem needs. (i) **Existence** needs include physiological and safety needs such as hunger, thirst, sex; (ii) **Relatedness** needs include social and external esteem relating to family, co-workers, friends and employers; (iii) **Growth**, include internal (or self) esteem and self-actualization needs (see more in section 2.4). Unlike Malsow’s well-known conceptualisation, ERG is empirically based (e.g. Arnolds and Boshoff, 2002) and its advantages stem from the job specific orientation its three dimensions reflect (e.g. pay, fringe benefits, relatedness needs from co-workers and superiors). ERG states that human needs cannot be easily depicted in terms of a five-level hierarchy as Maslow’s theory suggests. Needs may vary from one employee to another and may differ for the same person over time; moreover, each employee has different needs to satisfy (simultaneously) and if a manager focuses on any one need at a time, employees will not be motivated enough in their tasks. According to ERG, need satisfaction at one level (or category) of needs drives progression to the next level. In contrast, if needs at a given level are not met then an employee regresses to the lower order needs. For example, if a need for self actualization or internal (self) esteem is not satisfied then an individual will invest effort into the relatedness category hoping thus, to achieve the higher order needs pursued. This is known as the frustration-regression principle the signs of which, an experienced manager should identify to minimize frustration and motivate an employee to progress further.

### 2.2 Work-related stress

Following the brief review on motivation, the emphasis now shifts to the all-important issue of stress employees may experience at work. Selye (1956), as cited in Le Fevre et al. (2003), first introduced the term ‘stress’ to describe physical and psychological responses to severe conditions or influences. He used the word ‘stress’ which is an engineering term, to describe the responses to a force that when is implemented in bodies, causes deformation.
### TABLE 2: Stress models

<table>
<thead>
<tr>
<th>Theory</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Role Stressors</strong>&lt;br&gt;Kahn et al (1964)</td>
<td>Stress is defined as the result of stressors, which are, Role ambiquity, Role overload and Role conflict. The bigger the amount of stressors is the bigger is the stress.</td>
</tr>
<tr>
<td><strong>Job Demand-Control Model</strong>&lt;br&gt;(DCM) Karasek (1979)</td>
<td>Job stress arises when high job demands (especially work overload and time pressure) are combined with low job control. Job control is defined as the ability employees have, to take decisions themselves about how they will achieve their job demands.</td>
</tr>
<tr>
<td><strong>Conservation of Resources</strong>&lt;br&gt;(COR) Hobfoll (1989)</td>
<td>Stress is defined as a produced tension, which derives from the imbalance between what is demanded and offered to satisfy this demand. Job resources are related to: the organization’s offerings, interpersonal relationships, working structures and task structures.</td>
</tr>
<tr>
<td><strong>Job characteristics</strong>&lt;br&gt;Ganster and Schaubroeck (1991)</td>
<td>There is strong indirect evidence that stressors (job characteristics) affect human health. It is also assumed that there is a strong relationship between working experiences and psychological and emotional responses.</td>
</tr>
<tr>
<td><strong>Effort Reward Imbalance</strong>&lt;br&gt;(ERI) (Siegrist, 1996)</td>
<td>Job strain is the outcome of the imbalance between high effort and rewards both intrinsic and extrinsic (salary, esteem reward, career opportunities like promotion prospects, job security and status consistency).</td>
</tr>
<tr>
<td><strong>Person-environment P-E fit theory</strong>&lt;br&gt;(Edwards and Cooper, 1990)</td>
<td>According to this theory, when there is a misfit (P-E fit) between the person and the environment, then this becomes a stressor and stress results. Three basic relationships between stressors and stress: The demand-ability dichotomy, the needs-supplies dichotomy, a combination of the demand-ability and the needs-supplies.</td>
</tr>
<tr>
<td><strong>The Cybernetic theory</strong>&lt;br&gt;(Cummings and Cooper, 1998)</td>
<td>This theory considers that stressor and stress development is a temporal situation. What is perceived as distressful situation for someone maybe eustressful for someone else.</td>
</tr>
<tr>
<td><strong>Control theory</strong>&lt;br&gt;(Spector, 1998)</td>
<td>The more control someone has on the factors that can create stress, the less is the possibility to experience stress. This theory also determines the range of control, from complete autonomy, personal control over schedule and workload to no personal control over schedule or workload.</td>
</tr>
</tbody>
</table>

