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Perceived Value of Cloud Based Information Systems. Case: Accounting Information Systems.

Information Systems Science

Master's thesis

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Abstract of master's thesis

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Cloud based information systems are considered to benefit the organizations through their superior information capabilities compared to traditional information systems. Strong adoption of the cloud computing in the recent years has also affected the view on outsourcing of information technology enabled processes and led to creation of new service offerings represented by a combination of cloud and outsourcing. Earlier research closely considers the benefits of cloud computing and business process outsourcing. However, the empirical evidence of the positive relationship between the use of the cloud and outsourcing and organizational performance is lacking. The focus of the current research is to fill in this gap and analyze managerial perceptions of the value of cloud based information systems by grouping organizations based on their outsourcing pattern: 1) non-outsourcing, 2) selective outsourcing and 3) total outsourcing. Results of the analysis revealed the higher perceived improvements for cloud users compared to non-cloud users for organizations that perform processes in-house and practice selective outsourcing. For organizations, which are inclined towards total outsourcing, the use of cloud does not lead to significantly higher improvements. The clusters with low number of cloud users and outsourcing perceived most improvements in basic accuracy and data quality, while the clusters with high number of cloud users perceived highest improvements in accessibility. Based on the findings six propositions are identified and suggested for further research.

Keywords

Information systems, Information systems value, Cloud computing, Business process outsourcing

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GLOSSARY

ANOVA	Analysis of Variance
API	Application Programming Interface
BPO	Business Process Outsourcing
CaaS	Communication as a Service
DaaS	Data storage as a Service
HaaS	Hardware as a Service
HTTP	Hypertext Transfer Protocol
IaaS	Infrastructure as a Service
IS	Information System
IT	Information Technology
SaaS	Software as a Service
SLA	Service Level Agreement
PaaS	Platform as a Service
RBV	Resource Based View
R&D	Research and Development
ROA	Return on Assets
TCE	Transaction Cost Economics
VAT	Value Added Tax

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1 Introduction

1.1 Background and motivation

Adoption of the cloud computing services has been rapidly growing during the past years. Gartner estimated public cloud services at $129 billion for 2013 with a five-year compound annual growth rate (CAGR) of 17% (Potter, 2013). The use of cloud computing promises organizations significant improvements in their business processes due to superior capabilities of the cloud based information systems compared to traditional information systems. Superior capabilities of the cloud computing, as stated by numerous research findings, lead to improvements in accessibility of the data, information processing and data analysis, tracking of the end-users and their data manipulations, and improving automation of the business processes enabled through the use of the information technology (IT-enabled business processes).

Emergence and increasing adoption of the cloud has also strongly affected the views on outsourcing of the business processes. Organizations no longer perceive outsourcing as transferring their internal business processes or software to be performed or maintained by the external party. Now organizations purchase actual services from the outsourcing service providers, which are often delivered through the cloud (Pring, 2010). Thus, the concepts of the business process outsourcing and cloud computing are merging to create the new service offering, where cloud opens new possibilities for organizations to benefit from professionalism of the external service providers while at the same time maintaining full control over performance and quality of the processes being outsourced.

Exploring and understanding the business value of the business process outsourcing to the cloud arises as an important milestone in leveraging cloud computing and outsourcing to enhance performance of the organizations. However, despite of the relatively high number of the research papers dedicated towards outlining the benefits of the cloud based information systems, literature has a limited number of quantitative analysis that aims at identification of the relationship between the performance of the organizations and the use of the cloud based information systems and outsourcing.

Current research aims at filling in this gap by analyzing organizations based on their outsourcing patterns and linking the use of the cloud based information systems and outsourcing to the improvements in the business processes.

1.2 Objectives of the study

Four main objectives can be identified for the current research. The first objective is conducting a background research regarding the business value of the information systems (IS), cloud computing and business process outsourcing in order to lay the basis for the empirical part of the research. The background research in the area of IS value is dedicated towards exploration of the most widely used approaches towards identification of the value investments in information technology and information systems as well as defining and explaining the capabilities of the information systems through which information system value is realized.

Cloud computing section of the background research considers the main concepts of the cloud, its architecture, cloud service and deployment models as well as benefits and risks of cloud implementation. Cloud computing benefits are analyzed through the lens of the generic information technology capabilities discussed in the information system value section. The section dedicated towards business process outsourcing aims at introducing the main outsourcing concepts, outlining outsourcing decisions, discussing benefits and risks of the business process outsourcing as well as introducing specifics of outsourcing of the accounting processes. Additionally, this section contains discussion regarding relationship between cloud computing and outsourcing as well as the impact of the cloud computing on outsourcing processes. The main goal of the literature review and background section is to lay theoretical foundations and frameworks for the practical part of the research. The outcome of the literature review is represented by the conceptual framework, which is used during the analysis stage of the research.

The second main objective is dividing the dataset of the organizations into groups with evidently different characteristics based on their outsourcing decisions and create detailed description of each group based on certain criteria, such as improvements in the business processes, cloud adoption, outsourcing patters etc.

The third objective is to analyze the perceived value of the cloud based information systems for each group through the lens of relationship between the use of the cloud based information systems on the perceived improvements in the business processes of the organizations. Sub-goals of the first main objective refer to the following:

- If the results of the study show the evidence of the higher improvements in the business processes for the cloud users, the sources of these improvements are to be analyzed and such areas defined, for which the use of the cloud based information systems generate higher perceived improvements compared to non-cloud based information systems;
- In case the sources of perceived improvements for cloud users are identified as higher in comparison to non-cloud users, the reasons for better results will be related to the superior capabilities of the cloud based information systems compared to traditional information systems.

The fourth objective of the research is to analyze the relationship between organizations' outsourcing decisions and perceived improvements in the business processes along with the levels of cloud adoption. The outcome of the fourth objective should be identification of the combined impact of the cloud adoption and outsourcing decisions on perceived improvements and sources of these improvements. Problematic areas, if any, should be outlined and propositions for the further research suggested.

2 Literature review

2.1 Business value of information systems

2.1.1 Concepts and approaches

Information systems (IS) value is generally defined as “the impact of investments in particular information systems assets on the multidimensional performance and capabilities of economic entities at various levels, complemented by the ultimate meaning of performance in the economic environment” (Schryen, 2012). The author further clarifies that the gains or losses an organization achieves through implementation of the information systems derives from the way the information system is exploited. Alternatively, IS business value can be defined as “an outcome is the result of introducing a new IT system, a benefit is what is subsequently derived if the new capability is exploited” (Alshawi, Irani, & Baldwin, 2003). An example of such outcome of an information system can be that a task performed more quickly and the saved time is used to improve the business processes within an organization. Form the angle of performance improvements, information technology business value can be characterized as “organizational performance impacts of IT, including productivity enhancement, profit ability improvement, cost reduction, competitive advantage, inventory reduction, measures of performance” (Melville, Kraemer, & Gurbaxani, 2004).

Thus, as can be seen from the abovementioned definitions, the information systems value is often analyzed from the perspective of the positive impact of the information system on the performance of the business processes of the organization. There are several alternative approaches for identification of the IS value, which consider IS value from different angles as well as various organizational levels.

Most of the previous studies attempt to identify the IS value through the relationship between IT investment and organizational performance. However, inconsistency of the level of analysis (e.g. country, industry, firm, business unit levels) and differences in utilized metrics (accounting-, performance-, economic-, market-based indicators) lead to contradictory findings regarding the impact of the investment into information technology on organization’s productivity. These contradictory findings can range from detecting only insignificant or even negative relationships between IT investment and firm’s performance indicators to completely opposite outcomes that indicate considerable investment returns (Mooney, Gurbaxani, & Kraemer, 1996). The inconsistencies in the outcomes of the previously performed studies led to emergence of the concept identified as a “productivity paradox” (Baily & Gordon, 1988). “Productivity paradox” raises the issues of discrepancy between organizations’ levels of investment into information technology and returns of these investments (Mooney et al., 1996).

There are several major reasons of the negative or non-significant impact of the information technology on the business value that were found in earlier research studies (Barua, Kriebel, & Mukhopadhyay, 1995). Among following reasons it is worth to mention measurement problems, lags between IT investments and resulting impacts, redistribution of outputs within the industry and mismanagement (Brynjolfsson, 1993). Thus, one of the major downside of the previous research (Baily & Gordon, 1988) is the focus of the analysis of the information technology impact on the aggregated level that considers the whole organization rather than organization’s certain units, departments or separate processes (Barua et al., 1995).

Such high level of analysis attempts at relating information technology impacts to the overall organization’s performance while ignoring the intermediate processes through which IT impacts arise (Barua et al., 1995). In order to take into account the intermediary processes, the primary impacts of the information technology should be measured “at a lower operational levels in an enterprise, at or near the site where information technology is implemented” allowing in such a way measurement of the “first-order effects” of information technology implementation (Barua et al., 1995). Due to these reasons, process-oriented perspective on the information systems value has become widely adopted by researchers that aimed at demonstrating that the impact of the information systems’ investments on organization’s performance is intermediated by performance of organization’s separate business process (Schryen, 2012).

Some of the most widely used approaches for identification of the information systems’ value through numerous performance indicators include among others following approaches (Schryen, 2012):

- Performance measures;
- Process-oriented theories;
- Resource-based view;

- Production-oriented model.

Despite of the fact that each of the abovementioned approach considers information systems value from a slightly different angle, the main commonality among them can be described as strong linkage towards quantifying measurement of the information systems value based on certain performance indicators, which can be represented either by financial or operational indicators. Following paragraphs provide description of each group of approaches and consider their advantages as well as drawbacks for identification of the information systems' value.

Performance measures

Organization's performance measures have been widely utilized to analyze the IT / IS business value (Schryen, 2012). Economic measures proved to be most widely used among other performance measures. Such measures include productivity, capacity utilization, product quality, consumer welfare, a set of different profit ratios as well as other market-oriented measures (Schryen, 2012). The following represent some of the most widely used performance measures:

- *Accounting performance measures: productivity and capacity utilization.* Organizational productivity is one of the most widely used accounting performance indicator of evaluation of the information systems value. Despite of the failures of the earlier research in correlating IT investment and increase in firm's productivity, later studies, especially a study made by Brynjolfsson & Hitt (1996), who analyzed more than 1000 observations, found that computer capital and information systems' labor significantly increase the output of a firm. It was confirmed that computers contribute significantly to the firm-level output even after the depreciation, possible measurement errors and limitations of the research input data (Brynjolfsson & Hitt, 1996).

  The main reasons of such positive correlation in the contrast to the earlier research can be referred to three main factors. First of all, the study was conducted a later period of time compared to earlier research (1987-1991), during which computer capital was built-up by the companies more intensively. Secondly, more detailed firm-level data was used in the research and finally, usage of the rather large sample of the "Fortune 500" companies (Brynjolfsson & Hitt, 1996).

Other studies also show strong correlation between IT investment and productivity and capacity utilization. Improvements in productivity due to information technology have been detected by applying a production function approach to the analysis of the productivity of IT stock (Hitt & Brynjolfsson, 1996) as well as by evaluating intermediate variable such as capacity utilization and inventory turnover, that represent significant variables in determination of return on assets (ROA) (Barua et al., 1995).

– *Financial market-based measures: ROA, market share and other financial indicators*. Among the financial market-based measures, adopters of the performance-based approach towards determining IS value often utilize ROA, which is calculated as "income from continuing operations before interest expense divided by assets" (Dehning & Stratopoulos, 2002) . Some of the studies that utilized ROA to evaluate IT business value show that companies with IT-enabled strategy and superior IT management skills are more likely to have a sustainable competitive advantage compared to their competitors (Dehning & Stratopoulos, 2002).

  Other high level economic performance measures like ROA include, for example, market share, return on sales and value-added as the economic output variables (Barua et al., 1995) or Tobin's q indicator. Tobin's q indicator, which is defined as "the capital market value of the firm divided by the replacement value of its assets incorporates a market measure of firm value which is forward-looking, risk-adjusted, and less susceptible to changes in accounting practices". The results of the research show significant positive correlation between IT expenditures and Tobin's q (A. S. Bharadwaj, Bharadwaj, & Konsynski, 1999).

– *Product quality.* Attempts have been also made to relate IT investment to the improvements in the quality of the organization's products. It is suggested that IT facilitates tracking of the changing customer preferences and adjust better to the changing market environment, develop tailor-made products, utilize data mining tools for identification of the patterns in the data, which as a result leads to the possibility for the companies to create better products for their customers (A. S. Bharadwaj et al., 1999). Other studies also showed the negative correlation between the IT capital, production IT purchases and innovation (e.g. Research and Development (R&D)) as well as IT purchases and inferior quality (Barua et al., 1995).

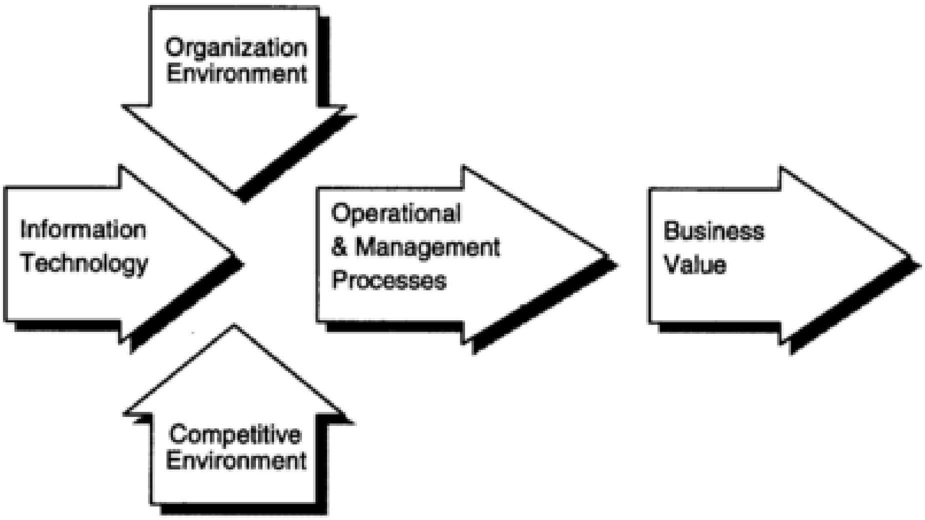
– *Consumer welfare.* Analysis of the total benefits of consumers based on the consumer surplus approach, showed that IT investment have a significant positive impact on consumer welfare (Hitt & Brynjolfsson, 1996). Thus, it is believed that IT can improve the reliability of the firm's service, reduce transaction errors, improve performance, develop and manufacture more customized products (A. S. Bharadwaj et al., 1999), which, as a result, leads to better customer service and, hence, improves consumer welfare.

Thus, performance measures have proven to be useful in identification of the business value of the information technology and information systems used in the organizations as they provide simple quantifiable indicators, the use of which allow creating solid business cases for IT investments. Moreover, a relatively high number of the earlier empirical studies with the use of these indicators are available for information technology and business professionals for reference. Despite of this, one significant disadvantage can be identified for the performance measurement approach. This disadvantage refers to the relatively high levels of the performance indicators (often organizational or, at best, business unit levels), which might provide executives with the full picture of the IT investment's consequences but, at the same time, leave out important details of the concrete benefits information system or IT in general can deliver to specific business processes.

Process-oriented approaches

Process-oriented approach to the information systems value identification aims at eliminating the performance management approach's problem related to the high level of the analysis. Thus, there has been strong evidence in the literature regarding the necessity to measure IT business value on the process or business unit level rather than on the industry level (Barua et al., 1995; Anandhi S. Bharadwaj, 2000; Dedrick, Gurbaxani, & Kraemer, 2003; Mooney et al., 1996). The process level analysis of IT business value allows evaluating the impact of the information technology on an individual business process and, as a result, defining specific performance measures rather than generalizing the IT impact on the firm level (Mooney et al., 1996). Figure 2 represents one of the examples of the process-oriented model of IT business value.

Figure 1. A process oriented model of IT business value (Mooney et al., 1996)



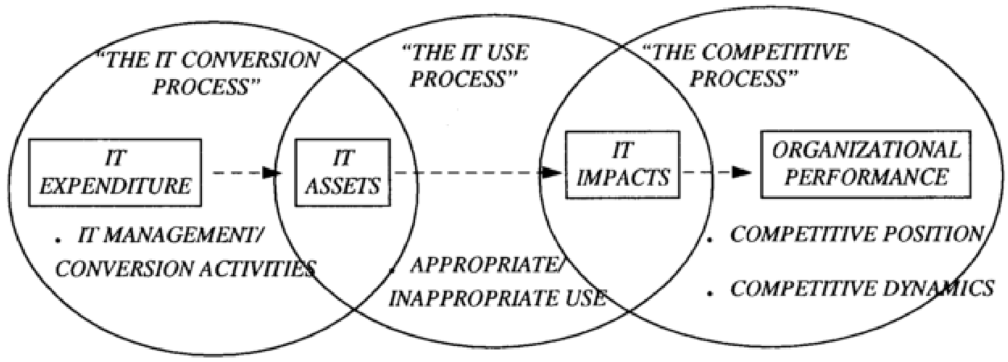
According to the model presented above, an organization derives business value from IT through the information technology's impact on organization's intermediate processes. Therefore, the process view on the IT business value is needed in order to:

- identify the value adding mechanisms of IT;
- develop an approach and set of metrics for measuring the technology's business value;
- enhance an understanding of the relationship between IT and organizations (Mooney et al., 1996).

According to the model suggested above, organization's business processes are divided into operational processes and management processes that are associated with processing of the information, controlling, coordination, communication and knowledge management. Thus, it is suggested that IT business value should be studied through the lens of the improvements of the management and operational processes enabled by information technology (Mooney et al., 1996).

It should be noted that some confusion in the meaning of the process-oriented approach for defining IS value can be derived from the literature. Thus, some studies suggest the process theory of business value creation through the information technology, which is focused on the actual IT implementation and IT use process, rather than on considering the value-added impact of the information technology on the organization's processes. One of such theories is presented in figure 2.

Figure 2. How IT creates business value: process theory (Soh & Markus, 1994)



According to the process theory of IT business value creation, three following IT management related processes are sequentially performed from the point of acquiring and implementing IT assets to the achievement of the organization's performance improvements:

- IT conversion process;
- IT use process;
- Competitive process (Soh & Markus, 1994).

The process theory suggests that IT business value is developed in the following sequence. Organizations spend on IT and due to certain degrees of effectiveness of the IT management process obtain IT assets. Obtained IT assets yield positive IT impacts provided the appropriate and successful IT use. And lastly, positive IT impacts lead to improved organizational performance if they are not negatively affected during competitive process (Soh & Markus, 1994). Thus, the difference of the current approach to the process-oriented approach towards analysis of the information systems value is mainly in their different focus of analysis. Process theory provides the tool for manipulation of the IT management process and shaping in the way that the highest value from IT investment will be delivered in case of the best IT management practices. Thus, this model expands off the boundaries of the IS value identification approaches by providing outline of the IT management process. However, it does not offer any guidelines on how IS value should be measured (e.g. process level) except for outlining overall organization performance as the measurement scope. Thus, this theory should not be confused with the process-oriented models.

In general, process-oriented approach is a logical outcome of the IS value thinking as it has been evolutionarily developed in order to solve the "productivity paradox" problem, which earlier researchers in the field were facing. As results of the later studies, in which performance indicators were applied to the individual processes in the organizations, showed positive correlations between IT investments and process performance, it can be argued that process-oriented approach proved to be useful in analyzing information systems' value.

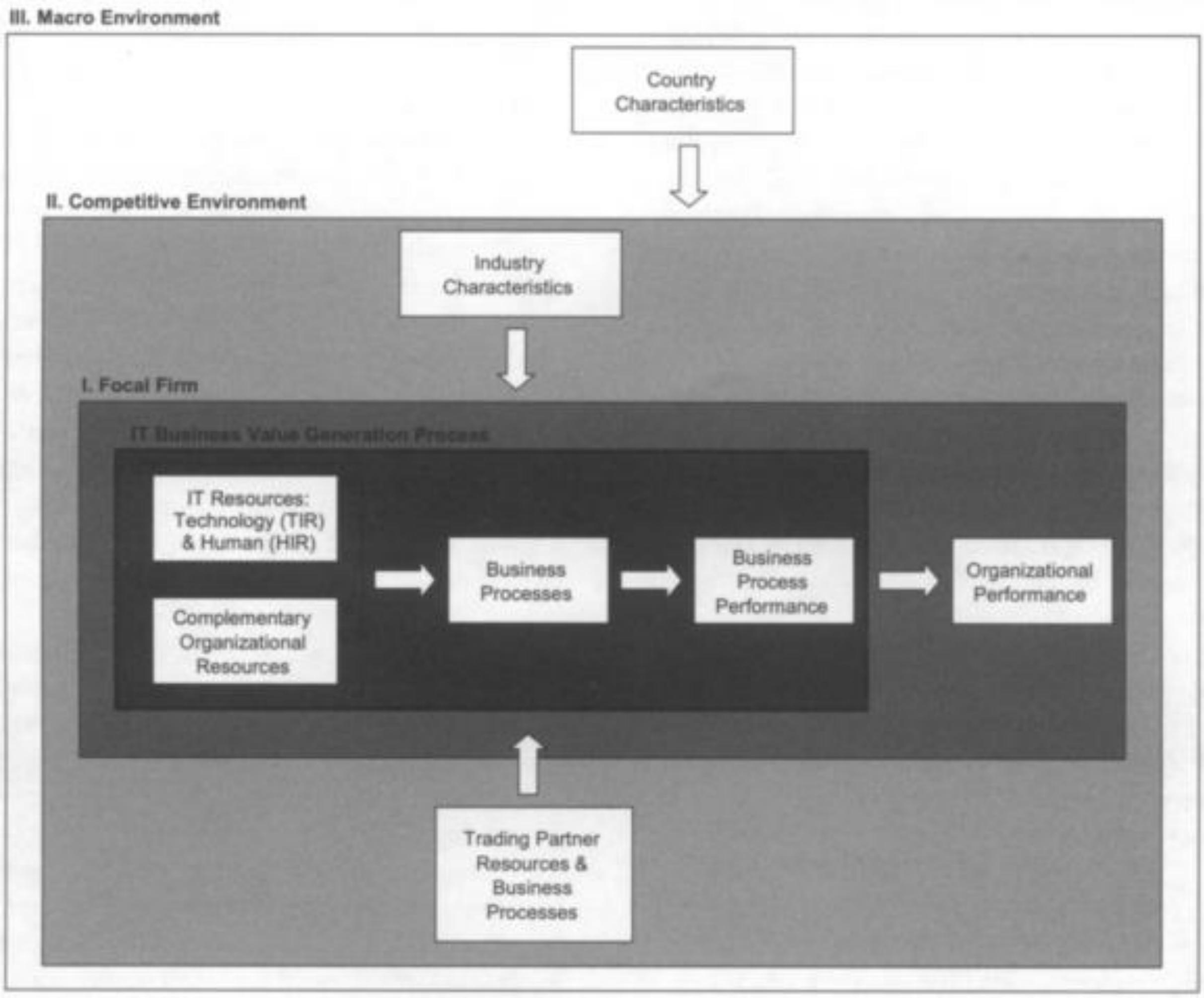
Resource-based view

Another view on the IS value, which is strongly based on the notions of the process-oriented view, refers to the resource-based view (RBV) of the IT assets in the organization. RBV emphasizes heterogeneous firm resources as a basis for competitive advantage (Melville et al., 2004). Evaluation of the IT business value through the lens of the RBV of the firm allows estimation how IT can facilitate an organization to achieve competitive advantage. Resource-based approaches (Anandhi S. Bharadwaj, 2000; Melville et al., 2004) consider IT as the resource that adds value to the organization's business processes and enhances their performance. In this case the focus of IT business value generation is represented by an organization that invests in and develops IT resources.

