AN EXPLORATION OF ADOPTION FACTORS FOR CLOUD ERP SYSTEMS IN THE PUBLIC SECTOR

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Abstract
Enterprise resource planning (ERP) systems and cloud-based systems are usually studied in isolation. The ERP research on cloud-ERP systems is scarce, particularly the motivations and barriers towards these systems within the public sector. Based on a review of literature and the Technology, Organization and Environment framework (TOE), a questionnaire focusing on benefits and disadvantages of cloud-based ERP systems adoptions was sent to 465 ERP stakeholders in Norwegian public organizations. Responses from 148 stakeholders helped to shed light on their stances toward cloud ERP adoptions. While many of our findings were surprisingly aligned with studies looking at adoption factors in the private sector, some noteworthy differences were discovered. The current deployment rate of cloud ERP systems among the public organizations is significantly lower than reports from existing studies focusing on private enterprises. A lack of interest in future adoptions is also indicated through respondents’ skepticism and hesitancy. Even though system availability is perceived as the most significant benefit, vendor dependency is perceived to be a major disadvantage. Through employing descriptive and inferential statistics, our findings also show that cloud ERP vendors struggle to oblige by the necessary customizations, IT-security, and data ownership requirements in public tendering procedures. Finally, a correlation analysis was performed to identify the level of which the various benefits and advantages affected respondents’ outlooks.

Keywords: Cloud, SaaS, ERP adoption, Public sector, Norway.

1. INTRODUCTION

Enterprise Resource Planning (ERP) systems are considered to be the backbone of most organizations worldwide, through enabling them to conduct their work tasks and business processes in a more effectively and integrated manner (Haddara & Elragal, 2013). The Cloud computing paradigm has in later years emerged to become one of most prominent and exciting computing technologies for business and academia alike (Pallis, 2010). While the adoption of this technology comes in several forms bundled with plentiful options, the most widespread approach is through leasing web-based software applications, also known as software-as-a-service (SaaS) model (Wu, 2011). A diverse range of applications such as web conferencing software and customer relationship management (CRM) systems are available through the SaaS model (Xin & Levina, 2008). SaaS is also gaining an increasing acceptance in more strategically complex software domains such as ERP systems (Benlian, Hess, & Buxmann, 2009), and thus changing how ERP systems are delivered and utilized. SaaS-based ERP systems are experiencing unembellished growth rates and are perceived as the type of cloud service heralded to be a serious alternative for on-premise software (Columbus, 2013). Indications show that organizations are starting to implement cloud-based solutions as replacements for their legacy applications (Kananacu, 2014). A Gartner study focusing on Cloud ERP’s future, argues that over the next 10 years (at the time of the study), the market is envisioned to “flip to the cloud” (Columbus, 2013). Another survey conducted by the same renowned research group indicated that close to half of the respondents intended to transfer their core ERP systems to the cloud in the next 5 years, whereas 26% of these within the coming 3 years (Columbus, 2014). Overall, Cloud-based ERP systems are experiencing exponential growth and are likely to be a force to be reckoned within the near future. While the cloud ERP adoption pace is fast in the industry, however research investigating these adoptions has emerged slowly. In later years, researchers such as Lenart (2011), Gill (2011), Johannson and Ruivo (2014) and Haddara et al. (2015) have all identified adoption factors related to cloud ERP in private enterprises. To our knowledge, however, no studies have investigated adoption of Cloud/SaaS ERP systems in the context of the public sector. Existing literature investigating on-premise ERP systems adoptions has been indicating a distinct difference between business and public organizations (Repa, 2006). Due to the nature of public administrations and organizations, Becker et al. (2013) state that the factors influencing ERP system adoption in private enterprises are not directly applicable to public organizations. Solutions and systems
that are successfully used in business can also not be applied to public sector organizations without significant changes (Wagner & Antonucci, 2004). These differences may include: business processes, organizational structure, software/hardware acquisition process, tendering processes, security requirements, data location regulations, etc. Knowing this contextual complexity, little is known about the drivers, triggers and organizational factors influencing the adoption of cloud ERP in the public sector. Based on the clear research gap, this exploratory study attempts to investigate the public sector’s attitudes towards the cloud ERP systems, and identify the commonalities and differences between our findings and the existing studies in the private sector. To guide this study, we developed two main research questions, which guided the research activities:

- *What are the key factors influencing adoption of Cloud-and-SaaS based ERP systems in the public sector?*
- *Are there any context-specific factors that differentiate adoption of Cloud-and-SaaS based ERP systems in the public sector compared to private enterprises?*

The rest of the paper is organized as follows: a literature review is presented in section 2. The research’s theoretical framework and method are provided in sections 3 and 4. Section 5 presents an overview of the results, followed by a discussion of the main findings in section 6. Finally, our conclusions are presented in section 7.

2. RELATED LITERATURE

2.1. ERP Systems

An ERP is a standard and modular system that provides integrated transaction processing and access to information with an organization. ERP systems support that cross-functionality of business processes, which can span multiple organizational units and business functions. The typical modules of an ERP system may include financial and accounting, human resources, supply chain, manufacturing, and customer service. Traditional ERP systems are based on a single centralized database repository. This repository gathers data from the different modules supporting the various business functions and processes. Organizations adopting ERP systems are aiming at reducing their operating costs, standardizing their infrastructure and processes, optimizing processes, improving their responsiveness and lead times, and enhancing timely reporting which would consequently enhance the decision making process. While ERP systems could provide a lot of benefits to organizations, however, their implementations are costly, and time and resource consuming (Haddara & Elragal, 2009).