While there is an agreement among researchers on the stress related terminology adopted (Maslach, 1998), Cummings and Cooper (1998) point out the difficulty to develop a coherent theory on stress, as different disciplines (medicine, psychology,
sociology, management) and research methodologies have looked into this area. Nevertheless, a constellation of key stress related conceptualisations are presented in Table 2 (see above). Stress can be defined as “the non-specific response of the body to any demand placed upon it” (Selye, 1987, p.17). Selye (1956) used also the term ‘stressor’ to describe the force that when acting to a body, creates stress. Le Fevre et al. (2003) maintains that the term ‘stress’ describes a force that causes deformation, while the notion of response is better described by the term ‘strain’ referring to the manifestation of stress in a body. Selye (1964) also, used the term eustress (or good stress); while eustress and distress are regarded as being distinct elements of total stress, it is only the individual who can perceive the eustress (or distress), according to whether one perceives the demand stimulus as pleasant or not (Selye, 1987).

Having acknowledged that employers would rather maintain an amount of pressure or stress at “optimal” levels to boost employee performance (Certo, 2003), it is not easy to maintain a fine line between stress levels, motivation and one’s well being. Internal competition may for example, exert an amount of pressure or stress that at times can act as a motivator. In this respect, Papasolomou-Doukakis et al. (2004) suggest that a competitive internal environment can motivate staff to improve performance; such competition among a firm’s salesmen is facilitated by focusing on the achievement of sales targets, linking the achievement of sales targets to monetary rewards and using league tables involving sales performance.

Too much pressure however, may have stress related implications such as employee mental alienation and/or impact on individual performance (Sdrolias et al, 2005); also, destruction of team spirit, dissatisfaction with or absence or even resignation from work can be manifestations of work stress (Strahan et al, 2008). Moreover, occupational stress may cause a loss of talent and an increase of training cost, due to high turnover (Cartwright and Boyes, 2000). While stress is inevitable, it constitutes a real threat to the quality of life for employees (Dyck, 2001) not to mention its link to an increased risk of morbidity and mortality (Siegrist, 1998). Also (and related to the above), is the widely studied effect called ‘burnout’. The term burnout syndrome was first introduced in the 1970s and defined as a response to chronic work stress (Freudenberger, 1974). It is a three-dimensional syndrome involving emotional exhaustion, depersonalization and decreased personal accomplishment (Byrne, 1993) dimensions that do not necessarily appear in the same order (e.g. see Golembiewski et al., 1986; Leiter and Maslach, 1988).

According to Certo (2003), the Yerkes and Dodson’s (1908) experiments with mice have introduced the idea of an optimal level of arousal of stress that can be a motivator for learning where too much or too little stress will work against learning. Le Fevre et al (2003) disagree with the implementation of the optimal level of stress idea in working environments. They argue that managers being practically advised to impose stress, err in terms of the fact that they can’t evaluate which amount of stress is optimal. In addition, individuals with a strong goal orientation can be more vulnerable to different kinds of work-related negative impacts (Burke 2000). A high focus on work-related goals has been associated with a low interest in other goals, such as those pertaining to family, close relationships and leisure activities, which may buffer the negative impact of work on one’s well-being (Salmela-Aro and Nurmi, 2004). The cumulative outcome, as Cranwell-Ward (1998) describes the notion of stress, might be a physiological and/or psychological reaction occurring when
individuals meet a threat or challenge that is beyond their immediate capacity; extended exposure to such stimulus may cause physical reactions (e.g. insomnia), emotional (e.g. depression) and mental reactions (e.g. forgetfulness).

Occupational stress has been of increasing concern to employers and employees and has attracted employers' interest because the risk of being persecuted legally for damages to stressed employees increased (Midgley, 1997). The financial effect of employees’ ill health (or well being) on employers is certainly not negligent and Harris (2000) highlights how important it is for managers to appreciate that maintaining motivated and satisfied employees is likely to lead to happy and satisfied customers, too. Clearly, employers have a moral (at least) obligation to protect their employees’ health and well being by providing a healthy (and possibly non-stressful) working environment (Patterson et al., 1997). Given the fact that non-properly managed stressors can be linked to poor employee well-being, lower productivity and increased absence from work, there are frameworks such as the Transactional model (Lazarus and Folkman, 1984) and Sedgeman's (2005) Health Realization -Innate health model, whose implementation is claimed to foster a healthy and productive working environment.