According to the RBV, the key IT-based resources are following: 1) IT infrastructure components, 2) human IT resources and 3) intangible IT resources (e.g. developed knowledge assets, customer orientation and IT synergy) (Anandhi S. Bharadwaj, 2000). Thus**,** IT enables organizations to enhance their customer orientation by providing tools that allow constant monitoring and anticipation of changing customer preferences. From the point of view of the synergy, IT allows resources and information sharing across the whole organizations by removing physical, spatial and temporal limitations to communications. Besides this, flexible IT systems allow easier access and sharing of the information as well as development and production of the products with less additional costs (Anandhi S. Bharadwaj, 2000).

Through the lens of the RBV view IT business value analysis may consist of three domains: 1) focal firm, 2) competitive environment and 3) macro environment (figure 3) (Melville et al., 2004).

Figure 3. Resource-based view of IT business value (Melville et al., 2004)



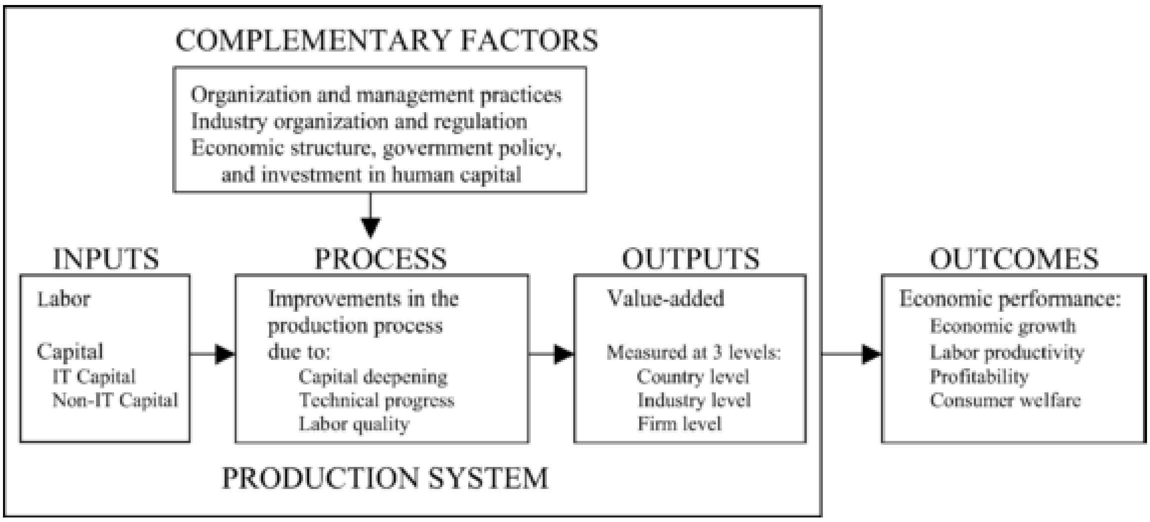
The focal level firm is comprised by IT resources and complementary organizational resources, which often facilitate and strengthen IT resources by creating synergy with them. IT and complementary resources are applied to the business processes and enhance their performance, which in turn affects the performance of the whole organization. Competitive environment includes the industry characteristics and business processes and IT resources of the focal firm's trading partners, which affect directly or indirectly organization and functioning of the focal firm's IT resources. Finally, the macro-environment includes country and non-country factors: e.g. governmental regulations that shape the application and utilization of the focal firm's IT resources. Such RBV model allows analyzing the IT resources on different organizational levels and defining the factors affecting IT resources development and utilization (Melville et al., 2004).

In principle, many similarities can be identified between the RBV and process-oriented approaches to analyzing IS value. Thus, both of these approaches consider impact of the information technology on the process level and both apply performance measures to evaluate improvements in organization's business processes. RBV though can be considered as a more complete approach as it extends the analysis environment beyond the firm or competitive level as in the process-oriented model and considers the macro environment in which the company operates. The value of this extension derives from the fact that by analyzing country or industry environments the organizations are able to adjust their IT needs and choose more suitable IT solutions.

Production-oriented model

The final performance-based approach on IS value analysis refers to the production system framework. Production system framework analyzes the connection between IT (as one component of the input to the business process) and economic performance from the firm-level and industry-level perspectives (figure 4) (Dedrick et al., 2003).

Figure 4. IT and economic performance framework (Dedrick et al., 2003)



The production system framework suggests that IT enables changes in the business processes and organizational structures that lead to increase in multifactor productivity (achieving larger output for the same amount of input) and, as a result, to better performance of the organization. Complementary management practices (e.g. decentralization of decision-making, business process redesign and total quality management) are critical to the extent of IT investment returns. The industry-level analysis of the IT impact from the point of view of the production systems shows the positive correlation between IT investment and productivity, especially, in the industries, that are utilizing IT extensively (Dedrick et al., 2003).

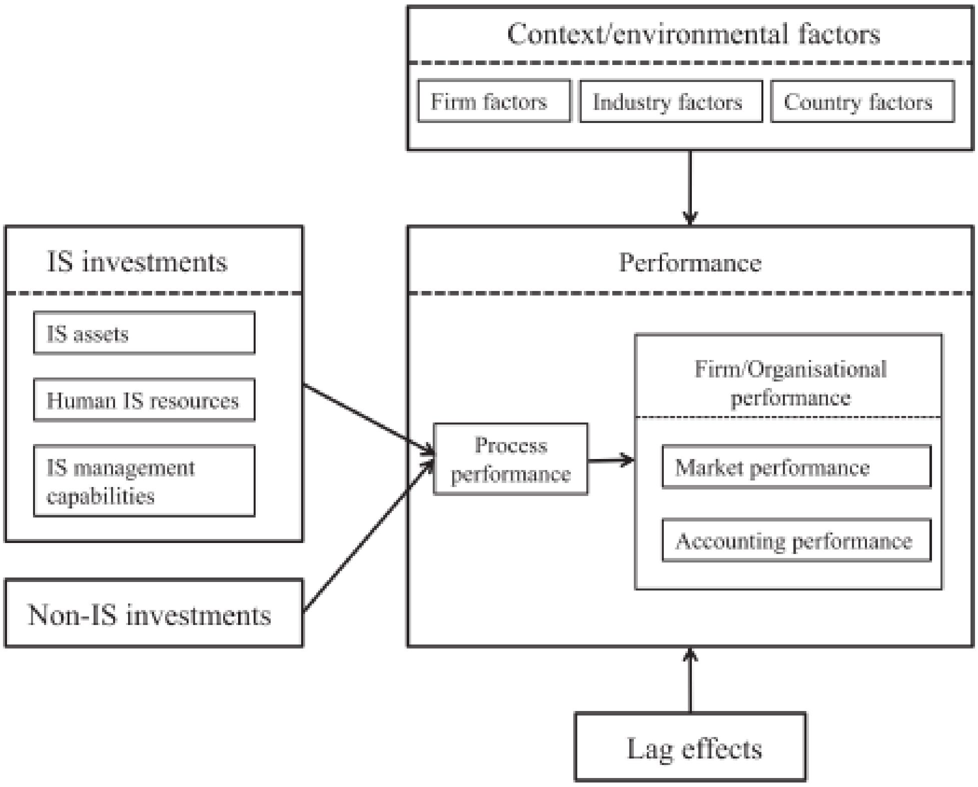
Thus, it is evident that also the production system approach has a strong connection to the process-oriented view of the IS value as the process plays the central part in the production system. The quality of the outcome of the production system is measured also through performance indicators as in case of the process-oriented and RBV. However, the main disadvantage of the approach is application of only three levels of the performance analysis, the most detailed one of which is the firm level.

Summary: views on information systems value

From the description of the various approaches towards the analysis of the IS value, it can be seen that although some differences exist between the process-oriented, RBV and production systems approaches, the main commonalities such as use of the performance measures / indicators (process, financial and market performance) and process level of analysis suggest the common trend in the performance-based views on the information systems value.

Graphically, synthesis of performance-based approaches for identification of the information systems value can be described as presented in figure 5. General investments and information system related investments serve as the inputs to the business processes, performance of which is measured on the process performance and firm / organizational performance level. Contextual factors, such as industry and country factors affect the environment in which the company operates. Lag effects may further affect the realization of the information systems value from implementation of the information systems.

Figure 5. Synthesis IS business value model (Schryen, 2012)



The main commonalities of the approaches to IS business value that are based on measurement of the firm's performance indicators, process-oriented approach, resource-based view and production system approach for evaluation of the IS business value, include the following (Schryen, 2012):

- In all abovementioned approaches information systems value is evaluated through the lens of the business performance measures indicators that are applied both on the process or overall organizational performance measures and are represented by market and financial performance indicators.

- As all approaches consider at least the firm level of operation, the impact of IT process performance is dependent on the contextual or environmental factors of a specific firm, industry or country.

- The IS investment can consist of several dimensions: IT expenditures (hardware, software, infrastructure etc.), human resources (e.g. IS training) and IS management capabilities.

- The impact of IT investment needs to take into account the time lag that can account for up to several years.

Thus, performance-based approaches for identification of IS business value concentrate on quantifying and formalizing the business benefits of IT by linking IT investments, which are applied to the organization’s business processes, with economic performance of the process, business unit, firm, industry or country levels. However, despite of the fact that later research shows positive correlation between IT investment and firm’s performance in the form of increase in productivity, such performance indicators have certain limitations. They often assess the processes / business units / firms on a high and abstract level, which does not deliver conclusive results regarding the role of the actual technology in the performance improvements of the business processes.

Besides this, performance measurements do not consider the contextual aspects of the organization and differences between perceptions of the information system’s business value, the degree of which can vary depending on the stakeholders assessing this value. Thus, adoption of the process analysis level from the abovementioned approaches and focusing on the information system’s value as perceived by managers could allow filling in the gap of performance-based analysis approach and obtaining results that take into account human and contextual factors of an organization.

2.1.2 Perceptual view

Number of researches show that perceptions of the organization’s executives are crucial to understand how IT affects firm’s performance (Tallon, Kraemer, & Gurbaxani, 2000). Perceptions and attitudes of CEO’s towards IT directly influence on the extent IT is utilized and developed in the organizations. Attitudes of executives and overall inside climate for IT serve as indicators of how IT is utilized to support the business strategy. However, two biases can be identified in this approach, which refer to the fact that executives might use their own experience while forming the general perception of IT impacts and that executives are to a large extent exposed to the views of their peers and subordinates regarding performance of IT while making investment decisions. However, executives can still be useful sources for perceptions of IT benefits as they are able to receive various opinions and views from different angles or parties on IT investment and their impact (Tallon et al., 2000). For example, results of a certain empirical research show that organizations that have different goals for IT also found to have different perceptions of IT payoffs (Tallon et al., 2000).

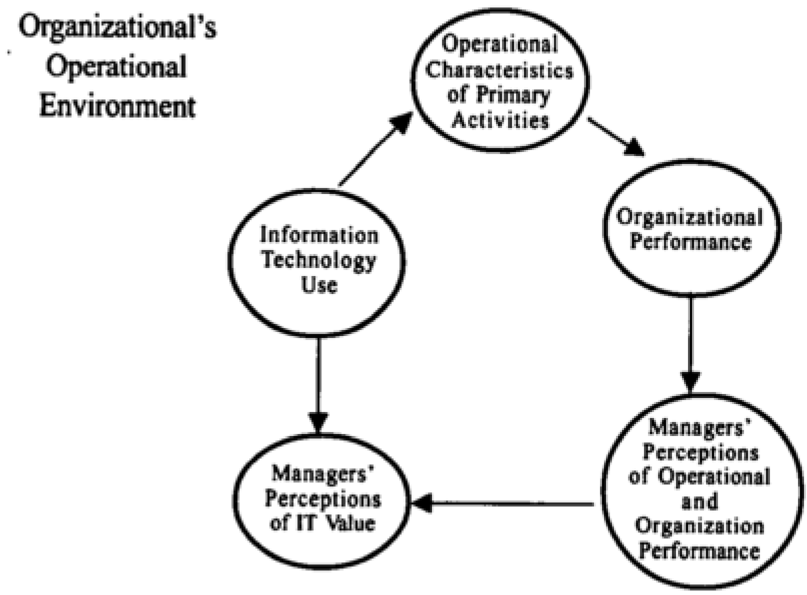
Thus, the IT value may depend on the subjective preferences of actors, that perform the evaluation of IT impact (Sylla & Wen, 2002). An example of such subjective judgment is that a decrease in personnel costs is usually positively evaluated by managers, while staff may consider such a decrease negatively. This argument indicates the necessity to distinguish between performance, which is measured by means of economic indicators, and its potentially different values in terms of the subjective interpretation of different stakeholders (Schryen, 2012). Thus, by analyzing subjective perceptions of IT value it is possible to retrieve "perceived benefits" of IT (Chau, Kuan, & Liang, 2007; Sylla & Wen, 2002).

In the literature there are numerous evaluation methods for tangible benefits of information technology, which rely mostly on the performance and accounting data and are targeted at analyzing IT investment and providing procedures to quantify IT benefits and risks (Sylla & Wen, 2002). However, methods for evaluation of intangible IT benefits "put emphasis on the process of obtaining agreement on objectives through continuous exploration and mutual learning" (Sylla & Wen, 2002). Among such methods it is worth to mention the following: multi-objective, multi-criteria (MOMC), value analysis and critical success factors (CSF) (Sylla & Wen, 2002).

Linking operational characteristics and perceived value

If the value of information systems is strongly related to organization's operational activities, perceptions of actors that are involved in these activities is crucial (Ragowsky, Stern, & Adams, 2000). Thus, one of the approaches to evaluate perceptions of the mangers regarding information systems value is to link the information systems use and managers' perceptions of performance of the organization's operational activities (figure 6). (Ragowsky et al., 2000).

Figure 6. Organizational operational environment and perceived operational performance and IT value (Ragowsky et al., 2000)



Thus, the use of information technology affects organization's primary activities as well as managers' perceptions of the value of that technology (Ragowsky et al., 2000). Each of the primary activities in turn affects organizational performance and management's perceptions of that performance. These perceptions form managers' understanding of the perceived value of the information technology. Operational decisions represent an input to the primary activities, which produces as an output organizational performance.

Thus, this framework allows analyzing the impact of the information technology through the lens of organization's primary activities as low-level operational decisions affect performance of the whole organization (Barua et al., 1995). Therefore, by analyzing the managerial perceptions of performance of the organization's activities and linking these perceptions to the use of the certain type of the information system, it could be possible to draw conclusions regarding the value of the information system in case for its certain type managers' perceptions of performance of the organizations' activities will be higher.

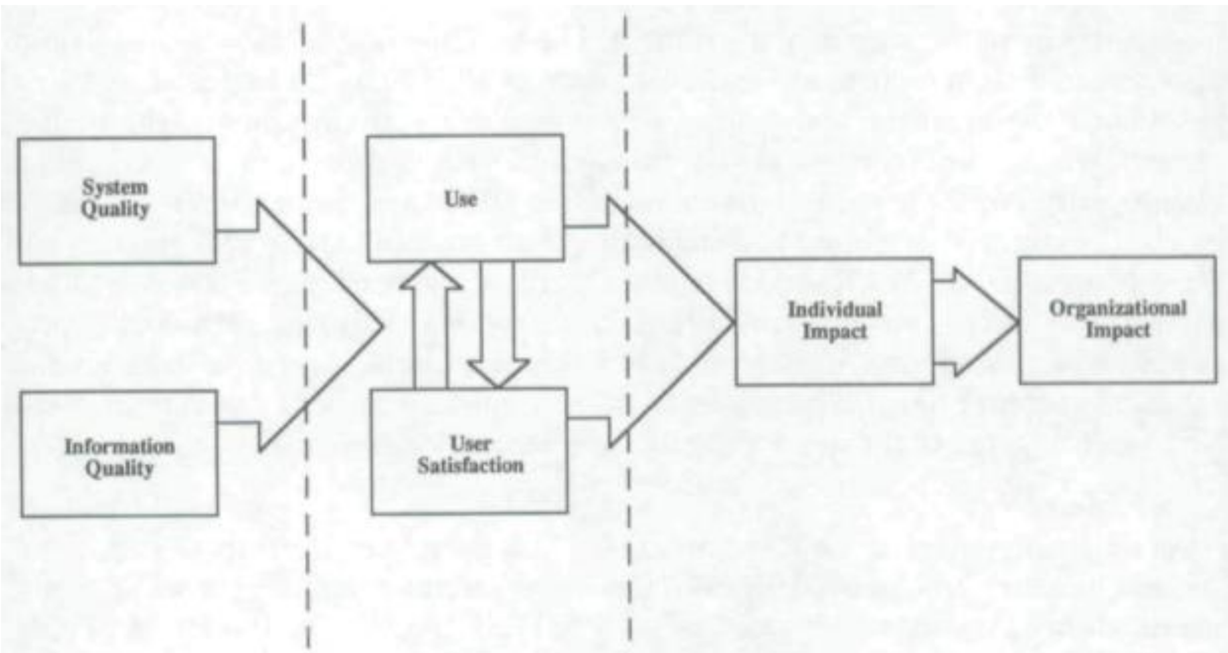
Information system success factors

Information systems value is strongly related to the benefits that information systems generate for the information intensive processes, which they automate. Thus, dimensions of the perceptual information systems value can be described through the information systems success factors – information system's performance indicators (DeLone & McLean, 1992) .

These performance indicators are grouped by six dimensions of the information system success and include the following (figure 7) (DeLone & McLean, 1992):

- System quality (quality of the actual system that produces the information);
- Information quality (accuracy, timeliness, meaningfulness of the information etc.);
- Use (measurement of the interaction of the information product with recipient);
- User satisfaction (measurement of the interaction of the information product with recipient);
- Individual impact (influence of the information product on management decisions);
- Organizational impact (effect of the information product on organizational performance).

Figure 7. Information system success model (DeLone & McLean, 1992)



Information systems success model has the process nature and should be considered from the perspective of six abovementioned variables as interdependent rather than individual ones (DeLone & McLean, 1992). Thus, system quality and information quality dimensions affect the use and user satisfaction with the information system, which in turn directly shape the individual impact of the information system. Lastly, the individual impact forms an overall organizational impact of the information system.

By selecting information system performance indicators, which can be applied to describe the sources of perceived improvements in the information intensive IT-enabled business processes (DeLone & McLean, 1992), it is possible to define the following indicators:

- Accessibility (enabling easier, faster and more efficient access to the information);
- Accuracy (ensuring high quality and fault-free information);
- Usability (ease of use, user-friendly interface and completeness of the functionality of the information system);
- Comparability (ensuring the information produced by the system can be easily contrasted and compared);
- Relevance (ensuring the information provided is relevant and up to date);
- Transparency (ensuring the possibility to review the whole process of data processing).

Thus, based on the perceptual approach towards analysis of the information systems value, perceived value can be identified through two dimensions. The first dimension refers to analyzing perceptions of the managers regarding performance of organization's operational activities and linking the use of the certain type of the information system to the performance. The second dimension refers to defining the sources of the improvements in operational activities (accessibility, accuracy, usability, comparability, relevance and transparency) and ranking the sources based on their relative importance.

Analysis of the perceptual value of the information systems instead of utilization of the performance based approaches discussed in section 2.1.1 allows taking into account subjective preferences of the organization's managers, whose opinions and choices may affect organization's strategy in future.

2.1.3 Value through IT capabilities

Business benefits of the information systems derive through the capabilities of these systems to improve the performance of the business processes by their automation and computerization. The most dominating view on IT capabilities in the literature refers to the resource-based view (Aral & Weill, 2007; Anandhi S. Bharadwaj, 2000; Sunil Mithas, Ramasubbu, & Sambamurthy, 2011; Rai, Pavlou, Im, & Du, 2012; Stoel & Muhanna, 2009).

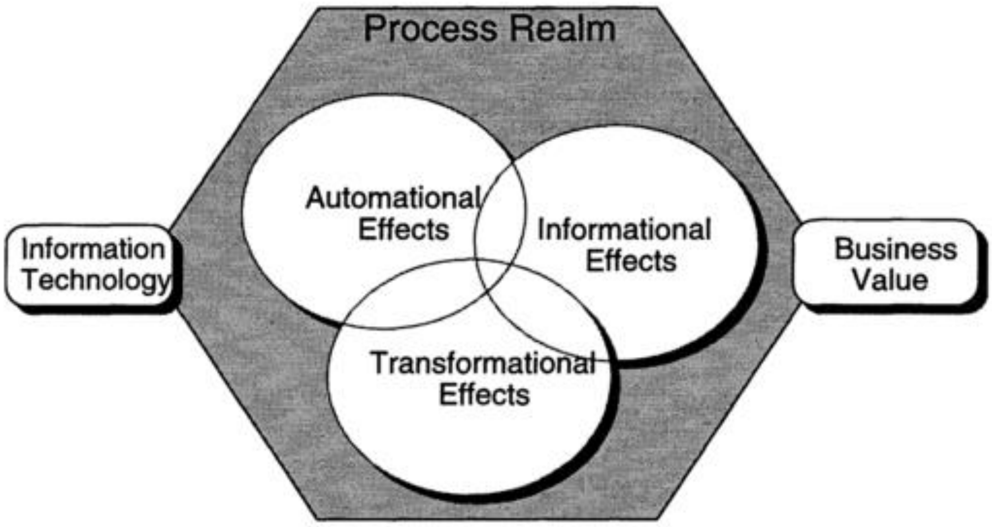
According to this view, IT capability is defined as organization's ability to utilize IT-related resources, skills and knowledge to provide desired results for the organization (Stoel & Muhanna, 2009). IT capability can be also considered as organization's ability to "mobilize and deploy IT-based resources in combination or co-present with other resources and capabilities" (Anandhi S. Bharadwaj, 2000). Thus, organization's IT capability is formed with IT infrastructure (computer and communication technologies and sharable software and databases), organization's IT human capital (technical and managerial) and its ability to utilize IT to achieve intangible benefits (customer orientation, synergy and build knowledge assets) (Anandhi S. Bharadwaj, 2000). Together these components create organization-specific resources and, as a result organization-wide IT capability.