2.2. ERP in the Norwegian Market

According to Herbert Nathan & Co. (2013) (the leading consulting and advisory company in the Nordic region focused on business systems), the Norwegian market is covered by more than 30 vendors and close to 40 different solutions and systems. Notable differences between them evolve around technology, (on-Premise vs. cloud-based), use of partners, business areas, multi-country use and support. Aberdeen group believes that the trend towards the implementation of cloud-ERP solutions will continue predominantly (Castellina, 2013). To grab this momentum, the four big players in the ERP market; SAP, Oracle, Sage and Microsoft are also offering their systems under the SaaS model (Ruivo et al., 2014). In Norway, SaaS- and Cloud-based ERP has seen a rapid acceptance (Herbert Nathan & Co, 2013).

2.3. Cloud- and SaaS-based ERP

SaaS, also referred to as 'software on demand', is becoming an increasingly popular tool for implementing various business applications today, and is also the most common delivery model when it comes to ERP (Lenart, 2011). Traditionally ERP systems have been implemented “on premise”, using local servers and workstations at a company’s site. With the SaaS deployment model, an ERP system can alternatively be deployed as hosted software, or what is called “as a service”. Customers then purchase licenses from the vendor, but all the hosting, upgrades, hardware, and general maintenance procedures are handled by either the ERP provider or an external third party (Arnesen, 2013). In cloud-based ERP environments, the application and data are practically under the control of the service provider. Further, the payment for the ERP usage is usually provided through subscription plans, similar to cell phone plans.
that can be paid per use on a monthly basis. It is important to note that cloud-ERP systems implementations usually follow the *vanilla* approach, due to the inability of customizing the cloud-ERP. Hence, in general cloud-ERP systems may better fit small-to-medium enterprises, or those who follow (or want to follow) the market standards in their processes.

### 2.4. IT and ERP Systems In The Public Sector

Use of information technology (IT) solutions can enhance the efficiency within the public sector and aid in serving the citizens and business community in an optimized fashion. IT has therefore become a tool for the modernization of the public sector that can eventually lead to several benefits. In regards to the IT in the Norwegian public sector, a report from the interest group for the Norwegian ICT industry; IKT Norge (2014) shows that the absence of the usual market mechanisms constitutes a risk that the public sector is lagging behind in the technological development. A yearly "IT in Practice" (2015) study was produced by the Rambøll Management Consulting in 2015 on behalf of the Norwegian government and focuses on strategies, trends and experiences in the use of IT among the 500 largest private and public enterprises in Norway. Looking at their findings within the public sector, IT-managers spend significantly more of their time maintaining their current services and systems than their counterparts in the private enterprises do. Fewer IT-managers also participate in the top management within their public sector organization than in the private sector (25% versus 38%). The prime minister and the central government has put forward the “Government digitalization program”, where the aim is for the public sector to provide enhanced services to citizens and business, and to utilize resources more efficiently. When it comes to reaching the goals related to IT set by the central government, only 29% expect to meet this target. When asked what could make realizing these goals easier, 67% of IT managers answered that simplifying the IT acquisition process would be the measure that will improve gains in the digitization project the most. Due to the differences of processes and regulations among private and public organizations (Becker, Kugeler, & Rosemann, 2003), there is a common perception that ERP systems’ use in public organization differ from private businesses. Kelly (1998) therefore argues that ERP systems in government agencies are mainly used to back up the supporting functions such as accounting, human resource management, fixed assets management and others, while in businesses it is crucial for primary and core activities like financials, logistics, production, etc.

### 2.5. Cloud-and SaaS-based ERP in the Public Sector

The landscape for public sector ERP deployments is changing dramatically. Bailey et al. (2011) proclaim that all levels of government should consider moving aggressively to adopt cloud computing solutions, in order to attain service enhancements and around 25% to 50% in cost savings. There is evidence to suggest that cloud computing has become a strategic direction for many government agencies and that it has the capability to be employed in critical areas of the government's IT-infrastructures. Likewise, a recent report developed by the CGI consulting group (2016) suggests that in order to stay focused on their mission of serving the public and spend less time managing technology, governments are turning their attention from highly customized, on-premise solutions toward shared platforms and cloud-enabled managed services. An example is the American state Maine who’s move to cloud-enabled ERP has allowed staff reallocation within the administration of the state, increasing the focus on a strengthened policy management, as well as, enhanced internal and fiscal controls. Another survey conducted in the US by the Center for Digital Government (2013) reported that 46 percent of IT professionals in state and local government are either willing, or currently engaged in cloud computing related endeavors. This is mainly due to the expected cost reductions in hardware, software, and maintenance. Gartner (2014) also predicts that many organizations are expected to move to cloud-ERP in the next 5 years. There results also suggest that close to half of the governmental sector are likely to adopt Cloud ERP systems within 5 years. In Norway, the contextual country for this study, the ERP-market is large with many cloud-based ERP vendors targeting the public sector.