Evidently, such frameworks imply how important stress is in terms of influencing individual employee outcomes such as job performance and job satisfaction. The consensus among these models is that, individuals need to possess the necessary coping strategies deriving from either one’s mental training to sustain positive thinking and/or the organization itself that helps stressed individuals to cope with the adverse effects of stress. Although a causal link seems to exist between work stress and emotional reactions at an individual level, measurements of other physiological and/or psychological responses due to either eustress or distress will not be made in the context of this study. Yet, examining the link between stress and bank employee job performance is by itself a controversial issue for bank management and employee trade unions. The key aim here, is to address (at least partially) the former controversy by looking into say, whether bank practices manage to motivate employees while striving simultaneously, to keep work stress at low levels.

2.3 Job Performance

Employee job performance is this study’s dependent variable (and one of the highly studied variables in organisational psychology); it refers to “the level of productivity of an individual employee, relative to his or her peers, on several job-related behaviors and outcomes” (Babin and Boles, 1998, p.82). According to Ilgen and Klein (1988), the direct impact of motivation on the productivity of a unit suggests the need to understand factors that affect motivation; such understanding helps managers modify conditions in the work setting to encourage individual behaviour so as to remain consistent with the organizational goals set. Nevertheless, Job performance is a multidimensional construct for which an agreement among researchers on how to conceptualise and capture has not been easy to reach. For example, Suliman (2001) suggested six dimensions namely, work skills, work duties, work enthusiasm, quality and quantity of work and readiness to innovate. Farth et al., (1991), captures performance in terms of quality and quantity, while Yousef (1998), suggests the use of quality and productivity of performance. More, Borman and Motowidlo (1997) distinguish job performance into task and contextual performance. Task performance
refers to behaviors that are directly involved in producing goods or services, while contextual performance involves behaviors that are not directly related to their main task but shape the organizational, social, and psychological context (Werner, 2000). For example, when employees help each other, cooperate with their supervisors, or make suggestions about organizational processes, they are engaging in contextual performance (Van Scotter et al., 2000).

Regarding the notions of employee motivation and job performance, the Process and the Content motivation theories (see Table 1) link the former to the latter construct. Indeed, the goal-setting theory (Locke and Latham, 2002) claims that work-motivation can predict job performance as the more challenging a goal is, the higher the performance level becomes and the higher the perceived satisfaction. The Expectancy theory (Vroom, 1964) also argues that an employee’s job performance is determined by the degree to which available rewards are attractive, so as efforts lead to higher levels of performance (i.e. first-level outcomes) which in turn, leads to second level outcomes (e.g. praise, friendship, wages). Yet, the level of performance is based on the degree to which, one values the second-level outcomes (i.e. need satisfaction). Along the same lines, Alderfer’s (1967) Need theory in particular, states that what motivates an individual in his/her work is the desire to satisfy three groups of core needs (see more in 2.1).

Arnolds and Boshoff (2000), investigate the relationship between need satisfaction, as proposed by Alderfer’s theory, and employee job performance. They conclude that satisfaction with pay has a significant influence on job performance, while satisfaction with fringe benefits and relatedness needs do not influence performance. Moreover, the satisfaction of relatedness needs from peers has a significant positive influence on frontline employees’ performance unlike the satisfaction of growth needs. Nevertheless, the latter significantly influences the top managers’ performance. Grasping what these needs actually are would offer greater insights into work-related behaviours so as to increase job performance (Arnolds and Boshoff, 2002). In light of the above discussion (see also discussion 2.1) one can conclude that the notions of employee motivation and job performance are positively related in the relevant literature, which is also clearly reflected in the hypothesised relationship (H1) presented in section 2.4 below.