According to resource-based view IT capability should be distinguished from IT functionality. IT functionality is considered to be a tool that is designed to automate the business process, while IT capability refers to the use and implementation of IT functionality with other resources to execute the business process (Rai et al., 2012). Thus, the combination between IT assets and organizational resources leads to emergence of organization's IT-enabled resources (Nevo & Wade, 2010).

Thus, the resource-based view emphasizes the fact that IT assets taken separately do not result in any competitive advantage, as they appear to be the same for any company. The benefit from implementation of the information systems can be truly leveraged only by development of organizational IT capability through building of the excellence in IT expertise and developing efficient IT management process. However, despite of the value of emphasizing the importance of the human factor in utilizing IT assets, the resource-based approach does not consider the actual IT properties that positively affect the business processes and, as a result, yield business benefits.

In the contrast to the resource-based view, IT capabilities can be considered as the effects on the business processes as described in figure 8 (Mooney et al., 1996).

Figure 8. Dimensions of IT business value (Mooney et al., 1996)



Thus, IT can provide automational, informational and transformational effects on a business process. Automational effect of IT refers to IT becoming a substitute for human labor and, as a result, yielding improvements in productivity, labor savings and cost reductions. Informational effects imply IT's capacity to collect, store, process and disseminate information, which leads to improved decision quality, employee empowerment, decreased us of resources, improved organizational effectiveness. Finally, the transformation effect is expressed with IT's ability to facilitate and support business process innovation and transformation, which leads to reduced cycle times, improved responsiveness and enhancement of organization's services or products (Mooney et al., 1996).

Thus, IT is a very powerful tool that can not only support existing processes, but also create new process design options through its generic capabilities that improve coordination and information access across organizational units (Davenport & Short, 1990). The list of eight generic IT capabilities is presented in table 1.

Table 1. IT capabilities and their organizational impacts (Davenport & Short, 1990)

Capability	**Description**
Transactional	IT can transform unstructured processes into routinized transactions
Geographical	IT can transfer information with rapidity and ease across large distances, making processes independent of geography
Automational	IT can replace or reduce human labor in a process
Analytical	IT can bring complex analytical methods to bear on a process
Informational	IT can bring vast amounts of detailed information into a process
Sequential	IT can enable changes in the sequence of tasks in a process, often allowing multiple tasks to be worked on simultaneously
Knowledge management	IT allows the capture and dissemination of knowledge and expertise to improve the process
Tracking	IT allows the detailed tracking of task status, inputs, and outputs
Disintermediation	IT can be used to connect two parties within a process that would otherwise communicate through an intermediary (internal or external)

IT generic capabilities are not limited to the ones presented in table 1. Each organization can define own IT capabilities that would correspond to the business goals of the organization and characteristics of its business processes (Davenport & Short, 1990). Thus, due to the fact that IT capabilities are directly interdependent with the sources of the information systems value, aligning IT capabilities of an information system type of interest and information system success performance indicators can be utilized as the tool for analyzing perceived value of the information system.

2.2 Cloud based information systems

2.2.1 Concept overview

Cloud computing refers to the information technology service model, where hardware and software services are delivered on-demand to customers across (distributed) IT resources/network in a self-service fashion, independent of the device and location (Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011; Motahari-Nezhad, Stephenson, & Singhal, 2009). Resources provided by the cloud can be dynamically adjusted allowing for more optimal resource utilization (Vaquero, Rodero-Merino, Caceres, & Lindner, 2009).

Cloud computing emerged as the evolution and technological advancement of the grid and distributed computing, web services, service oriented architecture, utility computing and virtualization (Koehler & Anandasivam, 2010; Motahari-Nezhad et al., 2009; Weiss, 2007). The main value of the cloud computing for businesses derives from offering resources in an economical, scalable and flexible manner, which are affordable and attractive to IT customers and investors (Motahari-Nezhad et al., 2009). It can be argued that promising business benefits of the cloud resulted in raising high expectations. Gartner Research expects cloud computing to be a $150 billion business by 2014, and according to AMI partners, small and medium businesses are expected to spend over $100 billion on cloud computing by 2014 (Marston et al., 2011).

Despite of the impression that might appear while defining the concept of the cloud, the cloud-based information system does not necessarily have to be implemented and hosted by a third-party. It can be also deployed and supported through organization’s internal resources provided that the key principles of the cloud are maintained: resource utilization, virtualized physical resources, architecture abstraction, dynamic scalability of resources, elastic scalability and automated self-provisioning of resources, ubiquity (i.e. device and location independence) and the operational expense model (Bhardwaj, Jain, & Jain, 2010; Marston et al., 2011).

Core technologies and architecture

Cloud computing is based on three core technologies that allowed its evolution to the current state: virtualization, multitenancy and Web services (Marston et al., 2011; Weinhardt et al., 2009).

Virtualization, enabled by two main technologies, such as paravirtualization and hardware-assisted virtualization (Youseff, Butrico, & Silva, 2008), allows providing an emulated computing platform to the users while hiding the platform's physical characteristics. Such approach enables easy on-demand configurability, maintenance and replicating of the system (Marston et al., 2011).

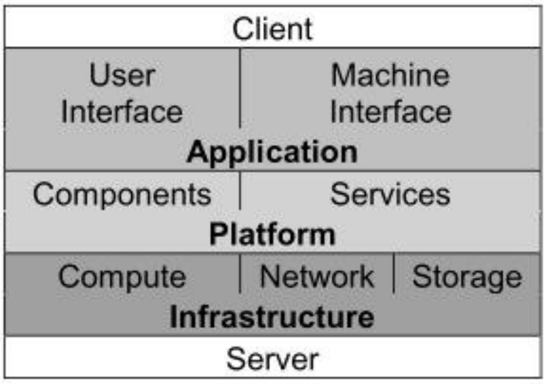
Multitenancy, which is related to the concept of virtualization, represents the second core technology of the cloud computing. Multitenancy allows sharing a single instance of the application between multiple users rather than duplicating the instance. As a result, the processing overhead and memory usage reduces, which leads to better utilization of the resources (Marston et al., 2011) and cost reduction (Motahari-Nezhad et al., 2009).

Finally, web services as the third major component of the cloud computing, can be described as systems that allow machine-to-machine interaction over the network and, namely, clients and servers that communicate of the Hypertext Transfer Protocol (HTTP). Due to the fact that web services allow standardization of the interfaces between applications, they enable the software client (e.g. a web browser) to easier access server applications (Marston et al., 2011).

Cloud service models

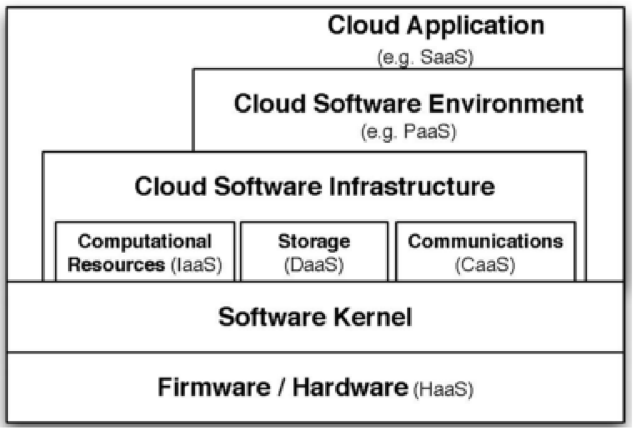
Schematically, architectural layers of cloud computing can be described in the form of service stack. In this model main three layers of the cloud computing architecture are traditionally defined as the application/software layer, platform layer and infrastructure layer (figure 9).

Figure 9. Cloud computing stack (Bhardwaj et al., 2010)



Some models also extend the service stack and include two more service levels into cloud's architecture – software kernel and firmware / hardware layer (figure 10).

Figure 10. Cloud computing ontology (Youseff et al., 2008)



Cloud computing service models can be grouped into three architectural levels: cloud application, cloud software environment and cloud software infrastructure that is comprised by computational resources, storage and communications. The basis of cloud's architectural levels are formed by the software kernel that provides software management for the physical cloud's servers and firmware / hardware layer (Youseff et al., 2008). Each of the service model can provided to the customers as separate service offerings (Bhardwaj et al., 2010). An overview of each cloud's service model is presented in table 2.

Table 2. Cloud computing service models

Cloud service model	**Description**
Software as a Service (SaaS)	Delivery of the application through the medium of the Internet as a service. This type of a service can offer a complete application functionality that ranges from productivity applications (e.g., word processing, spreadsheets, etc.) to programs such as those for Customer Relationship Management (CRM) or Enterprise-Resource Management (ERM) (Sultan, 2011). A SaaS provider typically hosts and manages a given application in their own data center and makes it available to multiple tenants and users over the Web (Bhardwaj et al., 2010).
Platform as a Service (PaaS)	Remote delivery of such services as operating systems, databases, middleware, Web servers and other software (Sultan, 2011). Quite often PaaS also represents an application development and deployment platform delivered as a service to developers (Bhardwaj et al., 2010). Service developers are supplied by the cloud service provider with a programming-language-level environment and a set of APIs to facilitate the interaction between the environments and the cloud applications, support the deployment and scalability of the service (Youseff et al., 2008).
Infrastructure as a Service (IaaS)	Remote delivery (through the Internet) of a full computer infrastructure (e.g., virtual computers, servers, storage devices, etc.) (Sultan, 2011) and computational resources enabled by the virtual machines (Youseff et al., 2008). The infrastructure layer provides the necessary resources to the higher-level layers of the cloud based system (Youseff et al., 2008).

Data-Storage as a Service (DaaS)	Remote data storage at remote disks and data access services (Youseff et al., 2008).
Communication as a Service (CaaS)	Provisioning of the service-oriented, configurable, schedulable, predictable and reliable network communication capabilities (Youseff et al., 2008).
Hardware as a Service (HaaS).	Services involving operating, managing and upgrading the physical hardware and switches by the HaaS operator on behalf of its consumers for the life-time of the hardware sublease (Youseff et al., 2008).

Cloud deployment models

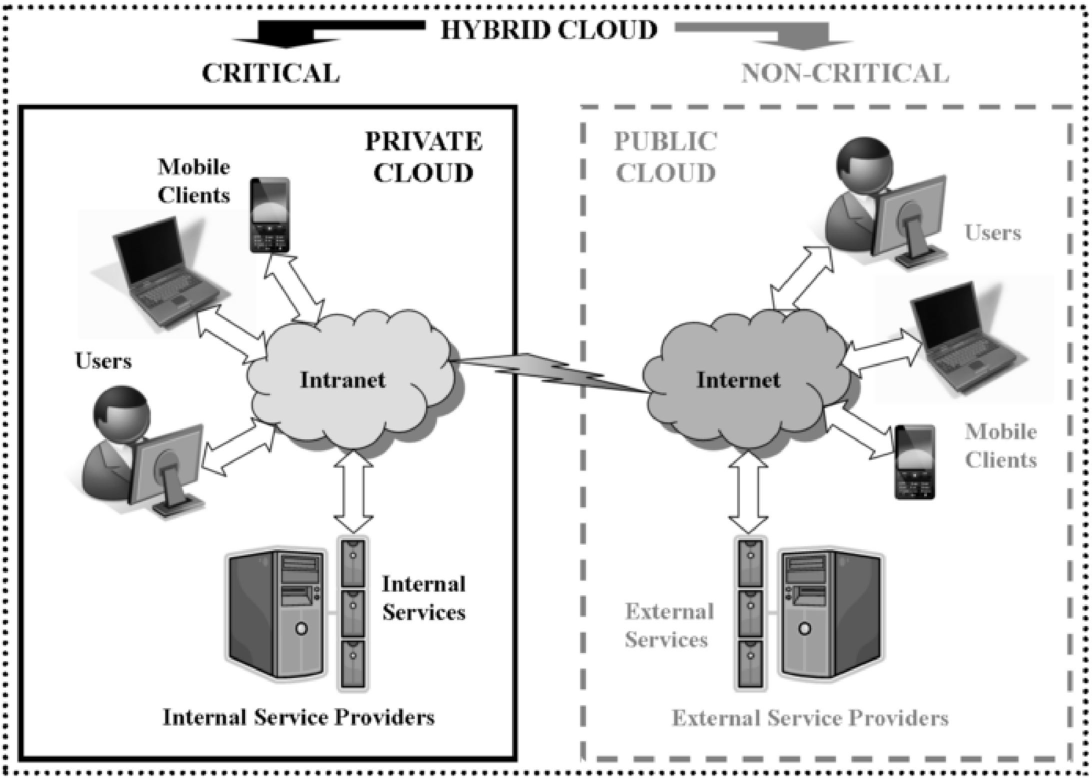
Cloud computing can be run based on various deployment models represented by private, community, public or hybrid cloud. More detailed description of each deployment model is presented in table 3.

Table 3. Cloud computing deployment models (Brian et al., 2008; Hoberg, Wollersheim, & Krcmar, 2012)

Deployment model	**Description**
Private cloud	The user of the cloud-based solution is a certain organization or user. A private cloud can be run internally or by a third-party provider.
Community cloud	Service is used by several members of a certain group and may be offered by several internal or external providers.
Public cloud	Service is available to the public and generally provided by a single provider.
Hybrid cloud	Combination of various deployment models and forms (e.g. sensitive data is provided in the private cloud, while publicly available data in the public cloud).

An illustration of the cloud computing deployment models is provided in the figure 11.

Figure 11. Illustration of cloud computing models (Géczy, Izumi, & Hasida, 2012)



According to figure 11, the critical resources and processes in the organization tend to be implemented as the private cloud while non-critical are often moved to the public cloud. It is worth to mention that implementation of the private clouds are more typical for large organizations that aim at reducing underutilization of the processing power. On the other hand, medium-sized and smaller companies are more prone to use the public clouds (Motahari-Nezhad et al., 2009).

2.2.2 Benefits of cloud computing

Cloud computing benefits

Implementation of the cloud based information systems is believed to result in significant business benefits due to cloud computing's superior capabilities in comparison with traditional information systems (Aljabre, 2012; Armbrust et al., 2010; Leimeister, Böhm, Riedl, & Krcmar, 2010; Marston et al., 2011; Mohammed, Altmann, & Hwang, 2009). Therefore, for the purpose of current research the benefits of the cloud computing are analyzed through the lens of relevant Devanport's generic IT capabilities discussed in section 2.1.2.2. General business benefits are presented before information system's capabilities.

Business benefits

Cloud technology is paid incrementally, which leads to the possibility for the organizations to save money (Bhardwaj et al., 2010). Cloud computing also brings cost allocation flexibility for organizations that aim at moving capital expenditures into operational expenditures. Organization's costs are reduced due to improvement of the operational efficiency and, as a result allow more rapid deployment of new services or products (Bhardwaj et al., 2010).

Cost savings for the organizations derive through lower cost computers for users and no heavy investments in IT infrastructure, hardware or software licensees of expensive large-scale information systems (Aljabre, 2012; Marston et al., 2011). Lower required investment in IT lead to lower barriers to entry for newly established organizations into certain business areas (Marston et al., 2011).

Automational capability

Automational and transactional capabilities of the information systems grouped as the automational capability allows automation of the routine business processes through implementation of the IT with the aim of increasing processes' performance efficiency. Routine processes are characterized with the lower extent of expertise and special knowledge required to perform the processes, in such a way making processes more standardizable. In turn, the more standardizable and modularizable the processes are, the easier IT can be applied to automate the business processes and, as a result, generate business value.

By considering the benefits of the cloud based information systems through the lens of the automational capability, it can be argued that principles of reusable infrastructure and modularity, which lay in the basis of cloud computing, allow more efficient automation of the standardizable routine processes compared to traditional computing methods (Iyer & Henderson, 2010). Automational effect of the cloud computing is also strengthened with the easier and smoother software upgrade and update process enabled by principles of decoupling and separation of the business service from the infrastructure needed to run it (i.e. implementation of the virtualization techniques) (Bhardwaj et al., 2010). Thus, automation of the server updates and handling of the computing challenges by the third-party can allow organizations to ensure the reliability and accessibility of the service (Bhardwaj et al., 2010). Scalability and high reliability are also considered to be important requirements for the cloud based information systems and, as a result, are major components in the cloud system's architecture (Klems, Nimis, & Tai, 2009).

More efficient automation of the business processes is also enabled through better integrating capabilities of cloud computing due to the fact that cloud's architectural principles enable better compatibility between applications and operating systems (Aljabre, 2012). As a result, the business processes of the organization are not only being automated within a certain business unit, but also are able to share the data and functionality with information systems from other units.

Cloud based systems are able to decrease he number of employees to operate IT infrastructure and, as a result, lead to increase of profits while decreasing the costs (Aljabre, 2012). The main reason of decrease in costs is related to decrease in number of the employees required to operate IT infrastructure, savings related to less purchases of IT equipment and lower real estate renting costs due to less space required for IT equipment (Aljabre, 2012). Besides this, cloud computing is based on principles of reusable infrastructure and modularity (Iyer & Henderson, 2010) that facilitate automation of the routing processes.

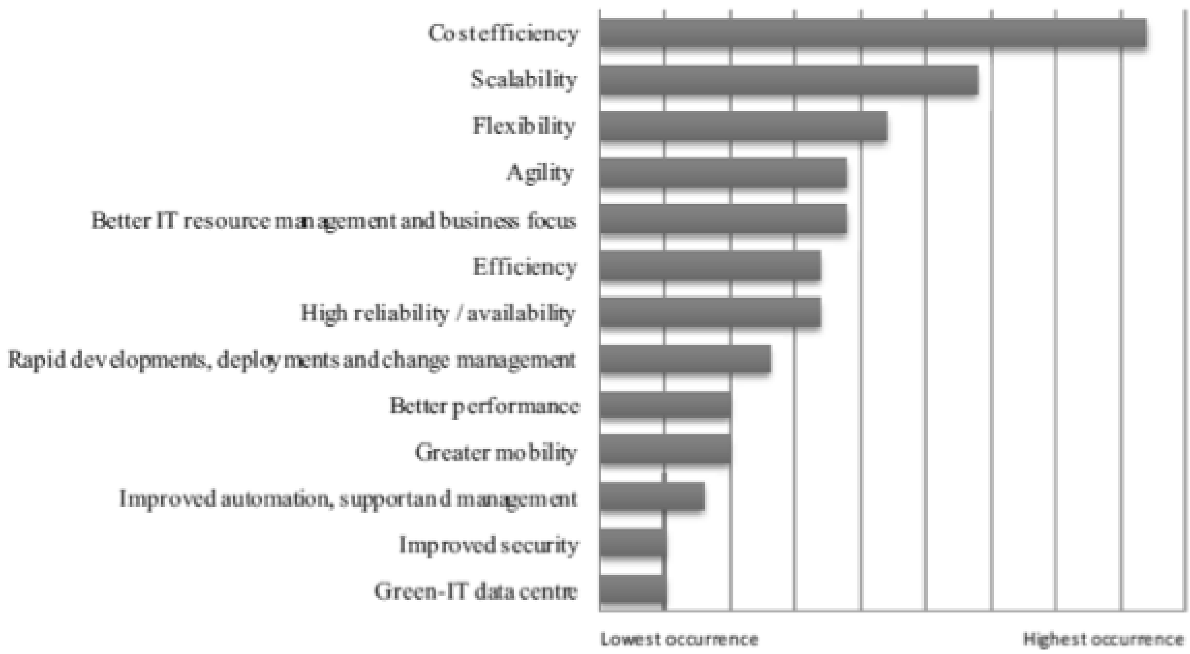
Therefore, the automational capability of the cloud based information systems is strengthened with the architectural specifics of cloud computing and, as a result, assumingly leads to the improvements in *usability* and *relevance* of the data used by the business processes.

Information processing capability

The higher the information intensive of the service activity, the easier it is to use the information technology to perform this activity at a time and location that is more efficient and results in higher quality (Apte & Mason, 1995). Cloud based information systems compared to the traditional computing methods provide more efficient information processing capabilities due to the elastic nature of the cloud computing infrastructure, which allows rapid allocation and de-allocation of the massively scalable resources to business services on a demand basis (Bhardwaj et al., 2010) and reduction of the time to process "computer-intensive or data-intensive jobs" (Aljabre, 2012). Such rapid elasticity capability of the cloud based information systems allows organizations to rapidly scale up service usage and, as a result, mirror information processing demands of organization (Iyer & Henderson, 2010), providing organizations with additional flexibility and scalability capabilities.

Besides scalability of the information processing power, flexibility of the cloud computing also arises from the possibility of the organizations to choose multiple vendors that provide reliable and scalable business services, development environments and infrastructure with no long term contracts (Bhardwaj et al., 2010). In such a way organizations are able to minimize the risks of provider lock-in and achieve service flexibility and scalability, which are defined among major cloud computing benefits (Carroll, Merwe, & Kotzé, 2011) (figure 12).

Figure 12. Cloud computing benefits (Carroll et al., 2011)



Information processing capability of the cloud computing is also strengthened with cloud's architecture. Cloud's controlled interface delivered through Application Programming Interfaces (APIs) makes applications more accessible by other applications and systems and, as a result allows the possibility for certain business units utilize analytical tools and access data of other units or external organizations (Iyer & Henderson, 2010). Organization-wide integration and centralized storage of the data in cloud computing systems is enabled through the sourcing interdependence, which allows sharing the information that is stored in the same format between different information systems (Iyer & Henderson, 2010). Due to powerful specialized data center servers and centralized data storage organizations are able to store more data in the cloud than on private computer systems (Bhardwaj et al., 2010). This enhances knowledge management capabilities of the cloud and, as a result, allows organization to utilize data more efficiently for analysis and decision-making purposes.

Through enhances in information processing, analytical and knowledge management capabilities, cloud computing enables development of virtual business environments, that can be defined as "a suite of integrated applications (processes) and tools that support specific, major business capabilities or needs" (Iyer & Henderson, 2010). Virtual business environments provide decision makers with integrated and seamless access to all the capabilities needed to analyze and execute business decisions.

Altogether, controlled interfaces, sourcing interdependence, centralized data storage and possibility to create knowledge sharing virtual business environments, cloud based information systems provides more possibilities for cross-organizational analysis and, as a result, improving information processing, analytical and knowledge management capabilities compared to traditional systems. Cloud benefits in terms of the information processing capabilities can be assumed to positively affect improvements in the areas of *accuracy*, *comparability* and *understandability* of the data utilized by the business processes in organizations.