### 3. THEORETICAL FRAMEWORK

Many theoretical models have been used to examine organizations’ adoption of IS innovations. Those widely used are the Technology Acceptance Model (TAM) (Davis, 1985); Theory of Planned Behavior (TPB) (Ajzen, 1991), Diffusion of Innovations (DOI) (Rogers, 2010), and the Technological,
Organizational and Environment framework (TOE) (Tornatzky, 1990). Where the TAM and TPB frameworks are at aimed at the individual level, DOI and TOE are better suited for studies at the firm level. Because most studies on IT adoption at the firm level are derived from theories such as the latter two (Chong, Lin, Ooi, & Raman, 2009), and our study is concerned with the larger context of an organization, thus the two theories/frameworks were initially considered in this research, namely DOI and TOE. After reviewing the applicability of these theories, we found out that the DOI theory is typically used to evaluate various technological, organizational, and environmental factors that facilitate or inhibit adoption/diffusion (Ramdani, Chevers, & Williams, 2013). However, it lacks the environmental dimension relevant for this research. The environment context presents both constraints and opportunities for technological innovation (Hsu, Kraemer, & Dunkle, 2006). As the TOE framework includes the environment context, hence, we consider the TOE framework as more suitable and better suited to explain Cloud ERP adoption, especially for reflecting the contextual importance.

### 3.1. Technology, Organization and Environment Framework

The TOE framework was created by Tornatzky and Fleischer (1990). As this is a contextual research, this framework is sought helpful as it explains how the organizational context influences the adoption and implementation of innovations. The TOE framework features three general aspects of a firm’s context that influence the adoption and implementation of the technological innovation process: the technological context, the organizational context, and the environmental context. The three dimensions are also consistent with the innovation diffusion theory, which highlights technological characteristics, and both the internal and external characteristics of organizations as drivers for technology dispersion (Rogers, 2010).

![Figure 1. The TOE Framework. Adopted from (Tornatzky, 1990).](image)

In brief, the **technological aspect** refers to the characteristics of technologies which the organization is currently using, as well as the availability of other technologies not in use by the firm. A firm’s existing technologies are important in the adoption process because they set a broad limit on the scope and pace of technological change that a firm can undertake (Baker, 2012). The **organizational aspect** denotes the characteristics and resources of the firm, including linking structures between employees, intra-firm communication processes, competitive environment, firm size, and the amount of slack resources. There are several ways in which this context affects adoption and implementation decisions (Baker, 2012). And the **environmental aspect** includes the structure of the industry, the presence or absence of technology service providers, and the regulatory environment (Baker, 2012). The TOE model is considered to have a broad applicability across several technological, industrial, and national/cultural contexts. It has been used in investigating the adoption of electronic data interchange (EDI) (Kuan, 2001), knowledge management systems (Lee, Wang, Lim, & Peng, 2009), ERP systems for SME’s (Haddara & Elragal, 2013), and others in a broad spectrum of general IS applications. For this study, the TOE framework has been used to identify technological, organizational, and environmental factors relevant to Cloud ERP adoptions for public sector organizations. The TOE framework has also been used in scooping the data collection process and as a basis for our research method. The factors have been identified and selected based on previous studies by other scholars who have adopted the TOE Framework.
3.2. Hypotheses

Based on our literature review and the theories discussed in this paper, the following hypotheses were made in regard to the survey results. **H1:** The adoption rate/deployment of Cloud-and-SaaS based ERP systems are lower in the public sector than in the private. **H2:** Organizational factors such as size and system knowledge are important predictors of adoption. **H3a:** Lower up-front costs are perceived as the most significant benefit. **H3b:** Increased availability is not perceived as a significant benefit. **H4a:** Security concerns are perceived as the most significant disadvantage. **H4b:** Lack of customization is perceived as a significant disadvantage.

4. METHOD

As mentioned earlier, the paramount aim of this study is to explore the attitudes and perceptions of Norwegian public organizations in regards to cloud ERP systems, with a main focus on benefits and disadvantages. Consequently, it seemed rational to employ a survey as our data collection instrument, and to craft a questionnaire that would be sent to a relevant sample of the population. According to Thayer-Hart et al. (2010), designing and implementing a survey research is a systematic process of gathering information on a specific topic by asking questions to individuals and then generalizing the results to the groups represented by the respondents. Thayer-Hart et al. (2010), define five distinct steps that should be followed in a survey-based research (see fig.2). These steps have been adopted as a guide in this study and will be briefly described in the following sections.

4.1. Survey Design

The first phase of the survey research evolves around the design of the survey. A substantial amount of time and effort were put into the process of designing the questionnaire. Before the design process, an important aspect of the development was to identify the commonly perceived benefits and challenges of Cloud ERP as described earlier. In accordance with Cornford and Smithson (2006), three overarching and linked goals have led the process. 1) Relevant questions to the topic in order to get useful results. 2) Well understood questions resulting in high response rates 3) A study performed in accordance with guidelines and principles from a theoretical framework.

![Survey Process](image)

*Figure 2. Survey Process. Adopted from (Thayer-Hart, 2010).*

Overall, the questionnaire design and the wording of the statements were strongly influenced by the TOE framework. The survey was constructed using the online tool, Survemonkey (www.surveymonkey.com). The survey contained several question logics. The first one excluded the respondents who both lacked a current ERP installation and did not consider an acquisition in all foreseeable future. They received a polite and thankful message, informing them that they were outside the target population and therefore unable to continue the questionnaire. This was done to avoid skewed answers based on the lack of knowledge and interest in the topic. Another question logic was used to separate those who represented organizations where tendering procedures are required and those with more freedom. This was done in order to receive relevant results from those with first-hand knowledge of the important factors related to the tendering process.