Regarding the notions of employee work stress and job performance expected, Yerkes and Dodson’s (1908) work suggested an inverted U-shaped function between arousal of stress and performance; an optimal level of arousal of stress can be a motivator for better performance, while too much or too little creates no motivation to perform. Allen et al., (1982) suggested that there are two forms of stress: functional and dysfunctional, while the dysfunctional stress is dominant in organizations. If organizational stress is more likely to be dysfunctional then it is possible to have a negative influence on performance. Jamal and Baba (1992) examined the influence of work stress on productivity based on four job stress factors (overload, conflict, ambiguity, and adequacy of resources), which had a slightly different (only) effect depending on the employee group examined and the measures of productivity (quality, quantity, and motivation) used; they concluded that the greater was the stress the less productive the workforce. Sullivan and Baghat (1992) considered four hypotheses for the relationship between stress and performance namely, stress may (1) increase performance, (2) decrease performance, (3) have no effect on
performance and (4) have an inverted-U shape relationship with performance and concluded that stress and performance are negatively related. This is consistent with Tubre and Collins (2000) findings supporting a negative relationship between stress and performance. Along the same lines, Tuten and Neidermeyer (2004), examined the effects of stress on performance between two different groups namely, pessimists and optimists and there wasn’t any support for the inverted-U relationship mentioned above. While a positive relationship between stress and performance (up to certain point) is not rejected by the above study (i.e. this could also be due to the lower to moderate stress levels found), the findings mostly favour a negative relationship where the pessimist-group perceives higher levels of stress than the optimists; yet, the fact that the two groups’ ability to cope with stress differs may have caused individual performance differences, too (see more in Tuten and Neidermeyer, 2004). While the above discussion implies that the relationship between stress and job performance is not always clear, there is stronger evidence in the relevant literature for a negative relationship between work-stress and job performance. This is also reflected in the hypothesis (H2) proposed in section 2.4 below.

2.4 Research Model and Hypotheses

The proposed conceptual framework shown in Figure 1 depicts the likely impact of job motivation and work-related stress on employee job performance. The relevant hypotheses are presented below.

With respect to the independent variable of job motivation remember that this study uses Alderfer’s (1967) conceptualisation of motivation (see ERG modified hierarchy of needs theory in section 2.1.1); hence the emphasis is on employee perceptions about specific motivation factors including, (i) existence needs (pay), (ii) existence needs (fringe benefits), (iii) relatedness needs (superiors), (iv) relatedness needs (peers), (v) growth needs and their influence on job satisfaction (i.e. the dependent variable shown in Figure 1). Regarding the independent variable of work stress, the focus is on the total sum of stress at work and involves employee perceptions about such stress factors as Demands, Control, Support, Inter-relationships and Role and their influence on employee job satisfaction. Next the research hypotheses are outlined.

Following the discussion in sections 2.1 and 2.3 one can conclude that motivation and bank employee job performance are positively related. By implication:

\textit{H1: The higher the job motivation, the higher the job performance is expected to be.}  
In light of the adoption of Alderfer’s multidimensional conceptualisation of motivation, a relationship should be also expected between each of the five motivation dimensions and employees’ job satisfaction (Arnolds and Boshoff, 2002). Hence:

\textit{H1a: The higher the level of job motivation related with existence needs (pay), the higher the job performance is.}  
\textit{H1b: The higher the level of job motivation related with existence needs (fringe benefits), the higher the job performance is.}  
\textit{H1c: The higher the level of job motivation associated with relatedness needs (superiors), the higher the job performance is.}  
\textit{H1d: The higher the level of job motivation associated with relatedness needs (peers), the higher the job performance is.}
H1e: The higher the level of job motivation related with growth needs, the higher the job performance is.

Figure 1. Conceptual framework

Following the relevant discussion involving work stress in sections 2.2 and 2.3, one is inclined to conclude that on average a negative relationship between stress and employee job performance should be expected in banks. In fact:

H2: The higher the level of work-stress employees experience, the lower the job performance is expected to be.

In addition to the hypotheses tested, this paper also explores the role of personal and organizational variables (i.e. bank type, age, gender, work experience, position, income) on bank employee perceptions about work stress, job motivation and job performance (see Figure 1).

3. Research Methodology

3.1 Sample

It was shown in the past, that people who work within the public sector have higher rates of self-reported work-related stress than those in the private sector (Kvarnstrom, 1997). To test the research hypotheses while avoiding any bias due to likely differences between the private and the public sector employees, a survey was carried out in two well-known banks in Greece (one public and one private). Specifically, five branches of the public bank (named Bank A) and five branches of the private bank (named Bank B) have been surveyed at the region of Thessaly.
The research focuses mainly on frontline bank employees where 220 questionnaires were administered altogether, using the “drop-off and collect” method. The sample consists of 143 employees (Bank A: 72 valid questionnaires and Bank B: 71 questionnaires), which corresponds to an overall 65% response rate. The respondents work in different positions (i.e. clerks, cashiers, supervisors, assistant managers, managers), 59% of them are female, 54% are more than 40 years old and the majority of them (66%) have got a university (and/or a postgraduate) degree.