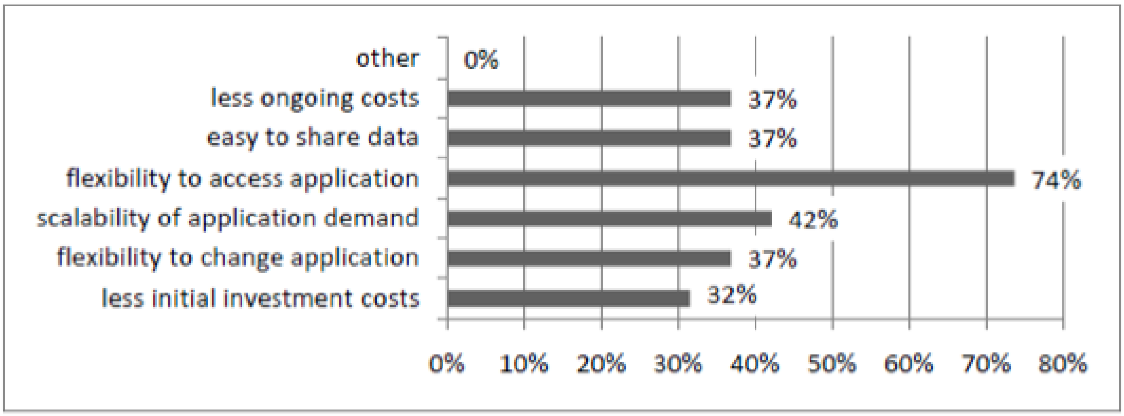
Geographical capability

Geographical capability of the information technology allows transferring the information with rapidity and ease across large distances, making processes independent of geography (Davenport & Short, 1990). Geographical capability is interdependent with sequential and disintermediation capabilities of the information technology, which allow easier and shared access to the organizational data despite of the location or number of users.

Improved information accessibility compared to traditional information systems belongs to one of the most prominently discussed advantages of the cloud based information systems. Through the cloud based system employees of the organization are able access information wherever they are, rather than having to remain at their desks (Bhardwaj et al., 2010). Thus, cloud based information systems provide emote access to resources (Aljabre, 2012).

Location independence and ubiquitous access enabled by the cloud based system facilitates free flow of the information not only across the organization's business units, but also across various geographical areas (Iyer & Henderson, 2010). For example, flexibility to access the application is defined as the main reason to consider Software as a Service in one of the surveys (Koehler & Anandasivam, 2010) (figure 13).

Figure 13. Reasons to consider SaaS (Koehler & Anandasivam, 2010)



Cloud based information systems allow collaborative working and shared access to resources (Aljabre, 2012) that enables collective problem solving (Iyer & Henderson, 2012). Cloud based systems are utilizing API-based interfaces, which unlocks the potential of the applications by making them accessible to internal and external requests and, as a result, create immense opportunities for collaboration and innovation within a company (Iyer & Henderson, 2010). Thus, cloud computing can be considered as an infrastructure for fostering innovation processes inside organization (Klems et al., 2009).

Superior disintermediation capability of cloud computing also allows an organization to build better business relationships with key players in the business (Klems et al., 2009) due to facilitated access to common information systems and more integration of the business processes.

Thus, it can be assumed that superior geographical capability of the cloud based information systems positively affect the *accessibility* of the data used in the business processes.

Tracking capability

The ability to verify the history, location, or application of an item through recorded documentation (traceability) is crucial for ensuring that companies comply with internal and external constraints (Iyer & Henderson, 2010). Tracking capability of the information systems allows detailed tracking of the process' status, inputs and outputs (Davenport & Short, 1990), which is especially important for the processes with low fault tolerance, where the consequences of the mistake can be significant and are able to affect on the organizational level.

Excellent addressability and traceability capabilities of the cloud based information systems allow more efficient tracking and control of the sensitive organizational information (Iyer & Henderson, 2010) lead to the assumption that there is a positive effect of the use of the cloud on *transparency* of the data used to perform a business process.

2.2.3 Risks of cloud computing

Despite of the business benefits of the cloud computing, there are certain risks and obstacles that affect organizations' decision to implement cloud based information systems.

Service performance

One of the major risks that cloud based information systems is related to ensuring business continuity and service availability (Armbrust et al., 2010) as well as service performance (Benlian & Hess, 2011). Even through cloud computing service providers are able to utilize various hardware and software techniques to ensure better reliability of the service through higher service fees and more strict Service Level Agreements (SLAs), there are always threats related to going out of business (Armbrust et al., 2010).

Besides application availability issues, service performance problems can be also related to the interoperability between the cloud based system and organization’s legacy applications, failure to deliver promised bandwidth, failure to provide required resources, poor management of the SLA agreements, lack of vendor capabilities (Benlian & Hess, 2011). A possible solution to some of these problem is to use several cloud computing providers (Armbrust et al., 2010).

Development of efficient SLAs are required to ensure the performance, reliability, quality and availability of computing resources. However, implementation and enforcement of the SLAs can also lead to certain complications for the cloud service providers: e.g. continuous monitoring of the cloud based system’s performance to ensure compliance with the SLAs, development of several sets of performance indicators depending on the cloud service model (SaaS, PaaS, IaaS) etc. (Dillon, Wu, & Chang, 2010). From the customer perspective, SLAs should incorporate different mechanisms for the feedback and service customization (Dillon et al., 2010), which in turn distracts organization’s employees from their primary activities.

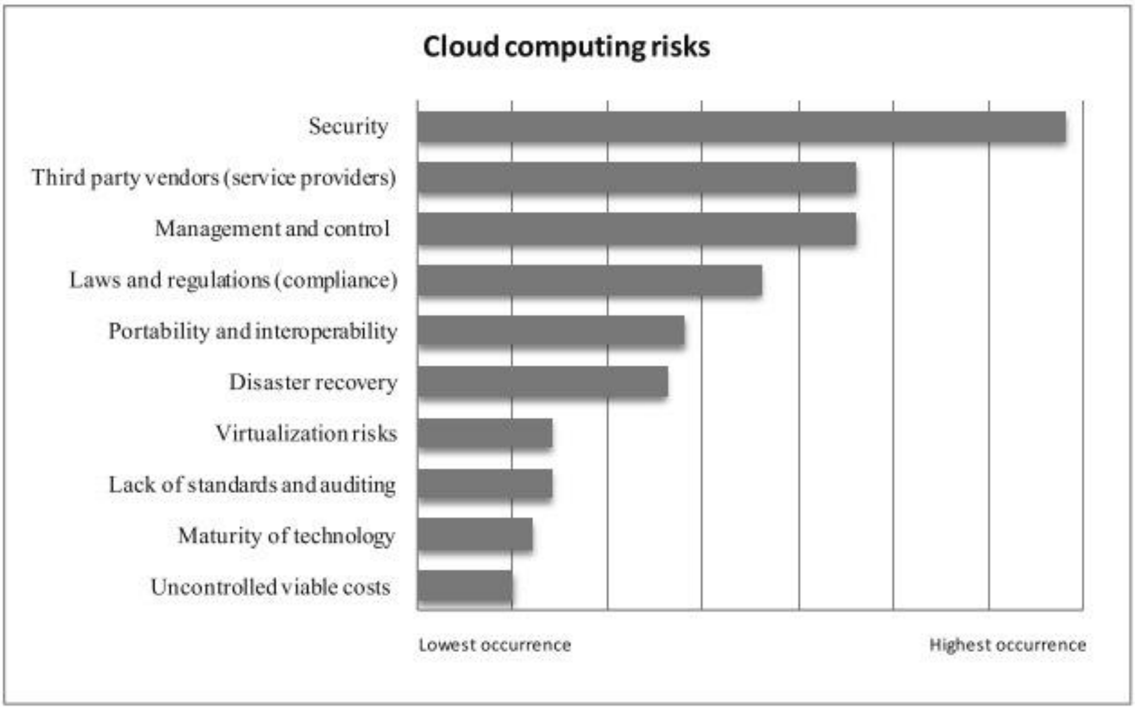
Data lock-in and transfer issues

Aspects related to data lock-in, data transferability limitations and data security are also among major obstacles for organizations to adopt cloud computing (Armbrust et al., 2010). Cloud based information systems provide improved data accessibility, however, extraction of the data in case of migration to another system can be problematic. Data lock-in can be minimized by usage of standardized Application Protocol Interfaces (APIs) and compatible software. Besides the data lock-in problems, data transfer costs can also go relatively high up due to applications being distributed among different components in the cloud (Armbrust et al., 2010). Thus, migrating to the cloud computing services can significantly reduce the infrastructure cost. However, it also usually raises the cost of data communication and cost per unit of computing resources (Dillon et al., 2010).

Security

Storing sensitive or confidential data in the cloud relates to one of the major security issues (Armbrust et al., 2010), which in general is defined as one of the biggest risks of cloud computing (Carroll et al., 2011) as shown in figure 14.

Figure 14. Cloud computing risks (Carroll et al., 2011)



It is believed that protection of the data in the cyber space is challenging due to the fact that organizations do not have physical direct control over their data (Carroll et al., 2011). Thus, even though data encryption techniques and firewalls allow reducing the security risks to some extent (Armbrust et al., 2010), inadequate encryption and utilization of absolute cryptography can impose significant risks on the data due to existence of novel methods of breaking the cryptography (Carroll et al., 2011). Additionally, weak authentication mechanisms can increase an unauthorized access to globally accessible applications due to multitenant nature of cloud computing (Carroll et al., 2011). In general, security threats such as man-in-the-middle attacks, authentication attacks, side channel attacks, social networking attacks and denial of service (DoS) attacks refer to major security problems of cloud computing (Carroll et al., 2011).

Managerial risks

Reputation and image of the manager responsible for a certain application can be harmed if this application is being moved to the cloud and outsourced to the external partner. This can affect the perception of managers by the peers, partners and customers that can in turn lead to loss of power or influence inside an organization (Benlian & Hess, 2011).

Legal risks

Due to the fact that cloud computing servers can be geographically distributed, ensuring compliance of cloud computing services to the laws and regulations of a certain country can be challenging (Carroll et al., 2011).

2.3 Cloud computing and business process outsourcing

2.3.1 Overview of business process outsourcing

Business process outsourcing (BPO), which represents outsourcing of the business processes to external third party, is considered to be a rapidly growing market with the average growth rate at 25% annually (Lacity, Solomon, Yan, & Willcocks, 2011). In the context of business process outsourcing, business processes represent transactional activities that transform input information to create value (Mani, Barua, & Whinston, 2010). Thus, information technology is an essential part of the execution and management of the BPO (Mani et al., 2010).

IT facilitates codifiability (the extent to which the information can be converted to the form suitable for transfer among economic agents), standardizability (a common framework and vocabulary to define business processes) and modularizability (decomposition of a product or service into components) that increase a business process' disaggregation potential (S. Mithas & Whitaker, 2007). In other words, information systems enable separation of "business processes and artifacts from the places where the processes were traditionally performed" (S. Mithas & Whitaker, 2007).

Outsourcing decision-making

Many outsourcing decisions was the desire to reduce costs, improve performance, and/or speed delivery on what is viewed as a non-core business process better provided by suppliers with superior skills, expertise and scalability (Lacity et al., 2011). Thus, there is a strong evidence in the literature that companies outsource their business processes in order to focus on core competencies and benefit from the specialized deep knowledge from the outsourcing companies in performing certain processes. Scaling up or down the production or service offerings as well as improvement of the customers' business processes are also considered as major motivations for outsourcing (Lacity et al., 2011). However, concerns regarding intellectual property may prevent certain companies from outsourcing their business processes in case the data associated with the processes is sensitive or are a subject for strict security (Lacity et al., 2011).

In manufacturing field, determinants of the outsourcing decisions were mainly analyzed through the framework of transaction cost economics (Everaert, Sarens, & Rommel, 2008). Transaction cost economics considers transactional costs (costs of running the service as well as costs related to re-negotiating the contracts and monitoring performance of the supplier) as one of the key aspects that influence outsourcing decisions (Williamson, 1979, 1981, 1998). A transaction occurs when a good or service is transferred across a technologically separable interface (Williamson, 1981).

Some transactions are simpler, while other are more complex and, as a result, require more attention and certain governance structures (Williamson, 1981). Two assumptions form the basis of transaction cost economics: 1) human agents are subjects to bounded rationality and 2) some of the agents are given to opportunism. For bounded rationality all economic exchange can be organized in an incomplete contract (incomplete due to limitations regarding processing of the complex contracts) (Williamson, 1981). An incomplete contract can be potentially sufficient provided that the economic agents are not subjects to opportunism and do not "disguise attributes or preferences, distort data, obfuscate issues, and otherwise confuse transactions" (Williamson, 1981). Thus, in circumstances when the opportunistic behavior develops, organizations might come to the conclusion that they would benefit more by replacing external suppliers with own employees due to the fact that the latter ones can be monitored and controlled more efficiently (Hennart, 1988).

Due to the fact that organization's transactions differ depending on their type, not all business processes are subjects to outsourcing. Therefore, transactions that are subject to outsourcing should be analyzed based on certain criteria to determine their outsourcing potential. Such criteria in transaction cost economics refer to degree of uncertainty, frequency with which a transaction occurs and asset specificity (Williamson, 1981). Asset specificity is an important factor in the context of outsourcing as in case the items are unspecialized parties involved in the transaction are able to choose their trading partners and markets more freely (Williamson, 1981). Human asset specificity is especially significant for outsourcing due to the fact that if the transactions do not require an extensive learning process and employees' skills that are required to perform a transaction in question are not highly specialized, human assets have a higher outsourcing potential (Williamson, 1981). In the contrast to low-skill occupations, high-skill occupations are less vulnerable to the service disaggregation as they involve "higher-order cognitive skills" and, as a result, are more difficult to be codified, standardized and set in the bounds of certain rules (S. Mithas & Whitaker, 2007).

Thus, organizations that are considering outsourcing of the business processes are more likely to outsource IT-enabled processes that are more information intensive, easier standardizable and modularizable and requiring less specific learning knowledge.

Selective outsourcing

Issues regarding the scope of business process outsourcing and potential benefits and risks of business process outsourcing led to distinguishing between total and selective sourcing (Böhm, Leimeister, Riedl, & Krcmar, 2011). Selective sourcing involves outsourcing of certain number of organization's activities over a fixed period of time ruled by the strict contract, which allows meeting organization's specific demands while minimizing the risks associated with outsourcing (Lacity, Willcocks, & Feeny, 1996).

Findings of the research on IT sourcing show that companies that made a decision on total outsourcing of IT function through the megadeals for the period of several years experienced relatively large loss of alignment between business and IT strategy, failed promises to access new technologies, higher service costs compared to the market average service fees (Lacity et al., 1996).

2.3.2 Benefits of business process outsourcing

Many outsourcing decisions are based on the desire to reduce costs, improve performance, and/or speed delivery on what is viewed as a non-core business process better provided by suppliers with superior skills, expertise and scalability (Lacity et al., 2011). Thus, there is a strong evidence in the literature that companies outsource their business processes in order to focus on core competencies and benefit from the specialized deep knowledge from the outsourcing companies in performing certain processes. Scaling up or down the production or service offerings as well as improvement of the customers' business processes are also considered as major motivations for outsourcing (Lacity et al., 2011).

Cost advantages

Cost advantages of the business process outsourcing refer to assumption that external vendors can provide business functions at lower costs due to specialization and the realization of economies of scale and scope (Gewald & Dibbern, 2009).

Focus on core competences

Focusing on core competencies frees up resources to be used more productively in areas that create value for the organization and which are strategically important for organization's differentiation. Thus, organizations can outsource the business processes, which are not generating the business value directly but represent supporting processes (e.g. human resources, logistics and supply chain management, information technology management and support etc.) (Gewald & Dibbern, 2009).

Access to specialized resources

Outsourcing service providers offer a set of services to their clients. Because of learning curve effects, the vendor develops skills in handling the offered processes. Besides this, economies of scale allow the service provider to utilize special resources (e.g., tax specialists for processing exotic mutual funds). Access to leading edge IT resources has been shown to be one of the main indicators of information systems outsourcing (Gewald & Dibbern, 2009).

Quality improvement

Quality improvement is a reason why some corporations choose to outsource. This is often associated with gain in efficiency and effectiveness. Banks expect the service provider to incorporate industry best practices and total quality management procedures. The quality of transaction processing can have a direct impact on customer satisfaction (Gewald & Dibbern, 2009).

2.3.3 Risks of business process outsourcing

Despite of the business benefits, perceived risks of the business process outsourcing may have significant negative consequences, which can prevent companies from making outsourcing decisions.

Performance risk

Performance risk related to the fact that business process outsourcing may not deliver the expected level of service. Potential losses due to this can be significant. They may severely damage the organization's reputation. Therefore, managers must carefully analyze the ability of the service provider. Potential sources of failure are the inability to provide the resources, a lack of vendor capabilities, declining service levels over time or the service provider's lack of experience (Gewald & Dibbern, 2009).

Financial risk

Financial risk assumes that an organization may have to pay more to reach the expected level of service than initially anticipated. Higher than expected costs often occur in IT implementation due to "creeping" requirements, hidden costs, or renegotiating the contract (Gewald & Dibbern, 2009). Hidden costs can arise as the hidden transition and management costs as well as hidden service costs (Aubert, Patry, & Rivard, 1998). Transition costs include setup costs, redeployment costs, relocation costs, and parallel-running costs etc., while management costs refer to the human resources that have to be put into managing an outsourcing contract (Aubert et al., 1998).

Poor service quality referred to one of the biggest risks in outsourcing. Service quality problems can be related to poor response time, poor turnaround time, late updates of software, applications that do not meet the requirements etc. Degradation of the service quality often results in increasing service costs targeted at improving the quality (Aubert et al., 1998).

Strategic risk

Strategic risk admits that an organization can lose critical resources and capabilities necessary to stay competitive. Essential resources and capabilities may include cross-functional skills as well as technological know-how necessary to facilitate innovation. Moreover, outsourcing may reduce an organization's flexibility to react quickly to new internal and external forces, leading to a general lack of control and a high dependency on the service provider (Gewald & Dibbern, 2009).

Psychological risk

Outsourcing may also affect the personal affairs of the managers responsible for the business process. Psychological risk involves the possibility that the personal reputation and career of the manager responsible for the business process will be harmed due to outsourcing. Outsourcing ventures are often associated with negative assertions in the daily press about loss of jobs. This may affect the personal reputation of the managers amongst peers, clients, and staff or lead to a loss of power due to loss of authority over resources (Gewald & Dibbern, 2009).

Contractual difficulties

Contractual amendments are often necessary, either due to changing client's needs or incompleteness of the contract. Sometimes, requests for changes in the service's terms and conditions lead to disputes or even litigation. Disputes also occur over the meaning of contractual terms: services to be rendered, service level or personnel expertise etc. These disputes lead to contractual difficulties, which are often associated with significant costs related to changing a service provider, litigation fees, repatriation costs etc. (Aubert et al., 1998).

Data privacy risks

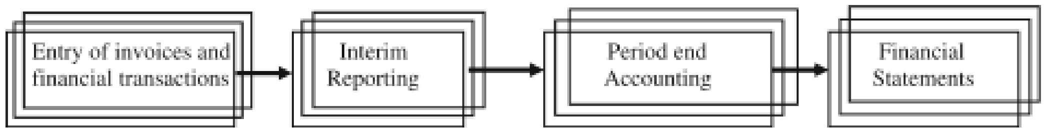
Concerns regarding intellectual property may prevent certain companies from outsourcing their business processes in case the data associated with the processes is sensitive or are a subject for strict security (Lacity et al., 2011).

2.3.4 Outsourcing of accounting processes

Such accounting processes as payroll, benefit and other accounting system are often considered as “useful commodities” and represent primary candidates for outsourcing (Lacity et al., 1996) due to their relatively high levels of modularizability and standardizability and relatively low levels of uncertainty and complexity.

It is argued that small firms often use a combination of the outsourcing and internalizing in regard to accounting tasks (Everaert et al., 2008). Figure 15 represents a schematic overview of the annual accounting process, which includes following tasks: 1) entry of invoices and financial transactions; 2) preparation of an interim profit and loss account; 3) period end accounting and 4) preparation of financial statements (balance sheets, profit and loss account, notes etc.) (Everaert et al., 2008).

Figure 15. Accounting process (Everaert et al., 2008)



In general, accounting tasks can be divided into routine (entry of invoices, interim reporting) and non-routine (period end accounting and financial statements preparation) (Everaert et al., 2008). The main difference between routine and non-routine accounting tasks refers to the relative standardizability and low complexity of the routine tasks and higher degree of personal judgment required for non-routing tasks.

Principles of transaction cost economics have been already previously applied to the problem of outsourcing of the accounting processes (Everaert et al., 2008). The results of previous studies show that accounting tasks with lower frequency are more frequent subjects to outsourcing compared to the tasks with high frequency. Asset specificity plays a significant role in the decision-making process for outsourcing of the accounting processes. Thus, non-routine tasks require more judgment, which forces companies to perform these tasks internally rather than outsourcing to external accountants/accounting firms. On the other hand, due to the fact that routine tasks are more standardized, they are more frequently outsourced compared to non-routine tasks and frequency of the accounting process becomes the most important factor while the outsourcing decision is made (Everaert et al., 2008).

2.3.5 Outsourcing to the cloud

Cloud computing represents one of the recent trends in IT outsourcing, where IT operations are outsourced partially to be run on a public cloud that provides highly scalable and flexible platform for organizational business processes (Armbrust et al., 2010; Dhar, 2012). Cloud computing creates big changes in the IT services marketplace to which both customers and providers must adapt. While organizations shift procurement from product licenses to services, enterprises are increasingly interested in Platform as a Service (PaaS) to facilitate cloud-optimized applications and outsourcing of process services. Services themselves have become more standard, repeatable and scalable through commoditization of technology, virtualization, connectivity and service-oriented architecture (Pring, 2010).

While cloud offers an alternative to traditional outsourcing, its benefits include at least theoretically higher cost efficiency, more optimal operation and agility of implementation and integration. Security is still a concern, though, as well as potential uncertainties in e.g. longer-term Total Cost of Ownership. These can be mitigated by careful management of organizations' IT governance and policies in co-operation with the cloud service providers (Pring, 2010).

As cloud solutions and architectures enable further "industrialization" of IT services with many perceived advantages, traditional outsourcing must stay relevant by enhancing their own capabilities in reuse, automation, standardization, specialization, templates and globalization. Cloud computing is perhaps not a revolution in itself, but it does represent a new set of principles and practices that are driving benefits within the industry in many ways (Pring, 2010).

Outsourcing to the cloud provides organizations a possibility to separate IT provisioning of the business process from the actual performance of the process due to the fact that the process can be still performed in-house.