4.2. Developing Questions and Measurables

In order to gain substantial answers based on relevant factors for adoption, the questionnaire was crafted in accordance with constructs of the TOE model. The technological aspect contained questions related to ERP system deployment, type of current installation and the respondents view on the existing solution. The organizational aspect focused on questions related to perceived knowledge of the relevant technologies, organizational size, and scales rating the organizational resources, competency and other important factors relevant to the adoption of new technologies and information systems. The environmental factor is especially important as it relates to the primary focus of this study, namely the public sector context and how it differs from the private sector in Cloud ERP systems adoption. Here the respondents were asked to identify their uniqueness with regards to tasks and work processes. The
respondents were also asked to identify whether a tendering process is a requirement for ERP acquisitions and if so, rank the factors that were identified as being the most important. In total, the survey contained 53 variables, whereas a total 19 of them are perceived benefits and challenges of Cloud/SaaS ERP adoption. These were posed as statements with answers on a 10-point likert scale. Applying a 10-point scale was done for comparative purposes, so that the results can be easily compared with studies conducted in the Norwegian private sector (e.g. (Haddara et al., 2015)). General information and demographic data were also acquired, including organizational department, category and length of career. Such questions were posed in order to enable the possibility of identifying differences or correlations based on different categorical values.

4.3. Pilot Study

The third phase in the process is testing and training. The questionnaire was created and reviewed by some of our colleagues and peers. Cornford and Smithson (2006) emphasize the importance of a pilot study in order to verify that the questionnaire is potentially clear and completely understandable by the target population. Hence, after the questionnaire was developed, a pilot study was conducted in order to identify ambiguities and other problems. The questionnaire was sent out to academic staff within the field of information systems at other universities, along with practitioners who belong to the targeted group in public sector organizations. Feedback from both academics and practitioners were mainly positive and focused on the fact that the survey targeted both Cloud ERP adoption and the specific context of the public sector in a well and understandable manner. Those who provided us with feedback also more or less unanimously found the advantages and challenges to of Cloud ERP adoptions to be highly relevant and representative of reality. The specific context of public sector organizations also seemed to be well addressed. Some remarks from the pilot testers were highly constructive, leading to the further enhancement of the survey. For example, remarks such as ”I work within a welfare organization, but I can’t find a relevant organizational category” led to more categorical options in the question asking what part of the public sector the respondent belonged to. Initially, the purpose was to have more general categories in order to group more respondents in each category, but was then changed after several respondents highlighted this as a problem. This also was done to avoid the placement of too many respondents in the ”other” category, which could have limited the possibility of comparative findings. Other replies that were recurrent such as ”Our organization has a hybrid/private cloud ERP system, but I can’t find that as an alternative” lead to the inclusion of such a category in the relevant questions.

4.4. Gathering Respondents

In Norway, there are 15 different central ministries, 19 directorates, 19 city councils and 428 municipalities, all with underlying organizational units. The public sector in Norway has approximately 660,000 employees (Statistikbyrå, 2014). It is unclear how many of these belong to the target group for our research project. Because of the high number of different public organizations and employees, we decided to go with a non-probabilistic convenience sample, which is often used in exploratory research where the researcher is interested in getting an overview and approximation of the truth (Cornford & Smithson, 2006). We then narrowed down the number of possible respondents by first using Wikipedia to identify the different ministries, directorates, city councils and municipalities and tried to base our targets on a geographical proximity. After identifying the organizations, we visited their websites to identify the employees who were perceived to be key stakeholders in an ERP system adoption process. Notes were taken of these potential participants, and listed them down as contacts with their e-mail addresses in an Excel spreadsheet.

4.5. Sample Size and Contact

After the targeting process was finished and contacts structured into Excel, the questionnaire was then sent out via e-mail to all the 465 different randomly gathered key stakeholders related to ERP adoption in true public sector organizations. These all had the job descriptions and responsibilities necessary to be included in the target group discussed in the paragraphs above. In order to increase the total number of respondents, 10 days after the initial email was sent out, a reminder was therefore sent out. This email excluded those who had had responded, stated that they forwarded it to other colleagues within the organization, and those who had responded by saying that they would not participate.
4.6. Response Rate

Initially, we received 118 survey responses. After a reminder e-mail was sent out, an additional 25 (21.1 % increase) participants answered the survey. In total, we received 143 responses. This means that the total response rate was 30.75 %. Oates (2005) states that response rates around 10 % are seen as common. We therefore were very pleased and highly grateful for the participants in our study.

