CLOUD COMPUTING ADOPTION FACTORS IN TURKISH LARGE SCALE ENTERPRISES

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Abstract

While most research regarding adoption of cloud computing by companies covers countries with highly developed IT infrastructure, cloud computing is actually used also in less IT-mature countries. Still, companies address cloud computing differently in countries with different levels of IT-maturity. This research explores cloud computing adoption factors in less IT-mature countries having Turkey as the example. Embracing an exploratory approach, we investigated five large Turkish companies. The results show that the main adoption factors in favour of cloud computing are "cost", "distributed organisational structure", "mobility of the employees", and "end-user satisfaction", while "security", "critical business processes", "loss of control over data and systems", and "technical infrastructure of the region in terms of broadband" are the factors that make companies cautious about cloud computing. The main difference between Turkey and more IT-mature countries with respect to cloud computing adoption factors is inadequate broadband access and lack of knowledge on cloud computing.

Keywords: Cloud computing, cloud computing adoption in Turkey, cloud computing adoption in developing countries.

1 INTRODUCTION

Cloud computing has been a topic of interest in both academic and business world for the last few years. In its almost the shortest, cloud computing is defined as "dynamically scalable virtualised resources provided as a service over the Internet" (Chorafas, 2011). Even though there exists a common opinion that cloud computing is a more appropriate solution for enterprises with limited information technology (IT) resources, Marston et al. (2011) argue that large scale enterprises-which have more resources to allocate on IT can realize cost savings using virtualisation technologies. Similarly, Hosseini et al. (2011) claim that large scale enterprises are attracted to cloud-based solutions that are superior to in-house data centres in terms of financial and technological dimensions. The most common financial benefits of cloud computing are cost reduction, pay-per-use and higher efficiency while the technological advantages can be lined up as elasticity, flexibility and availability. Despite these advantages, it has been claimed that cloud computing adoption rate is not growing as fast as expected (Banarjee 2009; Buyya et al 2009, Goscinski and Brock 2010) due to the security, privacy and reliability issues along with performance considerations which tend to be perceived differently by the customers. Cloud computing is currently at an early stage in Turkey where the level of IT utilisation lags behind many European Union (EU) countries due to economic, social, and technological reasons (Yayla & Hu 2012). The generally agreed upon idea is that cloud computing offers affordable IT resources which create opportunities for the companies of developing countries to improve their IT related capabilities and empowers them to be competitive in global markets. Specifically, large scale enterprises in Turkey are assumed to benefit more from cloud computing since their ability of following and implementing IT developments are higher than the small enterprises in which the use of IT is mainly for routine tasks (Kutlu & Özturan, 2008). According to a recent report of United Nations Conference on Trade and Development (UNCTAD, 2013) which covers 13 countries including Turkey, the use of cloud is greater in medium-sized than in small enterprises. Furthermore, the cloud usage in large scale enterprises of developing countries has an increasing growth similar to developed countries (UNCTAD, 2013). Considering the use of IT in developing countries, it is expected that cloud computing adoption initially starts up at large scale enterprises and depends on various factors. Although cloud computing adoption has been being examined by researchers, cloud computing adoption factors in Turkish private sector have not been researched thoroughly. Therefore, the main purpose of this study is to contribute the body of knowledge on cloud computing by exploring the adoption factors of cloud computing in large scale enterprises in Turkey which are also applicable to the countries of similar economies. Emerging from this context, the question "What are the adoption factors of cloud computing in large scale enterprises in Turkey?" forms the basis for the investigation in this study.

2 RELATED RESEARCH

The literature contains significant number of studies on cloud computing adoption factors at organisational level. Among these studies, Tan and Lin (2012), Morgan and Conboy (2013), Borgman et al. (2013) addressed the adoption factors for multi-sized (including both small and large scale) enterprises mostly in Europe and Asia-Pacific (APAC) regions. These three studies are theoretically based on Technology-Organisation-Environment (TOE) Framework (Tornatzky & Fleischer, 1990)-an organisational level theory identifying three aspects of a firm's context; technological-organisational-environmental influencing the adoption of technological innovation and Diffusion of Innovation (DOI) Theory (Rogers, 2003) which emphasises the characteristics of technological innovations (e.g. relative advantage, complexity, compatibility, observability, triability) as the influencers of technological innovation adoption. The findings of Tan and Lin (2012), Morgan and Conboy (2013) and Borgman et al. (2013) show that using TOE framework in conjunction with DOI constructs has mostly posed recurring factors of cloud computing adoption. In the meantime, relatively new adoption factors of cloud computing such as "security and privacy", "top management support" and "fear of losing control over data and systems" have been identified deriving from the exploratory approaches that these studies followed. In order to provide a better understanding of cloud computing adoption in large scale enterprises, the factors identified in the relevant works of Tan and Lin (2012), Morgan and Conboy (2013) and Borgman et al. (2013) are presented below.