Cloud computing should be distinguished from traditional IT outsourcing mainly due to the following reasons (Dhar, 2012):

- IT outsourcing implies transferring total or partial IT decision making, services and internal activities to the third-party provider while with the outsourcing to the cloud organizations are able to maintain a certain extent of control over their IT decisions while benefiting from the complex IT infrastructure without associated costs and maintenance process;
- Traditional IT outsourcing usually requires certain amount of the up-front costs while outsourcing to the cloud allows avoidance of the initial investment due to the fact that capital expenditures are, as a rule, taken into account in the rental fees;
- Traditional IT outsourcing services might not necessarily be on-demand, while in case of cloud services are on-demand and instantly scalable;
- Cloud outsourcing provides more possibilities for flexible increase or decrease of resources than traditional IT outsourcing;
- Traditional IT outsourcing is often associated with the large amount of hidden costs, while in case of cloud outsourcing cost structure is more transparent;
- Cloud outsourcing provides less possibilities for customization and less project management processes needed compared to IT outsourcing;
- Strategic and management consulting as not included into the scope of cloud outsourcing while in case of traditional IT outsourcing third-party service provides might offer additional value-added services;
- Traditional IT outsourcing can provide more security regarding the data, while in case of cloud computing security, privacy and continuity of the data might be questionable;

- Traditional IT outsourcing usually is performed through the long-term contracts, while for cloud outsourcing shorter-term contracts are more typical.

Therefore, cloud computing will have a significant impact on IT outsourcing service providers, who due to changing customer needs and advancement in the information technology field would be forced to explore cloud based IT service delivery methods and include cloud based service offerings into their portfolio (Dhar, 2012).

2.4 Literature review synthesis: conceptual framework

From the literature review conducted in sections 2.1, 2.2 and 2.3, it is possible to draw the following main conclusions:

- Information system value should be analyzed on the business process level. Only on this level correlation between the IT investments and increase in financial and operational performance of the organizations has been detected.

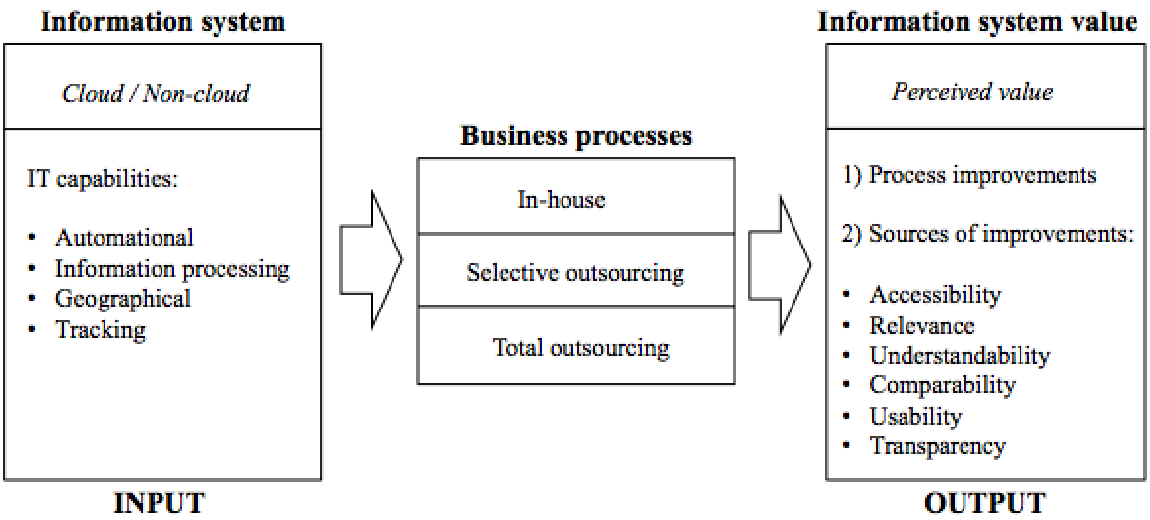
- Performance based measurements (e.g. financial, operational, market-based) can often describe organization's performance on the highly abstract level while leaving out contextual and human factors, such as subjective opinions of the managers, whose decisions and perceptions of the information systems value have a significant impact on organization's future strategy.

- Perceptions of the improvements in the business processes are related to the capabilities of the information systems that are used to automate and computerize these processes. Thus, perceived business benefits of the information system are realized through information system's capabilities. Based on numerous research studies, cloud computing is assumed to have more superior capabilities compared to traditional information systems, which in turn, have a positive effect on the perceived improvements and sources of improvements of the business processes.

- Cloud computing adoption changes organizations' perceptions regarding business process outsourcing, which proves the strong relation between outsourcing and cloud adoption. Accounting processes are more prone for outsourcing due to their specific characteristics.

Based on the approaches for analysis of the information systems value, information systems capabilities relation to the information system value and sources of this value, cloud computing benefits and capabilities and relation of business process outsourcing and cloud adoption, a conceptual model for empirical analysis can be suggested (figure 16).

Figure 16. Literature review synthesis: conceptual analysis model



Current framework represents a synthesis of the process-oriented, resource based, production system based and perceptual approaches towards identification of the information systems value. The analysis level according to the model is represented by the process level, which implies that separate business processes are evaluated from the angles of the outsourcing decision and the use of the information system that serves as the inputs to the process.

Thus, cloud or non-cloud information system influences the process, which can be performed in-house or outsourced, through certain IT capabilities (automational, information processing, geographical, tracking). The outcome of the use of the information system that is implemented to perform a process is derived information system's value, which is evaluated based on the improvements in the business processes as perceived by managers along with perceptions of the sources of these improvements (accessibility, relevance, understandability, comparability, usability, transparency).

According to the current model, organizations can be divided into groups depending on their outsourcing pattern and the perceived value of the certain type of the information system (cloud or non-cloud) can be analyzed in relation to the outsourcing decisions made by this organization.

3 Methodology

3.1 Outsourcing survey

The analysis is performed against the data obtained through the survey of more than 500 companies ranging from small to medium-sized and large organizations. The survey is dedicated towards automation of the accounting business processes and sets a goal of determining the role of outsourcing and cloud computing in improvements of the processes' performance. The survey was distributed in cooperation with OP-Pohjola bank and Confederation of Finnish Industries and performed in two rounds: 1) period between December, 2012 and January, 2013 and 2) period between March, 2013 and April, 2013.

Accounting processes being evaluated in the survey included following 22 processes divided into five groups (table 4).

Table 4. Accounting processes being evaluated in the survey

Process group	**Process number**	**Accounting process name**
Sales	1	Client register maintenance
	2	Product register maintenance
	3	Sending sales invoices
	4	Handling of sales invoices
	5	Sending note of complaint
	6	Sales ledger maintenance
Purchasing	7	Supplier register maintenance
	8	Receiving purchase invoices
	9	Handling purchase invoices
	10	Handling purchase, travel & other costs
	11	Purchases ledger maintenance
Payroll	12	Personnel register maintenance
	13	Basic payroll data maintenance
	14	Payroll calculations

Year-end reporting	15	Preparation of balance sheet and income statement
	16	Preparation and sending of VAT
	17	Preparation and sending of annual salary reports
	18	Preparation and sending of annual pension insurance reports
Payments	19	Periodic VAT payments
	20	Salary payments
	21	Payments for purchases, travel and other expenses
	22	Monthly payroll tax payments

Questions from the outsourcing survey that are relevant for the current research include the following:

- Improvements in 22 accounting processes ranked from 1 (no improvements at all) to 5 (significant improvements);
- Outsourcing decision of 22 accounting processes ranked as 1 (processes performed in-house) and 2 (processes are outsourced);
- Information systems implemented to automate the accounting processes (Microsoft Excel, Tikon, Heeros, Netvisor, Fivaldi, Econet, Nova, Lasso 2100, Maestro, ProCountor, Asteri, BasWare, EmCe, Netbaron, Sonet, Wintime, SAP or other ERP, others);
- Sources of improvements (accessibility, accuracy, usability, comparability, relevance, transparency, understandability);
- Descriptive variables (industry, size of the company in terms of employee payroll, turnover, number of invoices sent/received).

3.2 Focus group

Focus group consisting of three experts in the accounting field was organized on 1.11.2013 in order to discuss the results of the previously performed evaluation of the characteristics of the accounting processes and capabilities of the information systems in the context of accounting tasks. The focus group's experts were represented by:

- Owner of an accounting company;
- Owner of an accounting company and a board member of the Association of Finnish Accountants;
- Expert from an online accounting service provider company.

The discussion lasted for 90 minutes and was dedicated to evaluation of the capabilities of the cloud based and non-cloud based information systems from the perspective of the accounting field. Capabilities of the information systems were analyzed based on the set of capabilities provided by (Davenport & Short, 1990): transactional, geographical, automational, analytical, informational, sequential, knowledge management, tracking and disintermediation. As a result of the discussion capabilities of cloud based and non-cloud based information systems have been rated from 1 (low) to 3 (high). Certain issues regarding data ownership by the cloud service provider were raised and discussed.

3.3 Data analysis software and methods

The survey data for the current research was analyzed in IBM SPSS Statistics Version 21. The IBM SPSS Statistics provides tools that allow users to quickly view data, formulate hypotheses for additional testing, and carry out procedures to clarify relationships between variables, create clusters, identify trends and make predictions.

The tool includes the following key capabilities:

- Linear models (offer a variety of regression and advanced statistical procedures designed to fit the inherent characteristics of data describing complex relationships);
- Nonlinear models (provide the ability to apply more sophisticated models to data);
- Simulation capabilities (help analysts automatically model many possible outcomes when inputs are uncertain, improving risk analysis and decision making);
- Customized tables (enable users to easily understand their data and quickly summarize results in different styles for different audiences) (IBM, 2013).

Sequence and methods of data analysis

The data analysis sequence was divided into three stages:

- Stage 1: Cluster analysis;
- Stage 2: Profiling of the clusters;
- Stage 3: Identification of the perceived value of cloud based IS.

Stage 1: Cluster analysis

The main objective of the first stage of the analysis was to divide the respondents into meaningful groups depending on the outsourcing decisions that respondents (companies) made per accounting process. The technique used to perform the division of the dataset was represented by the cluster analysis.

Cluster analysis is a major technique for classifying large amount of information into manageable meaningful piles. Cluster analysis reduces the data and creates subgroups that are easier to analyze. Thus, cluster analysis is an exploratory data analysis tool for organizing observed data (e.g. people, things, events, brands, companies) into meaningful taxonomies, groups, or clusters, by maximizing the similarity of cases within each cluster while maximizing the dissimilarity between groups that are initially unknown. Cluster analysis creates new groupings without any preconceived notion of what clusters may arise, whereas discriminant analysis classifies people and items into already known groups (Burns & Burns, 2009). The most widely used approaches for cluster analysis include hierarchical cluster analysis and k-means cluster analysis.

Hierarchical cluster analysis represents one of the major statistical methods for finding relatively homogeneous clusters of cases based on measured characteristics. Hierarchical analysis starts with each case as a separate cluster (in the beginning there are as many clusters as cases) and then combines the clusters sequentially, reducing the number of clusters at each step until only one cluster is left. The clustering method uses the dissimilarities or distances between objects when forming the clusters. The SPSS program calculates 'distances' between data points in terms of the specified variables. A hierarchical tree diagram (a dendrogram in SPSS) can be produced to show the linkage points. The clusters are linked at increasing levels of dissimilarity. Distance between the linked elements are often calculated through the Squared Euclidian distance. The most widely used method for hierarchical cluster analysis due to its relative high efficiency is represented by the Ward's method, which uses an analysis of variance approach to evaluate the distances between clusters (Burns & Burns, 2009).

K-means cluster analysis differs from the hierarchical cluster analysis as it is used when there already exist certain hypothesis regarding the number of the clusters. Thus, k-means cluster analysis will produce as many k clusters as will be set in advance by the researcher. As a result of the k-means cluster analysis the cluster centers are produced, which represent the means of the cluster score for the elements of the cluster (Burns & Burns, 2009).

For the purpose of the current research the following cluster solutions have been applied and examined:

- Hierarchical cluster method;
- K-means cluster method with 3, 4 and 5 cluster solutions.

Variables that represented basis for clustering included variables describing an outsourcing decision per accounting process. As a result of comparison between cluster solutions, 4 cluster solution of the k-means cluster method has been chosen as the one that fitted the most the pre-defined cluster types for outsourcing: 1) Processes performed in-house, 2) Selective outsourcing and 3) Total outsourcing. Hierarchical method, 3- and 5-cluster solutions of the k-means clustering method did not provide the meaningful division into the clusters based on the outsourcing categories and, therefore, were omitted in the analysis.

The output of the cluster analysis is represented by the 4-cluster solution and a “Cluster membership” variable assigned to each case in the dataset. The output of the final cluster centers is shown in table A.1 of the Appendix A.

Stage 2: Profiling of the clusters

The main objective of this stage of analysis was to identify the characteristics of each cluster, define the differences between clusters and create clusters profiles.

Statistics methods for profiling of the clusters included the following:

- **Frequencies analysis.** Frequencies analysis identifies the number of cases per each category of value of variable. In the current research frequencies were applied to the

“Cluster membership” variable to define the number of cases in each cluster (table A.3, Appendix A).

- **Means comparison.** The means comparison analysis compares the means between independent groups or between pairs of related fields to test whether a significant difference exists. In the profiling of the clusters’ stage means comparison was applied to the following pairs of variables:
    a. “Information system used” and “Cluster membership” (table A.4, Appendix A) to identify the adoption of the cloud based information systems in each cluster;
    b. “Software satisfaction” and “Cluster membership” (table A.7, Appendix A) to identify the average software satisfaction level in each cluster;
    c. “Average improvements” and “Cluster membership” (table A.9, Appendix A) to identify the average improvements in accounting processes per each cluster;
    d. “Sources of improvements” and “Cluster membership” (table A.12, Appendix A) to identify levels of the sources of improvements in each cluster;
    e. “Outsourcing per process” and “Cluster membership” (table A.15, Appendix A) to identify the average outsourcing rate in each cluster.

- **Crosstabs.** The Crosstabs procedure forms two-way and multiway tables and provides a variety of tests and measures of association for two-way tables. The structure of the table and whether categories are ordered determine what test or measure to use. Crosstabs were applied to the following variables in the profiling of the clusters’ stage:
    a. “Information system used” and “Cluster membership” (table A.5, Appendix A) to identify the adoption of the cloud based information systems per each cluster in percentage;
    b. “Improvements (binned variable)” and “Cluster membership” (table A.10, Appendix A) to identify the average levels of improvements per cluster in percentage;
    c. “Industry” and “Cluster membership” (table A.16, Appendix A) to identify the major industries, in which companies operate, per cluster;

d. “Size” and “Cluster membership” (table A.18, Appendix A) to identify the size of the companies in each cluster;
e. “Invoices sent” and “Cluster membership” (table A.20, Appendix A) to identify the number of the invoices sent per cluster;
f. “Invoices received” and “Cluster membership” (table A.21, Appendix A) to identify the number of the invoices received per cluster;
g. “Turnover” and “Cluster membership” (table A.22, Appendix A) to identify the turnover of the companies per cluster.

- **ANOVA analysis**. ANOVA (Analysis of Variance) represents a collection of statistical models used to analyze the differences between group means and their associated procedures (such as "variation" among and between groups). ANOVA analysis has been applied to the means comparison analysis in order to check the statistical significance of differences between the mean values of the analyzed variables.

- **Chi-Square Tests.** Chi-Square Test is considered as any statistical hypothesis test in which the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true. Chi-Square Tests have been used to analyze the statistical significance of the results of the crosstabs analysis.

Stage 3: Identification of the perceived value of cloud based IS

The main objective of the third stage of the analysis was to analyze each cluster separately and identify the differences in the perceived improvements in the business processes for the cloud users and non-cloud users. Additionally, sources of improvements for the cloud and non-cloud users were defined and contrasted to each other.

For the purpose of this analysis **Means comparison** method was applied to the following variables:

- “Improvements” and “Information system used” (tables B.1 in Appendix B, tables C.1 in Appendix C, tables D.1 in Appendix D, tables E.1 in Appendix E);

- “Sources of improvements” and “Information system used” (tables B.3 in Appendix B, tables C.3 in Appendix C, tables D.3 in Appendix D, tables E.3 in Appendix E);

ANOVA analysis was applied to means comparison analysis to identify the statistical significance of differences between the mean values of the analyzed variables (tables B.2 and B.4 in Appendix B, tables C.2 and C.4 in Appendix C, tables D.2 and D.4 in Appendix D, tables E.2 and E.4 in Appendix E).

The improvements in the accounting processes represent in the current research the manifestation of the business value. Hence, the main assumption of the research is that the higher the adoption of the cloud based information systems is in a cluster and the higher are the improvements in the accounting processes, the higher is the perceived value of the cloud based information systems.

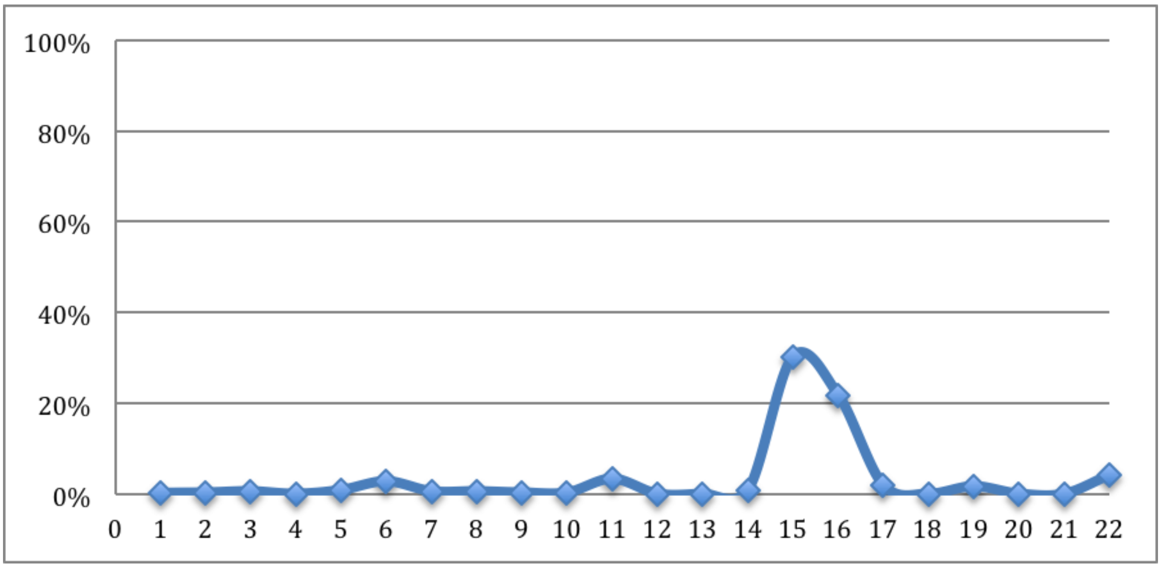
4 Analysis and interpretation of results

4.1 Profiling of the clusters

The output of the cluster analysis is represented by the 4-cluster solution with the cluster centers distributed in the way presented in table A.1 (Appendix A).

Based on the outsourcing rate calculations (table A.14, Appendix A), the first cluster has a strong incline towards performing the accounting processes in-house with the exception of the processes #15 “Preparation and sending of the income statement and balance sheet” and #16 “Preparation and sending of VAT” (figure 17). The outsourcing rate is calculated as following: number of processes outsourced / total number of processes in the cluster.

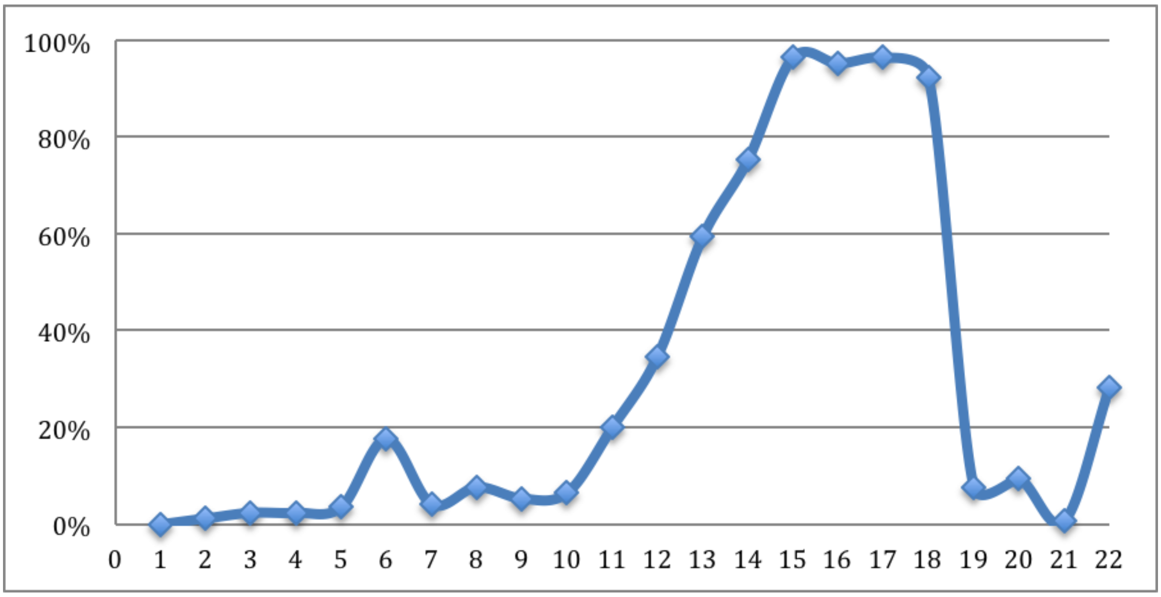
Figure 17. Outsourcing pattern for cluster #1



Based on the strong incline towards performance of the accounting processes in-house, cluster #1 can be labeled as **“Cluster #1: In-house”**.

The outsourcing pattern in cluster #2 strongly implies the selective outsourcing pattern, where majority of the processes are performed in-house, while some of the processes are being outsourced (figure 18).

Figure 18. Outsourcing pattern for cluster #2



According to the outsourcing rate the processes that are outsourced the most in cluster #2 refer to the following:

- #6 “Sales ledger maintenance”;
- #11 “Purchases ledger maintenance”;
- #12 “Personnel register maintenance”;
- #13 “Basic payroll data maintenance”;
- #14 “Payroll calculations”;
- #15 “Preparation of balance sheet and income statement”;
- #16 “Preparation and sending of VAT”;
- #17 “Preparation and sending of annual salary reports”;
- #18 “Preparation and sending of annual pension insurance reports”;
- #22 “Monthly payroll tax payments”.