4.7. Data Analysis

The data analysis employed both descriptive and inferential statistics. Means (μ) and standard deviations (σ) were investigated in order to find the middle values along with the spread of the responses. Mean differences were analyzed to find variables diverging from the “normality”. Bivariate Pearson correlation analysis was performed in order to identify correlations between ordinal numerical variables. In order to ensure that the findings were statistically significant, several measures were taken. With regards to mean differences, One sample T-tests were performed. According to Moore (2007), one sample t-tests are a statistical procedure that can be used with a purpose of examining the mean difference between a sample and the known value of the population mean. Due to a varying degree of responses from the respective organizational sectors, also bootstrapping with a 95% confidence interval was performed when these categorical values were used as a base for comparison. This was done in order for the results to be considered statistically significant. Bootstrapping falls in the broader class of resampling methods and refers to any test or metric relying on random sampling with replacement values (Davison & Hinkley, 1997). Efron and Tibshirani (1994) explain that bootstrapping allows researchers to assign measures of accuracy (such as variance, bias prediction error, confidence intervals, or other similar measures) to estimates of the sample. This technique therefore allows estimation of the sampling distribution of close to any statistic using random sampling methods. In order to measure if the correlation analyses performed was statistically significant, P-values were used. P-values are the standard method that statisticians use to measure the ‘significance’ and is a function of the observed sample results relative to a statistical model, measuring how extreme the observation is (Babbie, 2013). Statistical hypothesis tests using p-values as a determinant are frequently adopted in many fields of science and social sciences. Babbie (2013) argues that competent researchers investigating a hypothesized relationship will determine a p-value in advance of their empirical study. Most often values of either 0.01 or 0.05 are used. Fenton and Neil (2012) state that if data from the findings of a study shows a p-value of less than what has been specified in advance, the researcher can claim statistical significance of their study, rejecting the null hypothesis and conclude that a relationship really exists. In our study, p ≤ 0.05 was used as a cut-off point for statistical significance.

5. Findings

5.1. General Demographics

When investigating the overall general demographic findings from the responses, and looking the distribution of respondents based on public sector organization, many different organizational sectors are represented. However, four sectors were significantly more represented than others. The largest segments were Municipalities (32,1%), Education and Research sector (21,1%), County Councils (12,8%) and Hospitals and Health sector (11,9%). The respondents were quite evenly distributed among the different organizational departments within the target group, however, respondents from business/accounting departments were most prevalent (36,7%). The respondents were also mainly well experienced. Few had worked at their organization for less than a year (6,4%) and the largest group of respondents had worked at their current organization for more than 10 years (33%).

5.2. ERP Usage and Technology Awareness

The degree of ERP adoption among the respondents was relatively high. Most organizations currently had an ERP system deployed in their organization (91,7%). Out of these; 13% had adopted a Cloud-and-SaaS-based ERP system, while 57% was currently using an On-Premise system. There is a clear majority of organizations that have had the same ERP system deployed for over 10 years (51%). However, looking at the respondents’ view of their current ERP system, they were somewhat satisfied with their current solution. The respondents view their current ERP system as a highly critical tool for their daily work and organizational processes. Interestingly, the respondents do not feel strongly that their work tasks and
processes related to ERP systems differ from those in the private sector. Which contradicts with findings from existing literature. With regards to the adoption plans for Cloud ERP, there is a distinct majority of those who are uncertain whether they will ever acquire one (40.4%). Some are also ruling adoption out (10.1%), but a similar amount of respondents believe they will acquire one within 1-3 years (11%). Correlation analyses were performed based on respondents’ view of the organizations ERP system (CUERP1-6) presented in fig. 3 and table 1, their current type of ERP installation (ERPType) and the timeframe of Cloud ERP acquisition plans (ACQTIM). Correlation reveals notable links between uniqueness in work and task processes (Compared with the private sector), satisfaction with the current system, system tailored to the organization and complexity of switching to a new ERP system. Very interestingly, there is also a negative correlation between the uniqueness and acquisition plans, meaning that those who believe their work task and processes to be unique are more likely to hesitate in adopting Cloud-and-SaaS based ERP systems.

![Figure 3. Respondents’ view on current ERP system.](image)

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<td>0.134</td>
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<td>0.100</td>
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<td>2.978</td>
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<td>2.09</td>
<td>0.134</td>
<td>-0.334</td>
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<td>4.3</td>
<td>2.183</td>
<td>0.068</td>
<td>-0.019</td>
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Table 1. Correlations between current ERP systems and cloud ERP adoption plans.

Looking at the respondents’ perceived knowledge of key technologies relevant to this study, there is an overall solid knowledge when it comes to ERP systems. The participants have a (not so surprising) proportional lesser degree of knowledge in cloud computing technology and Cloud/SaaS ERP systems.
This is also reflected in the correlation analyses done in regards to these variables (KN1-3). ERPType and AcqTim are also included in the correlation analysis. A quite logical link between knowledge of Cloud-and-SaaS based ERP systems and those who currently are using such a system is visible. However more interestingly, a link between KN3 and AcqTim is revealed, indicating that those with higher perceived knowledge of Cloud/SaaS ERP systems are more likely to adopt one in the near future.

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\begin{array}{c|c|c|c|c|c|c}
\hline
\mu & \sigma & \text{Corr: ERPType} & \text{Corr: AcqTim} & \text{Corr: KN1} & \text{Corr: KN2} & \text{Corr: KN3} \\
\hline
\text{KN1: ERP} & 7.41 & 1.945 & -0.173 & -0.024 & 0.269 & 0.494 \\
\text{KN2: CC} & 6.02 & 2.236 & 0.134 & 0.113 & 0.269 & 0.659 \\
\text{KN3: CloudERP} & 5.15 & 2.275 & 0.221 & 0.217 & 0.494 & 0.659 \\
\hline
\end{array}
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Table 2. Correlations between Technology Knowledge and cloud ERP adoption.