3.2 Questionnaire Design, Variable Operationalisation and Measure Validation

A structured questionnaire was employed to carry out the survey. The measurement instrument was evaluated twice before released. Firstly, ten branch managers of the banks involved examined it. Secondly, two experienced researchers evaluated it and the instrument’s cognitive relevance to the banking sector was confirmed prior to data collection. The instrument was developed by adapting existing multi-dimensional scales to capture Alderfer needs, work stress and job satisfaction. For each item of the measures used, respondents were asked to indicate agreement on a seven-point Likert scale. Alderfer’s (1967) operationalization was used to capture the construct of motivation (i.e. the extent to which one’s job satisfies his/her needs). It is clear from Table 3 that the measures employed have a solid academic foundation as other researchers in the field (e.g. Arnolds and Boshoff, 2002, Weiss, et al. 1967; Kahn, et al, 1964) have used similar items.

<table>
<thead>
<tr>
<th>Measures</th>
<th>Items</th>
<th>Basic References</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alderfer needs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existence needs-pay</td>
<td>4</td>
<td>Alderfer (1967)</td>
</tr>
<tr>
<td>Existence needs-fringe benefits</td>
<td>4</td>
<td>Alderfer (1967)</td>
</tr>
<tr>
<td>Relatedness needs-respect from superiors</td>
<td>4</td>
<td>Alderfer (1967)</td>
</tr>
<tr>
<td>Relatedness needs-respect from peers</td>
<td>4</td>
<td>Alderfer (1967)</td>
</tr>
<tr>
<td>Growth needs</td>
<td>4</td>
<td>Alderfer (1967)</td>
</tr>
<tr>
<td><strong>Work stress</strong></td>
<td>15</td>
<td>Kahn, et al. (1964) JRTS</td>
</tr>
<tr>
<td><strong>Dependent variable</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Employee job performance was measured by a synthesis of three measures (see Table 3) capturing individual job performance on a 7-point scale ranging from 1=very low to 7=very high performance. This measure was constructed by using 2-items from Yousef (1998), 5-items from Suliman (2001) and 1-item by Farth et al (1991) in order to assess quality, quantity, productivity, individual goal achievement, working time available, decision-making, suggestions for improvement and overall ability to execute a job. The Self-report measures employed in this study are used in cases where there aren’t any valid objective measures of performance (or they are not available to the researcher). The literature supports the use of such self-report measures (see Babin and Boles, 1996), which allow researchers to access sensitive
areas not traditionally measured by existing measures while maintaining employee confidence (Kennedy et al., 2001).

3.3 Principal Component Analysis

Principal Component Analysis (PCA) was conducted to identify latent factors within Alderfer needs scale. Five factors were extracted from the data, applying both Kaizer and Scree plot criteria. These principal components accounted for over 75.6% of the total variation. A cut-off of 0.50 was used for item scale selection and it was adopted a normalized varimax rotation to bring about simple and interpretable structure. According to Lewis-Beck (1994), this method is the most commonly used in order to reduce the number of items in a survey questionnaire.

Table 4. Descriptive statistics and internal reliability analysis of all scales

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>S.D.</th>
<th>items</th>
<th>Cronbach’s alpha</th>
<th>KMO*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alderfer needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>existence needs (pay)</td>
<td>4.09</td>
<td>1.310</td>
<td>4</td>
<td>0.856</td>
<td>0.844</td>
</tr>
<tr>
<td>existence needs (fringe benefits)</td>
<td>3.80</td>
<td>1.394</td>
<td>4</td>
<td>0.921</td>
<td></td>
</tr>
<tr>
<td>relatedness needs (superiors)</td>
<td>4.35</td>
<td>1.519</td>
<td>4</td>
<td>0.936</td>
<td></td>
</tr>
<tr>
<td>relatedness needs (peers)</td>
<td>4.85</td>
<td>1.358</td>
<td>4</td>
<td>0.914</td>
<td></td>
</tr>
<tr>
<td>growth needs</td>
<td>4.85</td>
<td>1.218</td>
<td>4</td>
<td>0.826</td>
<td></td>
</tr>
<tr>
<td><strong>Work stress</strong></td>
<td>3.61</td>
<td>1.032</td>
<td>15</td>
<td>0.887</td>
<td>0.894</td>
</tr>
<tr>
<td><strong>Dependent variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job performance</td>
<td>5.25</td>
<td>0.902</td>
<td>8</td>
<td>0.870</td>
<td>0.858</td>
</tr>
</tbody>
</table>

*The Kaiser–Meyer–Olkin (KMO) indicator was calculated to assess sample size adequacy. Bartlett’s test of sphericity is significant at \( p<0.001 \) for all scales. Valid \( N=143 \).