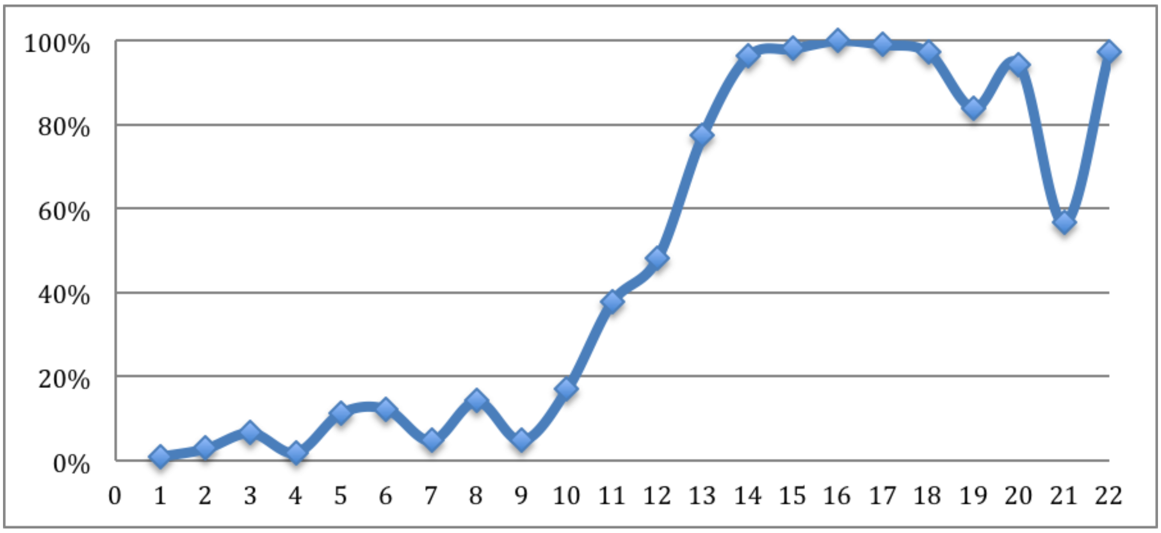
Based on the given outsourcing pattern cluster #2 can be labeled as **“Cluster #2: Selective outsourcing (lower number of processes outsourced)”**.

According to the outsourcing rate of cluster #3, larger number of accounting processes are outsourced compared to cluster #2. Processes being outsourced more compared to cluster #2 include the following:

– #5 “Sending note of complaint”;
– #6 “Sales ledger maintenance”;
– #8 “Receiving purchase invoices”;
– #10 “Handling purchase, travel & other costs”;
– #11 “Purchases ledger maintenance”;
– #12 “Personnel register maintenance”;
– #13 “Basic payroll data maintenance”;
– #14 “Payroll calculations”;
– #15 “Preparation of balance sheet and income statement”;
– #16 “Preparation and sending of VAT”;
– #17 “Preparation and sending of annual salary reports”;
– #18 “Preparation and sending of annual pension insurance reports”;
– #19 “Periodic VAT payments”;
– #20 “Salary payments”;
– #21 “Payments for purchases, travel and other expenses”;
– #22 “Monthly payroll tax payments”.

The outsourcing pattern of the cluster #3 is presented in figure 19.

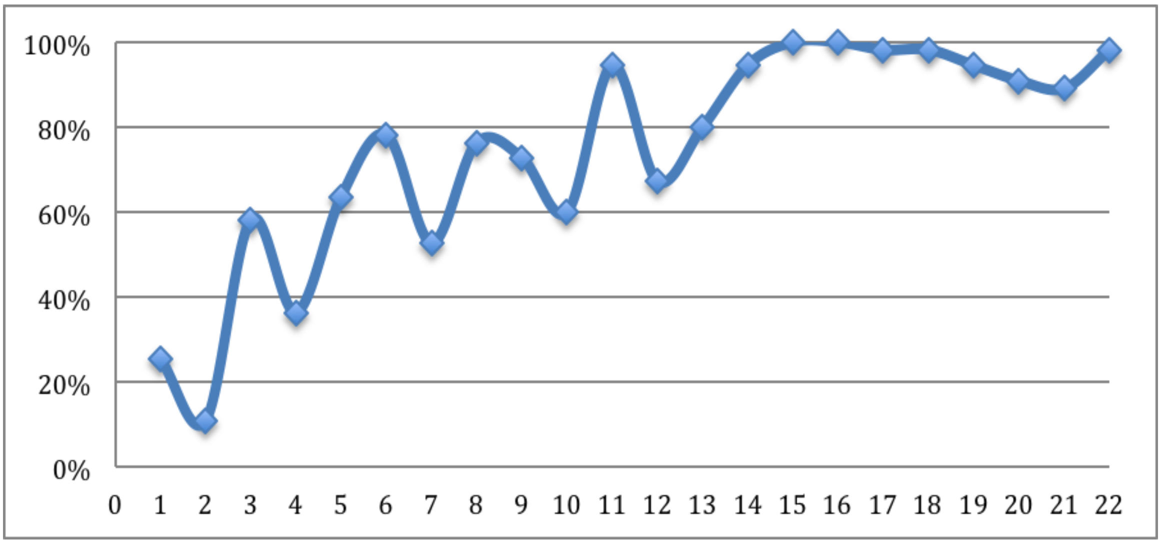
Figure 19. Outsourcing rate for cluster #3



Based on the outsourcing pattern, cluster #3 can be labeled as **“Cluster #3: Selective outsourcing (larger number of processes outsourced)”**.

Cluster #4 has the highest outsourcing rates of all processes compared to three other clusters (figure 20) and, therefore, indicates the strong incline of the respondents towards total outsourcing of the accounting processes. As a result of cluster analysis, cluster centers for cluster #4 have been identifed as "2" (processes being outsourced) for all processes except for processes #1 "Client register maintenance", #2 "Product register maintenance" and #4 "Handling of sales invoices".

Figure 20. Outsourcing rate for cluster #4



Based on the outsourcing rate, cluster #4 can be labeled as **"Cluster #4: Total outsourcing"**.

Table 8 represents profiling of the clusters based on the results of means comparison and crosstabs statistics (tables in Appendix A). Following characteristics of the clusters are ranked from 1 (highest ranking) to 4 (lowest ranking) for the purpose of convenience of comparison: Number of cloud based systems, Average improvements, Satisfaction with the software, Average size of company, Average size of invoices sent, Average size of invoices received and Turnover.

Table 5. Profiles of the clusters

Characteristic	**Cluster #1**	**Cluster #2**	**Cluster #3**	**Cluster #4**
Outsourcing pattern	In-house	Selective outsourcing (lower number of processes outsourced)	Selective outsourcing (larger number of processes outsourced)	Total outsourcing
Major industries of operation	– Industry – Construction – Other servicess	– Industry – Construction – Other services – Wholesale and retail trade, repair of motor vehicles and motorcycles	– Industry – Other services – Wholesale and retail trade, repair of motor vehicles and motorcycles – Healthcare and social services	– Industry – Other services – Construction – Wholesale and retail trade, repair of motor vehicles and motorcycles – Healthcare and social services
Level of adoption of the cloud based IS (0 – non-cloud based IS, 1 – cloud based IS)	4 (0,1)	3 (0,12)	1 (0,19)	2 (0,18)

Characteristic	**Cluster #1**	**Cluster #2**	**Cluster #3**	**Cluster #4**
Average level of improvements in processes (1 – low, 5 - high)	2 (3,50)	4 (3,32)	3 (3,43)	1 (3,71)
Level of the satisfaction with the software (1 – low, 5 - high)	2 (3,66)	4 (3,36)	1 (3,69)	3 (3,63)
Average size of a company (average number of employees on payroll)	1 (39)	4 (13)	3 (21)	2 (33)
Average number of invoices sent annually per company	2 (1756)	4 (1140)	3 (1368)	1 (2540)
Average number of invoices received annually per company	2 (1917)	4 (922)	3 (1375)	1 (2035)
Average turnover per company (million euros)	1 (9,06)	4 (3,00)	2 (5,05)	3 (4,16)
Top 3 most important sources of improvements	– Usability – Accuracy – Relevance	– Usability – Accuracy – Understandability	– Accessibility – Accuracy – Understandability	– Accessibility – Accuracy – Usability

Cluster # 1: In-house

Cluster #1 includes the companies that perform their accounting processes predominantly in-house. The majority of the companies in this cluster operate in such industries as industry, construction and other services. Current cluster has the highest average number of the employees per company, which implies that in cluster #1 there is the highest number of the large companies compared to other clusters (table 8; table A.18, Appendix A). The average number of invoices sent and received per company in this cluster is ranked as second highest among other clusters (table 8; table A.20, table A.21, Appendix A). In terms of the average turnover per company, current cluster contains the companies with the highest average turnover compared to other clusters (table 8; table A.22, Appendix A).

Current cluster has the lowest level of adoption of the cloud based information systems compared to other clusters, which translates in 9,6% of the cloud based systems from the total number of the information systems used (table A.5, Appendix A). At the same time results of the cluster analysis show that companies in cluster #1, i.e. companies that perform the accounting processes in-house, experience the second highest level of improvements in the accounting processes compared to other clusters (table 8; table A.9, A.10, Appendix A). This leads to the conclusion that since the level of improvements is relatively high compared to other clusters, there might be no immediate need for the companies in cluster #1 to move to other clusters (i.e. introduce outsourcing of some of the accounting processes). However, in case a company makes such decision, according to the findings it is more beneficial to outsource larger number of processes rather than outsource only a few processes (see description of the cluster #2).

Due to the fact that current cluster has the highest average size of a company, the reason for non-outsourcing behavior can be related to the fact that large organizations might prefer to maintain internal accounting unit in order to keep the accounting processes under control or due to legacy reasons. The relatively high level of improvements in accounting processes in current cluster could be explained by the fact that since accounting processes are performed in-house, organizations have higher control over the performance and quality of the processes and, therefore, can adjust or modify the processes to fit organization’s needs better.

Top three most important sources of improvements for current cluster were identified as usability, accuracy and relevance (table A.12, Appendix A). Thus, it can be argued that for large organizations that perform their accounting processes in-house improvements that are important are related to the quality, accuracy and convenience of processing the data.

In the current cluster users of the cloud-based information systems expressed higher levels of perceived improvements in the accounting processes compared to non-cloud based systems' users (table 8; table B.1, Appendix B). Such results may lead to the proposition that the use of the cloud based information systems has a positive effect on the perceived improvements in the business processes compared to the use of non-cloud based information systems. Sources of the improvements that were proven to be statistically significantly better for cloud based systems' users compared to non-cloud based systems' users are accessibility and usability (table B.3, table B.4, Appendix B).

Higher perceived improvements in terms of accessibility for cloud users correspond to the needs of types of organizations present in the current cluster. Due to the fact that cluster #1 has organizations with the highest average number of the employees per company, it can be argued that accessibility of the accounting information plays an important role in the large organizations that might have multiple locations and/or users requiring location-independent access to the information. The same notion also relates to the improvements in the usability since accounting processes at larger organizations are becoming more complex and information intensive. In such circumstances improvements in the usability facilitate the processing and comparing of the accounting information and, as a result, improve the efficiency of the processses. Higher levels of improvements in the accessibility and usability for the users of the cloud based information systems lead to the formulation of the proposition that cloud based information systems positively affect on the business processes due to their more efficient geographic and analytical capabilities compared to non-cloud based information systems.

Cluster # 2: Selective outsourcing (lower number of the processes outsourced)

Cluster #2 includes the companies that predominantly perform their accounting processes in-house while outsourcing some of the processes to the third-party account service providers. The majority of the companies in this cluster operate in such industries as industry, construction, other services and wholesale and retail trade, repair of motor vehicles and motorcycles. Cluster #2 has the lowest average number of the employees per company, which implies that this cluster contains the highest number of the small companies compared to other clusters (table 8; table A.18, Appendix A). The average number of invoices sent and received per company in this cluster is ranked as the lowest among other clusters (table 8; table A.20, table A.21, Appendix A). The average turnover per company in the current cluster is also the lowest compared to other cluster, which supports the conclusion that current cluster contains organizations with the lowest number of employees in comparison to three other clusters (table 8; table A.22, Appendix A).

Cluster #2 has the second lowest cloud based information systems' adoption rate, which represents 11,8% (table A.4, table A.5, Appendix A). The results also show that companies in the current cluster experience lowest level of improvements among all four clusters (table 8; table A.9, A.10, Appendix A). Such low level of improvements can be explained by the fact that companies in the current cluster outsource smaller number of processes compared to cluster #3 and cluster #4, while performing a large number of processes in-house. Selective outsourcing of a small number of processes by small sized organizations might lead to the situations, where such companies are not able to develop proper outsourcing capabilities or face problems with the integration of the data related to the outsourced processes. Thus, based on the relation of the average improvements in the processes and an outsourcing pattern, it can be suggested that if an organization makes an outsourcing decision, it is more beneficial to outsource larger number of processes rather than only a few.

Although the results show that an outsourcing pattern in this cluster can be one of the major reasons of the low levels of improvements, it can be argued that low improvement levels can be also related to he low number of the cloud based information systems in the current cluster. Higher level of adoption of the cloud based information systems could have facilitated the integration of the outsourced processes due to their geographical capabilities.

Top three most important sources of improvements for current cluster were identified as usability, accuracy and relevance (table A.12, Appendix A). Such results imply that for small-sized organizations that perform the majority of the processes in-house improvements related to the quality and convenience of processing the data are the most important among other improvements.

Despite of the lower levels of improvements compared to other clusters, the results show statistically significant difference between perceived improvements for cloud and non-cloud based systems' users (table C.1, table C.2, Appendix C). This leads to the proposition that cloud based systems have a positive effect on the average level of improvements in the business processes. As in cluster #1 results show that accessibility and usability is also statistically significantly better for the users of the cloud based information systems compared to the users of the non-cloud based information systems (table C.3, table C.4, Appendix C). Higher improvements in accessibility for the cloud users may be related to more efficient geographical capability of the cloud systems compared to non-cloud systems. Higher improvements in usability can be related to better analytical capabilities of the cloud systems.

Cluster # 3: Selective outsourcing (larger number of processes outsourced)

Cluster #3 includes companies that selectively outsource a larger number of the accounting processes to the third-party account service providers. The majority of the companies in this cluster operate in such industries as industry, construction, other services, wholesale and retail trade, repair of motor vehicles and motorcycles and healthcare and social services. Cluster #3 has the average number of the employees per company higher than cluster #2 but lower than two other clusters, which implies that this cluster contains medium- to small companies (table 8; table A.18, Appendix A). The average number of invoices sent and received per company in this cluster is ranked as the third among other clusters, which means that the average number of invoices sent and received is higher than in cluster #2 but lower than in two other clusters (table 8; table A.20, table A.21, Appendix A). The average turnover per company in the current cluster is the second highest after cluster #1 that supports the suggestion that current cluster contains medium-sized companies (table 8; table A.22, Appendix A).

Current cluster contains the highest number of the cloud-based systems in relation to the cluster size – 18,9% (table A.4, table A.5, Appendix A) as well as the highest level of the satisfaction with the software (table A.7, Appendix A), which leads to the proposition that software satisfaction is higher with the higher level of cloud adoption. Besides this, in cluster #3 perceived improvements in the accounting processes appear to be higher for the cloud users compared to the non-cloud users (table D.1, table D.2, Appendix D), which leads to the proposition that cloud based information systems have a positive effect on the general improvements in the business processes.

Top three most important sources of improvements for current cluster were identified as accessibility, accuracy and understandability (table A.12, Appendix A). Such results imply that for medium-sized organizations that outsource the majority of the accounting processes improvements related to the easier access to the data and the ability to manipulate the data and present it in the simple easy to understand format is the most important among other improvements.

In cluster #3 statistically significantly higher improvements for the cloud users compared to non-cloud users were identified in relation to accessibility, relevance and transparency (table D.3, table D.4, Appendix D). The difference in the sources of improvements for cloud users in cluster #3 and cluster #2 can be explained by the difference in the outsourcing patterns. Thus, it could be argued that for the accounting processes, which in cluster #2 are kept in-house, but are outsourced in cluster #3 (e.g. #5 "Sending note of complaint", #8 "Receiving purchase invoices", #19 "Periodic VAT payments", #20 "Salary payments" #21 "Payments for purchases, travel and other expenses", #10 "Handling purchase, travel & other costs") relevance and transparency of the information related to these processes are more important than e.g. usability, which was an important source of improvements for the respondents in cluster #2. Better levels of relevance and transparency indicated by cloud users can be explained by more efficient cloud system's capabilities that enable these improvements. Thus, better improvements in transparency may be enabled by better cloud system's capabilities in tracking, while higher improvements in relevance compared to traditional information systems may be enabled by more efficient analytical capability of the cloud system.

Compared to cluster #2, where the average improvements in the accounting processes appear to be the lowest among all clusters and the level of cloud adoption is low in comparison to cluster #3, it could be argued that cloud based systems facilitate selective outsourcing through better integration of the outsourced processes and process related data. Better integration is achieved due to the fact that third-party outsourcing providers can access in-house systems through the external interface and perform the outsourced processes seamlessly. Better integration of the processes by the cloud based information systems is enabled by more efficient geographical and analytical capabilities of the cloud systems compared to traditional information systems.

Cluster # 4: Total outsourcing

Cluster #4 includes companies that are strongly inclined towards total outsourcing of their accounting processes. The majority of the companies in this cluster operate in such industries as industry, construction, other services, wholesale and retail trade, repair of motor vehicles and motorcycles and healthcare and social services. Current cluster has the medium level of the average number of the employees per company, which implies that cluster #4 contains a high number of medium-sized companies (table 8; table A.18, Appendix A). The average number of invoices sent and received per company in this cluster is the highest among other clusters (table 8; table A.20, table A.21, Appendix A). In terms of the average turnover per company, current cluster contains the companies with the medium level of average turnover compared to other clusters (table 8; table A.22, Appendix A).

The level of adoption of the cloud based information systems in this cluster is the second highest after cluster #3 and represents 18,2% (table A.4, table A.5, Appendix A). Thus, the number of cloud based systems in this cluster is close to the number of cloud based systems in Cluster #3. However, respondents in cluster #4 experience significantly higher level of general improvements in their accounting processes among other clusters, while Cluster #3 has only medium level of improvements (table 8; table A.1, Appendix A).

At the same time, respondents in cluster #3 outsource significantly lower number of accounting processes compared to current cluster, where respondents indicate a strong incline towards total outsourcing. Due to this it can be suggested that the highest level of improvements among all clusters are achieved by the respondents in cluster #4 through the combination of heavy outsourcing and strong adoption of the cloud based information systems. As in cluster #3 it can be argued that cloud based information systems facilitate outsourcing through their superior capabilities (such as geographical, analytical, tracking etc.) compared to traditional information systems.

Top three most important sources of improvements for current cluster were identified as accessibility, accuracy and usability (table A.12, Appendix A). This implies that for the organizations that perform total outsourcing of the accounting processes improvements related to the easier access to the data and data quality are among the most important improvements.

Despite of the highest level of average improvements in the accounting processes in this cluster, it appears that companies that are inclined towards total outsourcing do not differentiate improvements depending on the type of the information system used to perform the processes (table E1, table E.3, Appendix E). This could be explained by the fact that total outsourcing implies the complete transferring of the responsibility for performance of the outsourced process to the third-party service provider. At the same time, the high level of perceived improvements implies that third-party outsourcing providers are able to maintain the high quality of the service level no matter which type of the information system is used to perform a process.

4.2 General findings and propositions for further research

As a result of the cluster analysis a given dataset was divided into four clusters with evidently different characteristics, differences in perceived improvements in the accounting processes as well as different sources of such improvements.

The highest level of improvements in accounting processes were indicated by the respondents in cluster #4, in which organizations are strongly inclined towards total outsourcing as well as have a high level of cloud systems' adoption. Additionally, improvements in accessibility (which is enabled by an efficient geographical capability of the cloud based information system) appear to be significantly better for cloud users. Such results lead to the following proposition for the further research:

Proposition 1: Cloud based information systems facilitate the outsourcing of IT-enabled business processes through efficient geographical capability.

As the results show, the sources of improvements differ depending on the outsourcing pattern of a company. Thus, companies of cluster #1 and #2, which perform the accounting processes predominantly in-house, indicated the highest improvements in such areas as accuracy, usability, understandability that refer to the quality and ease of processing and manipulation of the data. At the same time, companies in clusters #3 and #4, which are inclined towards more intensive outsourcing of the accounting processes, perceive improvements in accessibility among the most important improvements. This leads to the following proposition for the further research:

Proposition 2: Ease of access to the data plays a more important role for organizations that perform intensive outsourcing of the business processes, while data quality and accuracy appear to be more important for organizations that perform business processes predominantly in-house.

For all clusters except for cluster #4 with the incline towards total outsourcing cloud users indicated higher average improvements in accounting processes compared to non-cloud users. These results lead to the next proposition for the further research:

Proposition 3: Use of the cloud based information systems has a positive effect on improvements in the organization's business processes.

The highest level of satisfaction with the software, which is used to perform accounting processes, has been indicated by the respondents of cluster #3, in which the adoption of the cloud based information systems is the highest. Hence, the following proposition for the further research is formulated:

Proposition 4: Use of the cloud based information systems generates higher level of satisfaction with the software.

From the analysis of the cluster #4, it appears that organizations that practice the total outsourcing of the accounting processes do not experience higher improvements with the use of the cloud based information systems. Thus, the following proposition for the further research is formulated:

Proposition 5: For organizations practicing total or near total outsourcing type of the information system (cloud based or non-cloud based) does not have any effect on the improvements in the business processes.

The final proposition for the further research is related to the suggestion of the extensive study that would aim at identification of the practices of the third-party outsourcing providers to maintain the high quality of the service that, as shown in the results of the current research, led to the highest level of improvements in accounting processes:

Proposition 6: Third-party outsourcing providers are able to deliver services of high quality through best practices and approaches

Further research for the propositions presented above should be targeted at finding causal relationships between the use of the cloud based information systems and perceptions of their value in organizations.

4.3 Limitations of the research

Current research has a number of limitations, which might have had an impact on the quality of the output results of the cluster analysis.

The first set of limitations refers to the limitations related to the data sample used for the analysis. The majority of the companies, included into the sample, is represented by small and medium-sized companies operating in Finland. Due to this limitation differences across companies of different sizes and geographical areas of operation might have been neglected. Additionally, the range of business processes analyzed in the current research is limited only to accounting processes and do not include other areas of business.

The second group of limitations refers to the incompleteness of the survey data and missing values. The first limitation in this group relates to the unavailability of the historical information regarding the information systems previously utilized by the organizations included in the sample. This limits the possibility of comparison the previous performance of the business processes before the implementation of the cloud based information system and does not allow accurate identification of the process' problematic areas, which were improved with the use of the cloud computing. Ideally, current research would require a comprehensive longitudinal analysis over a significant period of time (e.g. five years) with continuous monitoring of performance.