### 5.3. Perceived Benefits of Cloud ERP Systems

As shown in the following table, a correlation analyses was done based Perceived Benefits (PB1-8), KN1-3, ERPType and AcqTim. This analysis revealed that those with higher perceived knowledge of Cloud-and-SaaS based ERP systems, rated Faster Implementation and Reduced need for internal IT-competency higher as perceived benefits. Interestingly it also showed that those considering adoption of Cloud ERP systems in the near future, generally ranked Lower TCO and Reduced need for Internal IT-competency as more key perceived benefits. Thus, respondents found System Accessibility and Faster Upgrades/Maintenance to be the most significant benefits with respective mean scores of 6.99 and 6.54.

\[
\begin{array}{c|c|c|c|c|c|c|c|c|c}
\hline
\mu & \sigma & \text{Corr: KN1:ERP} & \text{Corr: KN2:CC} & \text{Corr: KN3:CloudERP} & \text{Corr: ERPType} & \text{Corr: AcqTim} \\
\hline
\text{PB1: Lower TCO} & 5.79 & 2.028 & 0.074 & 0.013 & 0.059 & 0.091 & 0.204 \\
\text{PB2: Increased Usability} & 4.69 & 1.947 & -0.149 & 0.033 & -0.045 & 0.081 & 0.048 \\
\text{PB3: Increased Availability} & 6.99 & 2.331 & -0.067 & 0.025 & -0.003 & -0.001 & 0.149 \\
\text{PB4: Lower start-up costs} & 6.29 & 2.202 & 0.032 & 0.140 & -0.005 & -0.067 & 0.011 \\
\text{PB5: Increased scalability and customization} & 6.02 & 2.077 & -0.130 & 0.153 & 0.137 & 0.097 & 0.140 \\
\text{PB6: Easier upgrades} & 6.54 & 2.262 & 0.146 & 0.119 & 0.054 & -0.106 & 0.078 \\
\text{PB7: Faster} & 5.22 & 2.11 & 0.011 & 0.172 & 0.266 & 0.109 & 0.078 \\
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\]
Implementation

PB8: Less need for Internal IT-competency

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<tbody>
<tr>
<td></td>
<td>6,34</td>
<td>2,189</td>
<td>.180</td>
<td>.179</td>
<td>.237</td>
<td>.149</td>
</tr>
</tbody>
</table>

Table 3. Perceived benefits of Cloud-based ERP systems

5.4. Perceived Disadvantages

Results from the correlation analyses performed on perceived disadvantages and the same variables used in the previous analyses (KN1-3, ERPType and AcqTim), show that, interestingly those who currently have a Cloud ERP generally rated the perceived disadvantages lower, meaning that they show less concerns with such systems than those with on-premise installations. Those who have already adopted a Cloud- based ERP system look at data ownership and IT-security as perceived disadvantages with lesser concerns, while vendor dependency still is perceived as a disadvantage. The same disadvantages along with reliability issues were generally ranked as less disadvantageous by those considering adoption in the near future. Also here, the lack of negative correlation indicates that vendor dependency is a paramount reason why organizations either postpone adoptions of cloud ERP to the distant future, or don’t consider it at all. Respondents found vendor dependency and data ownership concerns as the most perceived disadvantages with respective means of 6,44 and 6,36.

The results (in table 4) also show significant mean differences in ratings from respondents in the Welfare Sector, County Councils, Infrastructure, Taxation organizations and Hospitals and Health sector. Table 4 indicates that Welfare Organizations is the sector with most concerns related cloud-based ERP systems with an especially higher rating of perceived disadvantage related of IT-Security and data ownership. Notably IT-Security is the perceived disadvantage with the most polarized rating. Mean differences also indicate that Taxation organizations seem to have concerns related to these factors. County Council respondents on the other hand, rate this factor significantly lower than the mean. Vendor dependency, who is considered to be the highest ranked perceived disadvantage overall, is not looked upon with the same concern in the health sector.

5.5. Organization-specific Findings

As the contextual factors are important in this study, we also analyzed the organization-size related factors. While we find a variance in the distribution of respondents representing organizations with different sizes, however, several of them had over 2000 employees (47,7%). In general, the respondents feel quite comfortable with their organizations’ competency in order to use new technology and don’t feel that necessary resources are a barrier to adoption of Cloud ERP systems. Overall, the distribution of the different types of ERP systems within the respective organizational sectors included in this survey is as follows: out of the respondents, the three sectors with a higher percentage of cloud ERP adoption tendency than the mean were Education and Research sector (23,8%), Ministries and Directorates (16,7%) and County Councils (15,4%). A correlational analysis was done based on organizational size, organizational technology factors including ERP Type and Acquisition Time. No significant correlations were found with regards to the technology factors. However, a highly interesting negative correlation was found between organizational size and Acquisition Time, indicating that larger organizations are less likely than smaller ones to adopt a Cloud ERP system in the near future.