Following an inspection of the items’ loadings on each factor, five distinct principal components were identified, corresponding to: existence needs (pay), existence needs (fringe benefits), relatedness needs (respect from superiors), relatedness needs (respect from peers) and growth needs. Also, one principal component was extracted explaining approximately 48.7% of the overall variance for the work stress scale, as well as one component for the job performance construct (52% of the total variation). Preceding PCA, the Bartlett sphericity testing on the degree of correlation between the variables \( (p<0.001) \) and the appropriateness of the sample according to Kaiser–Meyer–Olkin \( (\text{KMO over 0.70}) \), verified the appropriateness of the sample \( (\text{Norusis 1990}) \). Inter-item analysis used to assess internal consistency reliability for Alderfer needs, work stress and job performance scales suggests that all sub-scales exhibit well over the minimum acceptable reliability level of 0.70 \( (\text{Nunnally and Bernstein, 1994}) \) as Cronbach’s alpha calculations \( (\text{see Flynn et al., 1990}) \) for all scales show in table 4.
4. Multivariate Statistical Analysis

Multiple regression analysis was undertaken for job performance to test its relationship with work stress and the need satisfaction dimensions (i.e. existence needs (pay), existence needs (fringe benefits), relatedness needs (respect from superiors), relatedness needs (respect from peers) and growth needs). The regression analysis results are shown in table 5.

Table 5. Regression results pertaining to the relationship between employees’ Job Performance, Motivation (Alderfer needs) and Work stress

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Independent variables</th>
<th>Job performance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>-0.002</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>0.034</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td>-0.024</td>
</tr>
<tr>
<td>Working experience</td>
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<td>0.098</td>
</tr>
<tr>
<td>Position</td>
<td></td>
<td>-0.089</td>
</tr>
<tr>
<td><strong>Alderfer needs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>existence needs (pay)</td>
<td></td>
<td>-0.009</td>
</tr>
<tr>
<td>existence needs (fringe benefits)</td>
<td></td>
<td>-0.071</td>
</tr>
<tr>
<td>relatedness needs (superiors)</td>
<td></td>
<td>0.165</td>
</tr>
<tr>
<td>relatedness needs (peers)</td>
<td></td>
<td>-0.104</td>
</tr>
<tr>
<td>growth needs</td>
<td></td>
<td><strong>0.395</strong>*</td>
</tr>
<tr>
<td><strong>Work stress</strong></td>
<td></td>
<td><strong>-0.173</strong>*</td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td><strong>0.293</strong>*</td>
</tr>
</tbody>
</table>

* Significant at the 0.05 level, ** significant at the 0.01, *** significant at the 0.001 (Valid N=143)

Also note that there are no serious multi-collinearity problems between independent variables as the VIF is far below the 3 points limit suggested. The data were also examined for outliers, skewness, kurtosis, and multivariate normality using procedures and plots available by SPSS. The results (see table 5) show that the predictors have captured a quite significant proportion of change in the dependent variable, explaining almost 30% of the variance in employee job performance.

Unlike the four out (of five) need elements studied, it is the growth needs element (only) that is significantly and positively related to job performance (stand. b= 0.395, p<0.001). Also, according to the above findings, work stress is associated negatively with job performance (stand. b= -0.173, p<0.05) while none of the Control variables examined is significantly related to job performance (see table 5).
5. Discussion and Conclusion

This paper investigates empirically the impact of motivation (as conceptualised by Alderfer’s multidimensional need satisfaction (ERG) theory) and work stress on job performance among frontline employees in the banking sector. Based on the findings pertaining to Motivation, it seems that the most important driver of bank employees’ job performance is the satisfaction of higher order needs such as the Growth needs referring to the employee needs of self-esteem and self-actualization (see Table 5). Unlike the Growth needs, the Existence needs category (pay and fringe benefits) is not found to be a significant determinant of employees’ job performance; last, relatedness needs involving respect/fellowship from peers and/or relationship with supervisors do not seem to have any significant impact on job performance, either. With respect to work-Stress, table 5 shows a significant negative relationship with job performance. In light of the above findings, H1e and H2 have found support while hypotheses H1a, H1b, H1c, H1d, are not supported in the context of this study.