Final limitation in the group of the incompleteness of the survey data refers to the absence of the extensive performance data of the organizations being analyzed. Such data includes financial data (e.g. revenue, profit, margins) as well as operational data per business process (e.g. number of the employees involved in the process, length, information intensity etc.). More complete financial and performance data could have allowed more comprehensive research regarding the perceived value of the cloud based information systems.

5 Conclusions

5.2 Theoretical conclusions

Current research was targeted at analyzing the value of the cloud based information systems through the managerial perceptions of information systems' value. Perceived value was represented by the perceived improvements in accounting processes indicated by the respondents. The sources of information systems' value were analyzed through the approach suggest by DeLone and McLean (1992) and were represented by accessibility, accuracy, usability, comparability, relevance and transparency, which were linked to the capabilities of the information systems' adapted from (Davenport & Short, 1990) and represented by the following capabilities: automational, information processing, geographical and tracking capabilities.

The main objective of the current research was analyzing the capabilities of the cloud based information systems through the lens of the general information systems' capabilities and identifying the areas, in which cloud based systems are superior to the traditional information systems. As a result, assumptions regarding the benefits of the cloud based information systems have been suggested and linked to the sources of information systems value. Due to the fact that the study was focused on the improvements in accounting processes, which are highly prone to outsourcing, business process and information technology outsourcing was introduced in the literature review and the combination of the outsourcing and use of the cloud based information systems was considered as the driving force for the improvements in accounting processes being analyzed.

Cluster analysis was proved to be applicable for analysis of the suggested assumptions regarding capabilities of the cloud based information systems and impact of the use of the cloud and outsourcing on the average improvements in accounting processes. As a result of the cluster analysis, the dataset was divided into four clusters of organizations with significantly different outsourcing patters as well as level of adoption of the cloud based information systems. The main theoretical results show the combined positive effect of the cloud adoption and outsourcing decisions on the improvements in accounting processes. The results identified the superior capabilities of the cloud based information systems in the areas of geographical, information processing, analytical and tracking capabilities with the higher perceived improvements of the cloud users in accessibility, usability, relevance, comparability and transparency respectively for three out of four clusters. Based on these results it can be concluded that the use of the cloud based information systems is likely to have a positive effect on facilitating outsourcing of the business processes. The results also showed that the cloud based information systems did not have any apparent statistically significantly worse sources of improvements compared to non-cloud based information systems.

On the other hand, the results for the analysis of the cluster #4 revealed that companies with the incline towards total outsourcing do not perceive higher improvements in the accounting processes depending on the certain type of the information system (cloud or non-cloud) used to perform the processes. Perceived improvements for cloud and non-cloud users in this cluster appear to be relatively equal. Thus, high levels of improvements in the processes for companies in this cluster can be more associated with the outsourcing decisions and level of outsourcing quality delivered by the outsourcing service providers.

The cluster analysis proved to be useful in identifying the general relation of the cloud based information systems and outsourcing and the improvements in accounting processes and, as a result, developing propositions for the further research. These propositions should be further analyzed to identify causal relationships between the use of the cloud based information systems and IT outsourcing and perceived improvements in business processes.

5.3 Managerial conclusions

For customer company

The results of the analysis show that larger organizations intend to perform the accounting processes in-house rather than outsource them to the third-party service providers. Cluster #1 with the highest average number of the employees per company revealed the high levels of improvements in the accounting processes, which implies that organizations that are performing accounting processes in-house appear to be relatively satisfied with the levels of improvements in their processes. This leads to the conclusion that for such companies there is no immediate need to outsource processes or adopt cloud solutions provided that the cost of performing processes in-house is cost competitive compared to outsourced services. However, in case the outsourcing decision is made, companies need to develop proper outsourcing capabilities and implement cloud solutions, which would facilitate the integration of the outsourced processes. Proper outsourcing capabilities would allow such organizations to outsource larger number of processes, which would lead to higher levels of improvements compared to outsourcing a small number of processes as proved by results of cluster #2.

Results also show that cloud users in cluster #2 and #3 indicated higher levels of improvements in the processes compared to non-cloud users, which implies that implementation of the cloud solutions facilitates the outsourcing and results in higher perceived improvements in the processes, especially in terms of accessibility, usability, relevance and transparency.

For outsourcing service providers

Results show that in companies that perform selective outsourcing cloud users indicated higher improvement levels in their accounting processes than non-cloud users. This leads to the conclusion that outsourcing service providers may improve perceived value of their services by adopting cloud systems. In case of total outsourcers, the use of cloud systems did not appear to yield higher improvements, which leads to the conclusion that for customers that experience total outsourcing the high level of services maintained by the outsourcing service provider is more important.

It appears that for small-sized customers that outsource only a few processes, the average improvement levels in their processes are significantly lower compared to other customer segments. Thus, cloud solution providers should address the integration challenges that might be the reason of the low level of average improvements.

For cloud solutions providers

Cloud solutions providers should identify the opportunities in the segment of customers represented by cluster #1, organizations performing processes in-house and adopting low number of cloud based information systems but experiencing relative high satisfaction with the improvements in these processes. Cloud solution providers should develop such cloud systems that would motivate these organizations to switch to the cloud and / or outsource the processes.

For the selective outsourcing customers that outsource only a few processes and using low number of cloud based information systems, the market research should be performed to identify the reasons of the low cloud adoption, low outsourcing and low levels of the perceived improvements in the processes.

In the segment of customers that perform the total outsourcing, cloud solutions providers could develop better relationships with the outsourcing service providers for marketing of the cloud based information systems in terms of their positive effect on the improvements in the business processes.

6 References

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7 Appendices

7.1 Appendix A. Cluster analysis: general tables

Table A.1. Results of clustering

Final Cluster Centers				
	Cluster			
	1	2	3	4
Out_cust_reg_main	1	1	1	1
Out_prod_reg_main	1	1	1	1
Out_send_sales_inv	1	1	1	2
Out_proc_sales_inv	1	1	1	1
Out_manag_notes_compl	1	1	1	2
Out_sales_ledg_main	1	1	1	2
Out_suppl_reg_main	1	1	1	2
Out_rec_purch_exp	1	1	1	2
Out_proc_purch_exp	1	1	1	2
Out_proc_trav_exp	1	1	1	2
Out_purch_ledg_main	1	1	1	2
Out_pers_reg_main	1	1	1	2
Out_payr_data_main	1	2	2	2
Out_prep_payroll	1	2	2	2
Out_finan_stat	1	2	2	2
Out_tax_return_pr	1	2	2	2
Out_annual_compil	1	2	2	2
Out_insur	1	2	2	2
Out_VAT_paym	1	1	2	2
Out_payroll	1	1	2	2
Out_purch_trav	1	1	2	2
Out_tax_return	1	1	2	2

Table A.2. ANOVA analysis for clustering

ANOVA						
	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Out_cust_reg_main	1.069	3	.018	690	59.368	.000
Out_prod_reg_main	.186	3	.016	690	11.429	.000
Out_send_sales_inv	5.423	3	.037	690	144.941	.000
Out_proc_sales_inv	2.144	3	.027	690	79.537	.000
Out_manag_notes_compl	6.450	3	.047	690	138.499	.000
Out_sales_ledg_main	9.843	3	.095	690	103.296	.000
Out_suppl_reg_main	4.387	3	.039	690	111.401	.000
Out_rec_purch_exp	9.244	3	.053	690	173.320	.000
Out_proc_purch_exp	8.482	3	.037	690	232.311	.000
Out_proc_trav_exp	5.951	3	.057	690	104.136	.000

Out_purch_ledg_main	14.671	3	.096	690	152.124	.000
Out_pers_reg_main	12.923	3	.112	690	115.659	.000
Out_payr_data_main	28.130	3	.099	690	283.935	.000
Out_prep_payroll	42.226	3	.060	690	705.736	.000
Out_finan_stat	26.142	3	.122	690	213.676	.000
Out_tax_return_pr	33.237	3	.101	690	330.307	.000
Out_annual_compil	52.819	3	.021	690	2491.880	.000
Out_insur	52.009	3	.023	690	2256.613	.000
Out_VAT_paym	29.365	3	.051	690	578.639	.000
Out_payroll	33.865	3	.036	690	946.019	.000
Out_purch_trav	20.063	3	.047	690	427.557	.000
Out_tax_return	32.512	3	.076	690	425.481	.000
The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.						

Table A.3. Number of cases in each cluster

Number of Cases in each Cluster		
Cluster	1	363.000
	2	170.000
	3	106.000
	4	55.000
Valid		694.000
Missing		3.000

Table A.4. Distribution of the cloud based information systems in each cluster

Report			
IS			
Cluster Number of Case	Mean	N	Std. Deviation
1	.10	363	.296
2	.12	170	.323
3	.19	106	.393
4	.18	55	.389
Total	.12	694	.328

Table A.5. Distribution of the cloud based information systems in each cluster (percentage)

IS * Cluster Number of Case Crosstabulation							
			Cluster Number of Case				Total
			1	2	3	4	
IS	0	Count	328	150	86	45	609
		% within IS	53.9%	24.6%	14.1%	7.4%	100.0%
		% within Cluster Number of Case	90.45%	88.2%	81.1%	81.8%	87.8%
		% of Total	47.3%	21.6%	12.4%	6.5%	87.8%
	1	Count	35	20	20	10	85
		% within IS	41.2%	23.5%	23.5%	11.8%	100.0%
		% within Cluster Number of Case	9.6%	11.8%	18.9%	18.2%	12.2%
		% of Total	5.0%	2.9%	2.9%	1.4%	12.2%
Total		Count	363	170	106	55	694
		% within IS	52.3%	24.5%	15.3%	7.9%	100.0%
		% within Cluster Number of Case	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	52.3%	24.5%	15.3%	7.9%	100.0%

Table A.6. Chi-Square Test for cross tabulation of distribution of the cloud based information systems in each cluster (table A.6)

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.455[a]	3	.037
Likelihood Ratio	7.882	3	.049
Linear-by-Linear Association	7.474	1	.006
N of Valid Cases	694		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.74.			

Table A.7. Distribution of the satisfaction with the software in each cluster

Report			
Softw_satisf			
Cluster Number of Case	Mean	N	Std. Deviation
1	3.66	362	1.154
2	3.36	168	1.473
3	3.69	104	1.293
4	3.63	54	1.186
Total	3.59	688	1.267

Table A.8. Distribution of the satisfaction with the software in each cluster (percentage)

Softw_satisf * Cluster Number of Case Crosstabulation							
			Cluster Number of Case				Total
			1	2	3	4	
Softw_satisf	0	Count	7	14	6	0	27
		% within Saoftw_satisf	25.9%	51.9%	22.2%	0.0%	100.0%
		% within Cluster Number of Case	1.9%	8.3%	5.8%	0.0%	3.9%
		% of Total	1.0%	2.0%	0.9%	0.0%	3.9%
	1	Count	13	8	1	4	26
		% within Saoftw_satisf	50.0%	30.8%	3.8%	15.4%	100.0%
		% within Cluster Number of Case	3.6%	4.8%	1.0%	7.4%	3.8%
		% of Total	1.9%	1.2%	0.1%	0.6%	3.8%
	2	Count	36	16	8	7	67
		% within Saoftw_satisf	53.7%	23.9%	11.9%	10.4%	100.0%
		% within Cluster Number of Case	9.9%	9.5%	7.7%	13.0%	9.7%
		% of Total	5.2%	2.3%	1.2%	1.0%	9.7%
	3	Count	66	34	17	6	123
		% within Saoftw_satisf	53.7%	27.6%	13.8%	4.9%	100.0%
		% within Cluster Number of Case	18.2%	20.2%	16.3%	11.1%	17.9%
		% of Total	9.6%	4.9%	2.5%	0.9%	17.9%
	4	Count	157	58	44	25	284

		% within Saoftw_satisf	55.3%	20.4%	15.5%	8.8%	100.0%
		% within Cluster Number of Case	43.4%	34.5%	42.3%	46.3%	41.3%
		% of Total	22.8%	8.4%	6.4%	3.6%	41.3%
	5	Count	83	38	28	12	161
		% within Saoftw_satisf	51.6%	23.6%	17.4%	7.5%	100.0%
		% within Cluster Number of Case	22.9%	22.6%	26.9%	22.2%	23.4%
		% of Total	12.1%	5.5%	4.1%	1.7%	23.4%
Total		Count	362	168	104	54	688
		% within Saoftw_satisf	52.6%	24.4%	15.1%	7.8%	100.0%
		% within Cluster Number of Case	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	52.6%	24.4%	15.1%	7.8%	100.0%

Table A.9. Average improvements in accounting processes in each cluster

Report			
Impr_mean			
Cluster Number of Case	Mean	N	Std. Deviation
1	3.5081	363	.85523
2	3.3253	170	.88232
3	3.4334	106	.89163
4	3.7111	55	.91802
Total	3.4680	694	.87679

Table A.10. Average improvements in accounting processes in each cluster (percentage)

Impr_mean (Binned) * Cluster Number of Case Crosstabulation							
			Cluster Number of Case				Total
			1	2	3	4	
Impr_mean (Binned)	Low <2	Count	23	14	10	4	51
		% within Impr_mean (Binned)	45.1%	27.5%	19.6%	7.8%	100.0%
		% within Cluster Number of Case	6.3%	8.2%	9.4%	7.3%	7.3%
		% of Total	3.3%	2.0%	1.4%	0.6%	7.3%

	Medium <3.5	Count	145	82	37	18	282
		% within Impr_mean (Binned)	51.4%	29.1%	13.1%	6.4%	100.0%
		% within Cluster Number of Case	39.9%	48.2%	34.9%	32.7%	40.6%
		% of Total	20.9%	11.8%	5.3%	2.6%	40.6%
	High	Count	195	74	59	33	361
		% within Impr_mean (Binned)	54.0%	20.5%	16.3%	9.1%	100.0%
		% within Cluster Number of Case	53.7%	43.5%	55.7%	60.0%	52.0%
		% of Total	28.1%	10.7%	8.5%	4.8%	52.0%
Total		Count	363	170	106	55	694
		% within Impr_mean (Binned)	52.3%	24.5%	15.3%	7.9%	100.0%
		% within Cluster Number of Case	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	52.3%	24.5%	15.3%	7.9%	100.0%

Table A.11. Chi-Square Test for cross tabulation of average improvements (table A.10)

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.979[a]	6	.175
Likelihood Ratio	9.011	6	.173
Linear-by-Linear Association	.002	1	.967
N of Valid Cases	694		
a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 4.04.			

Table A.12. Sources of improvements per cluster

Report								
Cluster Number of Case		Accessibility	Accuracy	Usability	Comparability	Relevance	Transparency	Understandability
1	Mean	3.44	3.71	3.72	3.56	3.61	3.56	3.49
	N	363	363	363	363	363	363	363
	Std. Deviation	1.208	1.147	1.081	1.127	1.054	1.094	1.117
2	Mean	3.41	3.52	3.58	3.35	3.44	3.29	3.48
	N	170	170	170	170	170	170	170
	Std. Deviation	1.227	1.153	1.190	1.120	1.127	1.114	1.182
3	Mean	3.63	3.63	3.54	3.49	3.51	3.48	3.57
	N	106	106	106	106	106	106	106
	Std. Deviation	1.109	1.109	1.049	1.023	.996	1.012	.875
4	Mean	4.00	3.95	3.93	3.71	3.76	3.66	3.76
	N	55	55	55	55	55	55	55
	Std. Deviation	1.139	1.113	1.034	1.165	1.036	1.107	1.011
Total	Mean	3.51	3.67	3.68	3.51	3.57	3.49	3.52
	N	694	694	694	694	694	694	694
	Std. Deviation	1.201	1.143	1.103	1.116	1.064	1.092	1.093

Table A.13. Chi-Square Test for cross tabulation of sources of improvements (table A.12)

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Accessibility * Cluster Number of Case	Between Groups	(Combined)	18.091	3	6.030	4.238	.006
	Within Groups		981.760	690	1.423		
	Total		999.851	693			
Accuracy * Cluster Number of Case	Between Groups	(Combined)	8.949	3	2.983	2.295	.077
	Within Groups		897.006	690	1.300		
	Total		905.954	693			
Usability * Cluster Number of	Between Groups	(Combined)	7.741	3	2.580	2.132	.095
	Within Groups		835.313	690	1.211		

Case	Total		843.054	693			
Comparability * Cluster Number of Case	Between Groups	(Combined)	7.611	3	2.537	2.047	.106
	Within Groups		855.174	690	1.239		
	Total		862.785	693			
Relevance * Cluster Number of Case	Between Groups	(Combined)	5.789	3	1.930	1.710	.164
	Within Groups		778.738	690	1.129		
	Total		784.527	693			
Transparency * Cluster Number of Case	Between Groups	(Combined)	9.645	3	3.215	2.716	.044
	Within Groups		816.587	690	1.183		
	Total		826.231	693			
Understandability * Cluster Number of Case	Between Groups	(Combined)	3.907	3	1.302	1.091	.352
	Within Groups		823.269	690	1.193		
	Total		827.175	693			

Table A.14. Outsourcing rate per cluster

	Cluster1	**Cluster 2**	**Cluster 3**	**Cluster 4**
Out_cust_reg_main	0%	0%	1%	25%
Out_prod_reg_main	0%	1%	3%	11%
Out_send_sales_inv	1%	2%	7%	58%
Out_proc_sales_inv	0%	2%	2%	36%
Out_manag_notes_compl	1%	4%	11%	64%
Out_sales_ledg_main	3%	18%	12%	78%
Out_suppl_reg_main	1%	4%	5%	53%
Out_rec_purch_exp	1%	8%	14%	76%
Out_proc_purch_exp	0%	5%	5%	73%
Out_proc_trav_exp	0%	6%	17%	60%
Out_purch_ledg_main	3%	20%	38%	95%
Out_pers_reg_main	0%	35%	48%	67%
Out_payr_data_main	0%	59%	77%	80%
Out_prep_payroll	1%	75%	96%	95%
Out_finan_stat	30%	96%	98%	100%
Out_tax_return_pr	22%	95%	100%	100%
Out_annual_compil	2%	96%	99%	98%
Out_insur	0%	92%	97%	98%
Out_VAT_paym	2%	8%	84%	95%
Out_payroll	0%	9%	94%	91%
Out_purch_trav	0%	1%	57%	89%
Out_tax_return	4%	28%	97%	98%

Table A.15. Means comparison: outsourcing decision per accounting process per each cluster

Cluster Number of Case		Out_cust_reg_main	Out_prod_reg_main	Out_send_sales_inv	Out_proc_sales_inv	Out_manag_notes_compl	Out_sales_ledg_main	Out_suppl_reg_main	Out_rec_purch_exp	Out_proc_purch_exp	Out_proc_trav_exp	Out_purch_ledg_main	Out_pers_reg_main	Out_payr_data_main	Out_prep_payroll	Out_finan_stat	Out_tax_return_pr	Out_annual_compil	Out_insur	Out_VAT_paym	Out_payroll	Out_purch_trav	Out_tax_return
1	Mean	1.00	1.00	1.01	1.00	1.01	1.03	1.01	1.01	1.00	1.00	1.03	1.00	1.00	1.01	1.30	1.22	1.02	1.00	1.02	1.00	1.00	1.04
	N	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363
2	Mean	1.00	1.01	1.02	1.02	1.04	1.18	1.04	1.08	1.05	1.06	1.20	1.35	1.59	1.75	1.96	1.95	1.96	1.92	1.08	1.09	1.01	1.28
	N	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
3	Mean	1.01	1.03	1.07	1.02	1.11	1.29	1.05	1.14	1.05	1.17	1.38	1.48	1.77	1.96	1.98	2.00	1.99	1.97	1.84	1.94	1.57	1.97
	N	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106
4	Mean	1.25	1.11	1.58	1.36	1.64	1.78	1.53	1.76	1.73	1.60	1.95	1.67	1.80	1.95	2.00	2.00	1.98	1.98	1.95	1.91	1.89	1.98
	N	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
Total	Mean	1.02	1.02	1.06	1.04	1.08	1.16	1.06	1.10	1.08	1.09	1.20	1.21	1.33	1.41	1.62	1.58	1.48	1.45	1.23	1.24	1.16	1.32
	N	694	694	694	694	694	694	694	694	694	694	694	694	694	694	694	694	694	694	694	694	694	694

Table A.16. Cross tabulation: industry of firm's operation * cluster

Industry * Cluster Number of Case Crosstabulation							
			Cluster Number of Case				Total
			1	2	3	4	
Industry	1	Count	9	10	9	3	31
		% within Industry	29.0%	32.3%	29.0%	9.7%	100.0%
		% within Cluster Number of Case	2.5%	5.9%	8.5%	5.5%	4.5%
		% of Total	1.3%	1.4%	1.3%	0.4%	4.5%
	2	Count	25	1	2	3	31
		% within Industry	80.6%	3.2%	6.5%	9.7%	100.0%
		% within Cluster Number of Case	6.9%	0.6%	1.9%	5.5%	4.5%
		% of Total	3.6%	0.1%	0.3%	0.4%	4.5%
	3	Count	11	11	6	3	31
		% within Industry	35.5%	35.5%	19.4%	9.7%	100.0%
		% within Cluster Number of Case	3.0%	6.5%	5.7%	5.5%	4.5%
		% of Total	1.6%	1.6%	0.9%	0.4%	4.5%
	4	Count	3	0	0	0	3
		% within Industry	100.0%	0.0%	0.0%	0.0%	100.0%
		% within Cluster Number of Case	0.8%	0.0%	0.0%	0.0%	0.4%
		% of Total	0.4%	0.0%	0.0%	0.0%	0.4%
	6	Count	21	7	5	2	35
		% within Industry	60.0%	20.0%	14.3%	5.7%	100.0%
		% within Cluster Number of Case	5.8%	4.1%	4.7%	3.6%	5.0%
		% of Total	3.0%	1.0%	0.7%	0.3%	5.0%
	7	Count	5	3	1	0	9
		% within Industry	55.6%	33.3%	11.1%	0.0%	100.0%
		% within Cluster Number of Case	1.4%	1.8%	0.9%	0.0%	1.3%
		% of Total	0.7%	0.4%	0.1%	0.0%	1.3%
	8	Count	16	10	4	0	30
		% within Industry	53.3%	33.3%	13.3%	0.0%	100.0%
		% within Cluster Number of Case	4.4%	5.9%	3.8%	0.0%	4.3%