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<tbody>
<tr>
<td>Other</td>
<td>Mean</td>
<td>6,13</td>
<td>5,88</td>
<td>6,13</td>
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<tr>
<td></td>
<td>Std. Dev.</td>
<td>1,642</td>
<td>3,603</td>
<td>2,748</td>
<td>3,251</td>
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</tr>
<tr>
<td>Welfare</td>
<td>Mean</td>
<td>9,00</td>
<td>10,00</td>
<td>7,00</td>
<td>10,00</td>
</tr>
<tr>
<td></td>
<td>Std. Dev.</td>
<td>0,000</td>
<td>1,414</td>
<td>4,950</td>
<td>707</td>
</tr>
<tr>
<td>Ministries &amp; Directorates</td>
<td>Mean</td>
<td>5,83</td>
<td>7,17</td>
<td>5,33</td>
<td>4,83</td>
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<tr>
<td></td>
<td>Std. Dev.</td>
<td>2,787</td>
<td>2,483</td>
<td>1,366</td>
<td>2,229</td>
</tr>
<tr>
<td>County Councils</td>
<td>Mean</td>
<td>7,21</td>
<td>6,00</td>
<td>6,43</td>
<td>4,54</td>
</tr>
<tr>
<td></td>
<td>Std. Dev.</td>
<td>1,477</td>
<td>2,961</td>
<td>2,377</td>
<td>2,295</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Mean</td>
<td>7,67</td>
<td>7,67</td>
<td>7,67</td>
<td>9,00</td>
</tr>
<tr>
<td></td>
<td>Std. Dev.</td>
<td>1,155</td>
<td>1,528</td>
<td>1,528</td>
<td>1,732</td>
</tr>
<tr>
<td>Municipalities</td>
<td>Mean</td>
<td>6,29</td>
<td>6,29</td>
<td>5,57</td>
<td>5,56</td>
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<td></td>
<td>Std. Dev.</td>
<td>2,607</td>
<td>2,663</td>
<td>2,200</td>
<td>2,501</td>
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<tr>
<td>Culture</td>
<td>Mean</td>
<td>6,67</td>
<td>7,33</td>
<td>6,00</td>
<td>5,33</td>
</tr>
<tr>
<td></td>
<td>Std. Dev.</td>
<td>2,517</td>
<td>1,528</td>
<td>2,000</td>
<td>3,215</td>
</tr>
<tr>
<td>Education &amp; Research</td>
<td>Mean</td>
<td>6,74</td>
<td>6,13</td>
<td>5,87</td>
<td>5,65</td>
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<tr>
<td></td>
<td>Std. Dev.</td>
<td>1,573</td>
<td>2,492</td>
<td>2,181</td>
<td>2,269</td>
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<tr>
<td>Taxation</td>
<td>Mean</td>
<td>8,50</td>
<td>10,00</td>
<td>7,00</td>
<td>10,00</td>
</tr>
<tr>
<td></td>
<td>Std. Dev.</td>
<td>0,000</td>
<td>1,414</td>
<td>0,000</td>
<td>0,707</td>
</tr>
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</table>
Based on our data analysis and findings presented above, we can then present our hypothesis results:

H1: The adoption rate/deployment of Cloud-based ERP systems are lower in the public sector than in the private. **Supported**

H2: Organizational factors such as size and system knowledge are important predictors of adoption. **Supported**

H3a: Lower up-front costs are perceived as the most significant benefit. **Not supported**

H3b: Increased availability is not perceived as a significant benefit. **Not supported**

H4a: Security concerns are perceived as the most significant disadvantage. **Not supported**

H4b. Lack of customization is perceived as a significant disadvantage. **Supported**

### 6. Discussion

The aim of this study was to explore and assess the technological, organizational and contextual factors affecting the adoption of cloud-based ERP systems in the public sector. A survey was created with the objective of identifying the characteristics that were considered most beneficial and disadvantageous within this context. In this section, we will discuss the factors that hold the highest influence of cloud-based ERP adoption. As this is a field that is scarcely explored, the findings discussed hopefully will contribute significantly towards the current body of knowledge on such systems deployments.

Looking at the technological findings, it is interesting to see that the adoption rate of cloud ERP systems is significantly lower in this study of the public sector than what has been reported in the private sector by earlier studies, such as the Panorama Consulting Group’s report (2015). Only 13% of the respondents in this study currently had such a solution deployed in contrast to the rapid acceptance reported and envisioned earlier by Castellina (2013), Herbert Nathan & Co (2013), and Columbus (2014) in the private organizations within the Norwegian context. In addition, approximately half of the respondents were either uncertain or had already decided that they were unlikely to ever adopt such a technology, does not seem to be in line with Gartner’s proclamation that the on-premise ERP systems of (what then was) today are likely to be referred to as “legacy systems” in 2016 (Kanaracus, 2014). Our findings should raise an alarm for vendors targeting the public sector and emphasize the importance of investigating the factors that influence this hesitancy and lack of adoption. On the other hand, several findings of organizational factors in this study are congruent with previous research within the private sector domain. A notable similarity relates to the findings of Lenart (2011) and Karabek et al. (2011), which is that organizational size is an indicator for adoption acquisition time. Indicating that cloud ERP systems are perceived to be more suitable for smaller organizations also in the public sector. As the majority of the respondents represented larger organizations, this may have led to some skepticism towards the cloud. An interesting addition to the current research is the linkage between knowledge and cloud ERP adoption and time of acquisition, indicating that those with perceived knowledge of such solutions are more inclined to adopt them. Therefore, if system vendors believe their systems to be suited for larger organizations, listening to the following advice from the

<table>
<thead>
<tr>
<th>Hospitals &amp; Health Sector</th>
<th>Mean</th>
<th>4.92</th>
<th>5.92</th>
<th>5.54</th>
<th>6.85</th>
<th>3.92</th>
<th>5.31</th>
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<tr>
<td>Std. Dev.</td>
<td>1,891</td>
<td>3,121</td>
<td>2,757</td>
<td>2,512</td>
<td>1,498</td>
<td>2,097</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Mean</td>
<td>6.44</td>
<td>6.36</td>
<td>5.89</td>
<td>5.82</td>
<td>3.39</td>
<td>4.55</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>2,154</td>
<td>2,732</td>
<td>2,233</td>
<td>2,603</td>
<td>1,905</td>
<td>2,084</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Perceived disadvantages per sector
Panorama Group (2015, p. 5) might not be a bad idea. "If cloud systems are going to resume the steep market share gains it had demonstrated in past years, SaaS and cloud ERP vendors need to do a better job educating potential buyers and countering some of these negative perceptions”.