The above findings pertaining to the relationship between Motivation (i.e. Alderfer’s need-satisfaction or ERG theory) and bank employees’ job performance generally differ from Arnolds and Boshoff’s (2002) findings highlighting the importance of satisfying employee relatedness needs with superiors and peers. Bank employees do not seem to place much emphasis on either their peers’ acceptance and camaraderie or their superiors’ respect for them in order to be able to perform well in their jobs. Both studies however, seem to agree on the fact that job specific characteristics such as fringe benefits (pertaining to the satisfaction of employees’ existence needs) do not seem to play a significant role in driving employee job performance, either. Regarding employees’ existence needs, this study has also found that the satisfaction of existence needs (pay) is not an influential driver of job performance. In fact, this seems to be (partially) in line with Herzberg’s view (see table 1) that pay is a hygiene factor (rather than a motivator) that prevents employees from feeling dissatisfied (yet, it does not help increase their job performance).

More specifically, this study has found that the satisfaction of one’s personal growth needs (see table 5) is the most important driver of a bank employee’s performance in his/her job; the evidence also suggests that such performance is negatively affected by employees’ stress levels experienced, while it seems there is no significant difference between male and female bank employees or even bank type (public vs. private) in terms of the level of stress experienced.

The foregoing empirically established causal relationship (see table 5) have managerial implications involving the development of relevant HR policies and/or practices in a banking context. Bearing the above findings in mind, it seems that greater emphasis should be given in motivating employees rather than stressing them. Specifically, banks need to invest in programs (i) aiming to develop a cohesive organisational culture where employees are motivated primarily by rewarding them based on a fair growth scheme (rather than a fringe benefits scheme) offering appropriate training and development programs to satisfy employees’ professional career growth needs; (ii) valuing a healthier working environment where work stress is effectively controlled across the organisation. In this context, it is worth re-examining bank practices that may contribute to increasing work stress. For example, one of the two Greek banks studied uses MBO as an individual performance evaluation system. MBO was initially introduced by Drucker in 1955 as a system of
management by objectives and self-control, which helps increase productivity if used collaboratively (D’Aveni, 1995). Although MBO has been very popular, it may prove to be more of a hindrance rather than a help if the original intent is not followed (Van Tassel, 1995). Bank management needs to realise that the implementation of an MBO initiative may well fail in practice and end up creating stress for employees when applied as an individual performance appraisal system as opposed to a goal congruence and alignment system (as was initially intended to be) based on collaboration and self-control (Dinesh and Palmer, 1998).

This paper shares the view that companies owe their existence to the contemporary international economic environment where they are not only dependent on that, but are also forced to adapt their behaviour and policies to the environment’s complicated and unexpected processes (Sdrolias et al., 2006). Acknowledging the economic crisis’ adverse effects industries face nowadays and also the recession period within which organisations operate, it is important for HR policies and practices to be used as a strategic tool, adapted to help organisations’ take advantage of their human capital potentials in order to improve individual and organisational performance and competitiveness (Storey and Sisson 1993). In this context, the paper tried to address (at least partially) a controversial issue between bank management and bank employee trade unions pertaining to whether bank practices manage to motivate their employees while keeping stress at low levels to help boost employee performance.


The contribution of this paper involves the better understanding of the causal link between employees’ job performance and its drivers in the banking sector. Yet, the sample is quite limited and does not allow the generalization of the findings. Different forms of stress such as eustress (or good stress) and distress (see section 2.2) and their impact on job performance have not been considered in this study; this is a limitation and at the same time, a direction for further research. Also, this study has not looked into the relationship between bank employees’ job motivation and job satisfaction (i.e. where satisfaction may act as a mediator between motivation and performance) particularly when there is an established link between employee job satisfaction and job performance (see Bowling and Hammond, 2008). Last, this study has not examined such variables as employee personality and stress coping ability as well as customer demands that may influence the relationship between work stress and job performance (Cummings and Cooper, 1998); this is also the case for other organisational and managerial characteristics that need to be considered in relevant future conceptualisations.

References