		% of Total	2.3%	1.4%	0.6%	0.0%	4.3%
	9	Count	10	9	5	2	26
		% within Industry	38.5%	34.6%	19.2%	7.7%	100.0%
		% within Cluster Number of Case	2.8%	5.3%	4.7%	3.6%	3.7%
		% of Total	1.4%	1.3%	0.7%	0.3%	3.7%
	10	Count	60	22	13	8	103
		% within Industry	58.3%	21.4%	12.6%	7.8%	100.0%
		% within Cluster Number of Case	16.5%	12.9%	12.3%	14.5%	14.8%
		% of Total	8.6%	3.2%	1.9%	1.2%	14.8%
	11	Count	3	2	0	0	5
		% within Industry	60.0%	40.0%	0.0%	0.0%	100.0%
		% within Cluster Number of Case	0.8%	1.2%	0.0%	0.0%	0.7%
		% of Total	0.4%	0.3%	0.0%	0.0%	0.7%
	12	Count	53	22	7	6	88
		% within Industry	60.2%	25.0%	8.0%	6.8%	100.0%
		% within Cluster Number of Case	14.6%	12.9%	6.6%	10.9%	12.7%
		% of Total	7.6%	3.2%	1.0%	0.9%	12.7%
	13	Count	13	4	3	3	23
		% within Industry	56.5%	17.4%	13.0%	13.0%	100.0%
		% within Cluster Number of Case	3.6%	2.4%	2.8%	5.5%	3.3%
		% of Total	1.9%	0.6%	0.4%	0.4%	3.3%
	14	Count	3	2	4	0	9
		% within Industry	33.3%	22.2%	44.4%	0.0%	100.0%
		% within Cluster Number of Case	0.8%	1.2%	3.8%	0.0%	1.3%
		% of Total	0.4%	0.3%	0.6%	0.0%	1.3%
	15	Count	79	23	19	9	130
		% within Industry	60.8%	17.7%	14.6%	6.9%	100.0%
		% within Cluster Number of Case	21.8%	13.5%	17.9%	16.4%	18.7%
		% of Total	11.4%	3.3%	2.7%	1.3%	18.7%
	16	Count	15	14	12	8	49
		% within Industry	30.6%	28.6%	24.5%	16.3%	100.0%

		% within Cluster Number of Case	4.1%	8.2%	11.3%	14.5%	7.1%
		% of Total	2.2%	2.0%	1.7%	1.2%	7.1%
	17	Count	23	20	11	7	61
		% within Industry	37.7%	32.8%	18.0%	11.5%	100.0%
		% within Cluster Number of Case	6.3%	11.8%	10.4%	12.7%	8.8%
		% of Total	3.3%	2.9%	1.6%	1.0%	8.8%
	18	Count	4	4	0	0	8
		% within Industry	50.0%	50.0%	0.0%	0.0%	100.0%
		% within Cluster Number of Case	1.1%	2.4%	0.0%	0.0%	1.2%
		% of Total	0.6%	0.6%	0.0%	0.0%	1.2%
	19	Count	2	4	3	1	10
		% within Industry	20.0%	40.0%	30.0%	10.0%	100.0%
		% within Cluster Number of Case	0.6%	2.4%	2.8%	1.8%	1.4%
		% of Total	0.3%	0.6%	0.4%	0.1%	1.4%
	25	Count	8	2	2	0	12
		% within Industry	66.7%	16.7%	16.7%	0.0%	100.0%
		% within Cluster Number of Case	2.2%	1.2%	1.9%	0.0%	1.7%
		% of Total	1.2%	0.3%	0.3%	0.0%	1.7%
Total		Count	363	170	106	55	694
		% within Industry	52.3%	24.5%	15.3%	7.9%	100.0%
		% within Cluster Number of Case	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	52.3%	24.5%	15.3%	7.9%	100.0%

Table A.17. Chi-Square Test (table A.15)

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	81.539[a]	54	.009
Likelihood Ratio	91.180	54	.001
N of Valid Cases	694		

Table A.18. Size of the company per cluster

Crosstab							
			Cluster Number of Case				Total
			1	2	3	4	
Size	1	Count	135	107	53	14	309
		% within Size	43.7%	34.6%	17.2%	4.5%	100.0%
		% within Cluster Number of Case	37.2%	62.9%	50.0%	25.5%	44.5%
		% of Total	19.5%	15.4%	7.6%	2.0%	44.5%
	2	Count	33	25	16	7	81
		% within Size	40.7%	30.9%	19.8%	8.6%	100.0%
		% within Cluster Number of Case	9.1%	14.7%	15.1%	12.7%	11.7%
		% of Total	4.8%	3.6%	2.3%	1.0%	11.7%
	3	Count	56	24	18	13	111
		% within Size	50.5%	21.6%	16.2%	11.7%	100.0%
		% within Cluster Number of Case	15.4%	14.1%	17.0%	23.6%	16.0%
		% of Total	8.1%	3.5%	2.6%	1.9%	16.0%
	4	Count	26	4	6	8	44
		% within Size	59.1%	9.1%	13.6%	18.2%	100.0%
		% within Cluster Number of Case	7.2%	2.4%	5.7%	14.5%	6.3%
		% of Total	3.7%	0.6%	0.9%	1.2%	6.3%
	5	Count	14	2	3	3	22
		% within Size	63.6%	9.1%	13.6%	13.6%	100.0%
		% within Cluster Number of Case	3.9%	1.2%	2.8%	5.5%	3.2%
		% of Total	2.0%	0.3%	0.4%	0.4%	3.2%
	6	Count	20	1	1	1	23
		% within Size	87.0%	4.3%	4.3%	4.3%	100.0%
		% within Cluster Number of Case	5.5%	0.6%	0.9%	1.8%	3.3%
		% of Total	2.9%	0.1%	0.1%	0.1%	3.3%
	7	Count	40	3	4	4	51
		% within Size	78.4%	5.9%	7.8%	7.8%	100.0%
		% within Cluster Number of Case	11.0%	1.8%	3.8%	7.3%	7.3%

		% of Total	5.8%	0.4%	0.6%	0.6%	7.3%
	8	Count	36	3	4	5	48
		% within Size	75.0%	6.3%	8.3%	10.4%	100.0%
		% within Cluster Number of Case	9.9%	1.8%	3.8%	9.1%	6.9%
		% of Total	5.2%	0.4%	0.6%	0.7%	6.9%
	9	Count	3	1	1	0	5
		% within Size	60.0%	20.0%	20.0%	0.0%	100.0%
		% within Cluster Number of Case	0.8%	0.6%	0.9%	0.0%	0.7%
		% of Total	0.4%	0.1%	0.1%	0.0%	0.7%
Total		Count	363	170	106	55	694
		% within Size	52.3%	24.5%	15.3%	7.9%	100.0%
		% within Cluster Number of Case	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	52.3%	24.5%	15.3%	7.9%	100.0%

Table A.19. Chi-Square Test (table A.18)

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	84.454[a]	24	.000
Likelihood Ratio	91.530	24	.000
Linear-by-Linear Association	11.223	1	.001
N of Valid Cases	694		
a. 11 cells (30.6%) have expected count less than 5. The minimum expected count is .40.			

Table A.20. Invoices sent per cluster

Crosstab							
			Cluster Number of Case				Total
			1	2	3	4	
Inv_sent	1	Count	13	7	9	0	29
		% within Inv_sent	44.8%	24.1%	31.0%	0.0%	100.0%
		% within Cluster Number of Case	3.6%	4.1%	8.5%	0.0%	4.2%
		% of Total	1.9%	1.0%	1.3%	0.0%	4.2%
	2	Count	51	70	26	8	155
		% within Inv_sent	32.9%	45.2%	16.8%	5.2%	100.0%
		% within Cluster Number of Case	14.0%	41.2%	24.5%	14.5%	22.3%
		% of Total	7.3%	10.1%	3.7%	1.2%	22.3%
	3	Count	103	51	28	19	201
		% within Inv_sent	51.2%	25.4%	13.9%	9.5%	100.0%
		% within Cluster Number of Case	28.4%	30.0%	26.4%	34.5%	29.0%
		% of Total	14.8%	7.3%	4.0%	2.7%	29.0%
	4	Count	62	16	20	7	105
		% within Inv_sent	59.0%	15.2%	19.0%	6.7%	100.0%
		% within Cluster Number of Case	17.1%	9.4%	18.9%	12.7%	15.1%
		% of Total	8.9%	2.3%	2.9%	1.0%	15.1%
	5	Count	63	9	14	9	95
		% within Inv_sent	66.3%	9.5%	14.7%	9.5%	100.0%
		% within Cluster Number of Case	17.4%	5.3%	13.2%	16.4%	13.7%
		% of Total	9.1%	1.3%	2.0%	1.3%	13.7%
	6	Count	29	5	2	6	42
		% within Inv_sent	69.0%	11.9%	4.8%	14.3%	100.0%

		% within Cluster Number of Case	8.0%	2.9%	1.9%	10.9%	6.1%
		% of Total	4.2%	0.7%	0.3%	0.9%	6.1%
	7	Count	42	12	7	6	67
		% within Inv_sent	62.7%	17.9%	10.4%	9.0%	100.0%
		% within Cluster Number of Case	11.6%	7.1%	6.6%	10.9%	9.7%
		% of Total	6.1%	1.7%	1.0%	0.9%	9.7%
Total		Count	363	170	106	55	694
		% within Inv_sent	52.3%	24.5%	15.3%	7.9%	100.0%
		% within Cluster Number of Case	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	52.3%	24.5%	15.3%	7.9%	100.0%

Table A.21. Invoices received per cluster

Crosstab							
			Cluster Number of Case				Total
			1	2	3	4	
Inv_rec	1	Count	3	1	4	0	8
		% within Inv_rec	37.5%	12.5%	50.0%	0.0%	100.0%
		% within Cluster Number of Case	0.8%	0.6%	3.8%	0.0%	1.2%
		% of Total	0.4%	0.1%	0.6%	0.0%	1.2%
	2	Count	42	38	16	7	103
		% within Inv_rec	40.8%	36.9%	15.5%	6.8%	100.0%
		% within Cluster Number of Case	11.7%	22.9%	15.4%	13.2%	15.1%
		% of Total	6.2%	5.6%	2.3%	1.0%	15.1%
	3	Count	101	76	40	18	235
		% within Inv_rec	43.0%	32.3%	17.0%	7.7%	100.0%
		% within Cluster Number of Case	28.2%	45.8%	38.5%	34.0%	34.5%
		% of Total	14.8%	11.2%	5.9%	2.6%	34.5%
	4	Count	63	27	19	15	124
		% within Inv_rec	50.8%	21.8%	15.3%	12.1%	100.0%
		% within Cluster Number of Case	17.6%	16.3%	18.3%	28.3%	18.2%
		% of Total	9.3%	4.0%	2.8%	2.2%	18.2%
	5	Count	75	16	17	7	115
		% within Inv_rec	65.2%	13.9%	14.8%	6.1%	100.0%
		% within Cluster Number of Case	20.9%	9.6%	16.3%	13.2%	16.9%
		% of Total	11.0%	2.3%	2.5%	1.0%	16.9%
	6	Count	28	3	3	1	35
		% within Inv_rec	80.0%	8.6%	8.6%	2.9%	100.0%
		% within Cluster Number of Case	7.8%	1.8%	2.9%	1.9%	5.1%
		% of Total	4.1%	0.4%	0.4%	0.1%	5.1%
	7	Count	46	5	5	5	61
		% within Inv_rec	75.4%	8.2%	8.2%	8.2%	100.0%
		% within Cluster Number of Case	12.8%	3.0%	4.8%	9.4%	9.0%

		% of Total	6.8%	0.7%	0.7%	0.7%	9.0%
Total		Count	358	166	104	53	681
		% within Inv_rec	52.6%	24.4%	15.3%	7.8%	100.0%
		% within Cluster Number of Case	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	52.6%	24.4%	15.3%	7.8%	100.0%

Table A.22. Turnover of companies per cluster

Crosstab							
			Cluster Number of Case				Total
			1	2	3	4	
Turnover	1	Count	199	150	76	30	455
		% within Turnover	43.7%	33.0%	16.7%	6.6%	100.0%
		% within Cluster Number of Case	54.8%	88.2%	71.7%	54.5%	65.6%
		% of Total	28.7%	21.6%	11.0%	4.3%	65.6%
	2	Count	95	13	20	23	151
		% within Turnover	62.9%	8.6%	13.2%	15.2%	100.0%
		% within Cluster Number of Case	26.2%	7.6%	18.9%	41.8%	21.8%
		% of Total	13.7%	1.9%	2.9%	3.3%	21.8%
	3	Count	57	5	9	2	73
		% within Turnover	78.1%	6.8%	12.3%	2.7%	100.0%
		% within Cluster Number of Case	15.7%	2.9%	8.5%	3.6%	10.5%
		% of Total	8.2%	0.7%	1.3%	0.3%	10.5%
	4	Count	12	2	1	0	15
		% within Turnover	80.0%	13.3%	6.7%	0.0%	100.0%
		% within Cluster Number of Case	3.3%	1.2%	0.9%	0.0%	2.2%

		% of Total	1.7%	0.3%	0.1%	0.0%	2.2%
Total		Count	363	170	106	55	694
		% within Turnover	52.3%	24.5%	15.3%	7.9%	100.0%
		% within Cluster Number of Case	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	52.3%	24.5%	15.3%	7.9%	100.0%

7.2 Appendix B. Cluster analysis: Cluster #1

Table B.1. Average improvements for cloud and non-cloud users in Cluster #1

Report			
Impr_mean			
IS	Mean	N	% of Total N
0	3.4566	328	90.4%
1	3.9913	35	9.6%
Total	3.5081	363	100.0%

Table B.2. ANOVA analysis for table B.1

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Impr_mean * IS	Between Groups	(Combined)	9.041	1	9.041	12.762	.000
	Within Groups		255.732	361	.708		
	Total		264.773	362			

Table B.3. Sources of improvements for cloud and non-cloud users in Cluster #1

Report								
IS		Accessibility	Accuracy	Usability	Comparability	Relevance	Transparency	Understandability
0	Mean	3.36	3.70	3.67	3.53	3.58	3.53	3.47
	N	328	328	328	328	328	328	328
	% of Total N	90.4%	90.4%	90.4%	90.4%	90.4%	90.4%	90.4%
1	Mean	4.24	3.84	4.20	3.83	3.93	3.85	3.67
	N	35	35	35	35	35	35	35
	% of Total N	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%
Total	Mean	3.44	3.71	3.72	3.56	3.61	3.56	3.49
	N	363	363	363	363	363	363	363
	% of Total N	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table B.4. ANOVA analysis for table B.3

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Accessibility * IS	Between Groups	(Combined)	24.242	1	24.242	17.358	.000
	Within Groups		504.161	361	1.397		
	Total		528.403	362			
Accuracy * IS	Between Groups	(Combined)	.702	1	.702	.533	.466
	Within Groups		475.751	361	1.318		
	Total		476.453	362			
Usability * IS	Between Groups	(Combined)	8.762	1	8.762	7.636	.006
	Within Groups		414.225	361	1.147		
	Total		422.987	362			
Comparability * IS	Between Groups	(Combined)	2.842	1	2.842	2.245	.135
	Within Groups		456.983	361	1.266		
	Total		459.825	362			
Relevance * IS	Between Groups	(Combined)	3.945	1	3.945	3.576	.059
	Within Groups		398.208	361	1.103		
	Total		402.152	362			
Transparency * IS	Between Groups	(Combined)	3.230	1	3.230	2.712	.100
	Within Groups		429.903	361	1.191		
	Total		433.132	362			
Understandability * IS	Between Groups	(Combined)	1.151	1	1.151	.922	.338
	Within Groups		450.523	361	1.248		
	Total		451.674	362			

7.3 Appendix C: Cluster analysis: Cluster #2

Table C.1. Average improvements for cloud and non-cloud users in Cluster #2

Report			
Impr_mean			
IS	Mean	N	% of Total N
0	3.2601	150	88.2%
1	3.8138	20	11.8%
Total	3.3253	170	100.0%

Table C.2. ANOVA analysis for table C.1

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Impr_mea IS	Between Groups	(Combined)	5.409	1	5.409	7.204	.008
	Within Groups		126.154	168	.751		
	Total		131.563	169			

Table C.3. Sources of improvements for cloud and non-cloud users in Cluster #2

Report								
IS		Accessibi lity	Accuracy	Usability	Compara bility	Relevance	Transpar ency	Understan dability
0	Mean	3.33	3.48	3.51	3.29	3.44	3.28	3.46
	N	150	150	150	150	150	150	150
	% of Total N	88.2%	88.2%	88.2%	88.2%	88.2%	88.2%	88.2%
1	Mean	3.95	3.76	4.10	3.75	3.49	3.44	3.68
	N	20	20	20	20	20	20	20
	% of Total N	11.8%	11.8%	11.8%	11.8%	11.8%	11.8%	11.8%
Tota l	Mean	3.41	3.52	3.58	3.35	3.44	3.29	3.48
	N	170	170	170	170	170	170	170
	% of Total N	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table C.4. ANOVA analysis for table C.3

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Accessibility * IS	Between Groups	(Combined)	6.723	1	6.723	4.562	.034
	Within Groups		247.549	168	1.474		
	Total		254.271	169			
Accuracy * IS	Between Groups	(Combined)	1.371	1	1.371	1.032	.311
	Within Groups		223.215	168	1.329		
	Total		224.587	169			
Usability * IS	Between Groups	(Combined)	6.138	1	6.138	4.425	.037
	Within Groups		233.039	168	1.387		
	Total		239.177	169			
Comparability * IS	Between Groups	(Combined)	3.702	1	3.702	2.984	.086
	Within Groups		208.388	168	1.240		
	Total		212.089	169			
Relevance * IS	Between Groups	(Combined)	.053	1	.053	.041	.839
	Within Groups		214.531	168	1.277		
	Total		214.584	169			
Transparency * IS	Between Groups	(Combined)	.471	1	.471	.378	.539
	Within Groups		209.216	168	1.245		
	Total		209.687	169			
Understandability * IS	Between Groups	(Combined)	.865	1	.865	.618	.433
	Within Groups		235.122	168	1.400		
	Total		235.987	169			

7.4 Appendix D: Cluster analysis: Cluster #3

Table D.1. Average improvements for cloud and non-cloud users in Cluster #3

Report			
Impr_mean			
IS	Mean	N	% of Total N
0	3.3114	86	81.1%
1	3.9581	20	18.9%
Total	3.4334	106	100.0%

Table D.2. ANOVA analysis for table D.1

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Impr_mean * IS	Between Groups	(Combined)	6.785	1	6.785	9.200	.003
	Within Groups		76.692	104	.737		
	Total		83.476	105			

Table D.3. Sources of improvements for cloud and non-cloud users in Cluster #3

Report								
IS		Accessibility	Accuracy	Usability	Comparability	Relevance	Transparency	Understandability
0	Mean	3.48	3.59	3.45	3.41	3.42	3.34	3.50
	N	86	86	86	86	86	86	86
	% of Total N	81.1%	81.1%	81.1%	81.1%	81.1%	81.1%	81.1%
1	Mean	4.24	3.80	3.95	3.85	3.90	4.06	3.89
	N	20	20	20	20	20	20	20
	% of Total N	18.9%	18.9%	18.9%	18.9%	18.9%	18.9%	18.9%
Total	Mean	3.63	3.63	3.54	3.49	3.51	3.48	3.57
	N	106	106	106	106	106	106	106
	% of Total N	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table D.4. ANOVA analysis for table D.3

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Accessibility * IS	Between Groups	(Combined)	9.345	1	9.345	8.116	.005
	Within Groups		119.741	104	1.151		
	Total		129.086	105			
Accuracy * IS	Between Groups	(Combined)	.703	1	.703	.570	.452
	Within Groups		128.426	104	1.235		
	Total		129.130	105			
Usability * IS	Between Groups	(Combined)	4.060	1	4.060	3.791	.054
	Within Groups		111.380	104	1.071		
	Total		115.439	105			
Comparability * IS	Between Groups	(Combined)	3.125	1	3.125	3.043	.084
	Within Groups		106.789	104	1.027		
	Total		109.914	105			
Relevance * IS	Between Groups	(Combined)	3.787	1	3.787	3.928	.050
	Within Groups		100.287	104	.964		
	Total		104.074	105			
Transparency * IS	Between Groups	(Combined)	8.271	1	8.271	8.663	.004
	Within Groups		99.292	104	.955		
	Total		107.563	105			
Understandability * IS	Between Groups	(Combined)	2.508	1	2.508	3.348	.070
	Within Groups		77.906	104	.749		
	Total		80.413	105			

7.5 Appendix E: Cluster analysis: Cluster #4

Table E.1. Average improvements for cloud and non-cloud users in Cluster #4

Report			
Impr_mean			
IS	Mean	N	% of Total N
0	3.7208	45	81.8%
1	3.6676	10	18.2%
Total	3.7111	55	100.0%

Table E.2. ANOVA analysis for table E.1

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Impr_mean * IS	Between Groups	(Combined)	.023	1	.023	.027	.870
	Within Groups		45.486	53	.858		
	Total		45.509	54			

Table E.3. Sources of improvements for cloud and non-cloud users in Cluster #4

Report								
IS		Accessibility	Accuracy	Usability	Comparability	Relevance	Transparency	Understandability
0	Mean	4.04	4.00	3.96	3.69	3.78	3.67	3.73
	N	45	45	45	45	45	45	45
	% of Total N	81.8%	81.8%	81.8%	81.8%	81.8%	81.8%	81.8%
1	Mean	3.80	3.70	3.80	3.80	3.70	3.60	3.90
	N	10	10	10	10	10	10	10
	% of Total N	18.2%	18.2%	18.2%	18.2%	18.2%	18.2%	18.2%
Total	Mean	4.00	3.95	3.93	3.71	3.76	3.66	3.76
	N	55	55	55	55	55	55	55
	% of Total N	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table E.4. ANOVA analysis for table E.3

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Accessibility * IS	Between Groups	(Combined)	.489	1	.489	.373	.544
	Within Groups		69.511	53	1.312		
	Total		70.000	54			
Accuracy * IS	Between Groups	(Combined)	.736	1	.736	.590	.446
	Within Groups		66.100	53	1.247		
	Total		66.836	54			
Usability * IS	Between Groups	(Combined)	.198	1	.198	.182	.671
	Within Groups		57.511	53	1.085		
	Total		57.709	54			
Comparability * IS	Between Groups	(Combined)	.101	1	.101	.073	.788
	Within Groups		73.244	53	1.382		
	Total		73.345	54			
Relevance * IS	Between Groups	(Combined)	.049	1	.049	.045	.832
	Within Groups		57.878	53	1.092		
	Total		57.927	54			
Transparency * IS	Between Groups	(Combined)	.037	1	.037	.030	.863
	Within Groups		66.167	53	1.248		
	Total		66.204	54			
Understandability * IS	Between Groups	(Combined)	.248	1	.248	.239	.627
	Within Groups		54.947	53	1.037		
	Total		55.195	54			