One particularly notable and interesting organizational factor was found in this study is the commonality of the work tasks, which is strongly contrasting much of the current literature of IS adoption and acquisition in the public sector. For example, Repa (2006) argues that processes within a public administration are more complex than those in private enterprises. Also, Becker et al. (2003) have suggested that the functionality of ERP systems for public administration is different from its functionality for business organizations. In addition, another study (Wagner & Antonucci, 2004) has also put forward the notion that most public sector organizations require special systems and thus less can use off-the-shelf solution than private companies. The respondents in this survey, however, did not perceive their work tasks and processes related to ERP systems to be specifically different than those in the private sector, indicating that the context-specific reasons for adopting (or not adopting) perhaps are previously overstated. This study does, however, reveal links between uniqueness in work and task processes and satisfaction with current system, indicating that those who actually perceive their tasks and processes to be unique are satisfied with their current system. These respondents also seem to find that their systems are tailored to their specific organization, and that adopting a new one is therefore a highly complex endeavor. Thus, this explains the negative correlation between the work and process uniqueness and acquisition plans, which indicate that those who actually believe that their work tasks and processes are unique show higher hesitancy in adopting cloud ERP systems. On the other hand, the perceived benefits found in this research are surprisingly congruent with those in studies of the private sector, undermining some of our initial hypotheses which were stemming from Kelly’s (1998) argument that ERP systems in government agencies are mainly used to back up supporting processes rather than core processes centered around meeting the collective and individual needs of citizens. Thus, analogously to the findings presented by Haddara et al. (2015), increased availability is found to be the highest perceived benefit. Another notable finding diverging from other similar studies, is the low weighting of the cost aspect of cloud ERP systems. With the exception of Ministries and Directorates and Taxation organizations (who rated both lower TCO and start-up costs high), the overall population did not consider Lower Start-up costs and TCO as significant benefits, rating them respectively 4th and 6th. The reason behind the hypothesis rating Lower Start-up costs as the highest perceived benefit was based on Moløkken et al.’s (2004) argument that the tendering process puts a strong emphasis on price, and that artificial deadlines, political cycles, and budget hypersensitivity all can lead to short term goals by management. There can be several explanations to the relatively low weighting of cost factors. As argued by Arnesen (2013) and Marston et al. (2011) the total subscription fees may turn out to be quite costly in the long term and cost-efficiency is overall highly size and context-sensitive. Respondents might be quite aware of this and as many of them represented larger organizations, they may have considered this and rated TCO lower as a result.

When investigating perceived disadvantages, it was especially interesting to find that those who currently had a cloud ERP system deployed, generally perceived such systems to be less disadvantageous. This was also (more understandably) a fact with those who were thinking about acquiring such a solution in the near future. This again indicates that knowledge and actual experiences with the system potentially reduce skepticism and hesitancy. Another noteworthy finding is the rating of Vendor Dependency as the perceived disadvantage with most concerns. This can be explained by Benlian and Hess’ (2011) argument, that cloud customers might fear the increased bargaining power that system vendors get when owning the entire environment where the customers’ data lives. As the purpose of the public sector is to serve the general public, it obviously has access to a high amount of sensitive information about country’s citizens. This was the main motivation for predicting security concerns as the perceived disadvantage that would be given the most weight, which would also be in accordance general tendencies found in Cloud/SaaS literature. Although the hypothesis was not supported, it was not far from being true. Even though IT-security was ranked 4th as a perceived disadvantage, data ownership concerns which in many ways overlap was ranked 2nd as a main concern. Interestingly, organizational sectors that are perceived as having a relatively high amount of sensitive data about the population, namely the Welfare sector (Zviran, Pliskin, & Levin, 2005) and Taxation organization ranked IT-security and Data Ownership as the top concerns. Interestingly Data Ownership and IT-security was also 2 out of the three perceived disadvantages that were shown relatively less concern among those with a current cloud ERP deployment.
7. CONCLUSIONS AND FUTURE RESEARCH AVENUES

While Cloud-based ERP systems are becoming more widespread and the system providers are experiencing increasing success, however, research has not been able to keep up with the diffusion, and the lack of relevant empirical studies are clear. Hence, this study attempts to identify the factors that influence the decisions regarding cloud ERP adoptions for key stakeholders in several public sector organizations.

Our main findings show that cloud ERP systems are adopted at a significantly lower rate than in the private sector, and the potential future adoptions also indicate skepticism and hesitancy. Even though we provided some recommendations to improve the systems and adoption rates, it is also important to increase the stakeholders’ knowledge of cloud ERP systems. Hence, cloud ERP vendors that are targeting public sector organizations should invest in more strategic marketing efforts in order to educate potential customers and decrease their reluctance.

Overall there is a large and unfulfilled potential with regards to cloud-based ERP adoptions in the public sector, and further efforts from both researchers and practitioners will increase the possibilities of a bright future for the cloud.

References