- Relative advantage denotes the degree which an innovation is considered 'better' than the practice it supersedes (Rogers, 2003). Cloud computing is considered as a relatively advantageous IT solution in terms of its economic benefits such as reducing the hardware, software, maintenance and back-up costs. These cost related benefits have positive influences on cloud computing adoption (Tan and Lin, 2012, Borgman et al., 2013; Morgan and Conboy, 2013).
- Complexity describes the degree to which the innovation is perceived as difficult to understand and complex to use (Rogers, 2003). Companies consider to implement and use cloud computing, if it doesn't require advanced technical skills and greater efforts (Tan and Lin, 2012, Borgman et al., 2013, Morgan and Conboy, 2013).
- Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters (Rogers, 2003). The compatibility of cloud computing have a positive impact on organisational adoption (Tan and Lin, 2012, Borgman et al., 2013, Morgan and Conboy, 2013).
- Security refers to the degree which cloud computing is perceived to be relatively secure and protect legality. According to Morgan and Conboy (2013), companies tend to adopt cloud computing if they perceive cloud computing as a secure solution.
- Top management support as an organisational factor denotes the supportive attitude of management for implementing cloud computing. The positive attitude of top management increases the likelihood of cloud computing adoption (Borgman et al., 2013).
- Fear of losing control over data and systems denotes the IT manager's considerations related with losing the control over data and services. In cloud's shared pool of resources, the managers have limited control over their systems' management (Morgan and Conboy, 2013).

3 METHODOLOGY

3.1 Research Design

In order to identify adoption factors of cloud computing in large scale enterprises in Turkey, case studies were conducted in five large scale enterprises based in Turkey. According to Turkish Trade Law (2012), a large scale enterprise is the one which employs more than 250 people and exceeds at least two of the following figures: (1) an annual sales revenue of more than 40 million Turkish Lira, (2) a balance sheet total of more than 40 million Turkish Lira. The companies were selected from different sectors-manufacturing, energy, healthcare, engineering and construction considering the sectorial diversity as a requirement for reflecting different information technology needs and practices. The two out of the five companies were cloud service users and labelled as "adopter(s)" while the other two companies which didn't use cloud services were labelled as "non-adopter(s)" and one company which used cloud services in the past but moved out of cloud at the time of investigation was labelled as "past adopter". Interview respondents were selected from similar organisational positions in every company considering their technical and managerial expertise to evaluate the company's existing IT system as well as cloud computing services. In order to maintain the confidentiality, companies are presented with identifiers namely Case A, Case B, Case C, Case D and Case E. Companies and respondents that take part in this study are briefly described in table 1.

Companies	Cloud Usage	Sector	Respondent	Respondent's Position
Case A	Adopter	Oil and Gas	Participant 1 Participant 2	Software developer IT Manager
Case B	Adopter	Health-Care	Participant 3 Participant 4	IT Manager Computer Hardware specialist
Case C	Past Adopter	Manufacturing	Participant 5	IT Manager
Case D	Non-Adopter	Construction	Participant 6	Software developer
Case E	Non-Adopter	Engineering	Participant 7	IT Manager

Table 1. Descriptions of companies and respondents that take part in this study

3.2 Data Collection and Analysis

Embracing an exploratory research method, the qualitative data collected through semi-structured interviews were analysed using Strauss and Corbin's Grounded Theory Analysis (1998). Grounded theory analysis (Strauss and Corbin, 1998) is specifically useful when a researcher attempts to discover new insights about an existing phenomenon and when the topic of interest has been relatively ignored in the literature or has been given only superficial attention (Denscombe, 2010). Using Strauss and Corbin's (1998) open and axial coding techniques, adoption factors of cloud computing were determined by following conceptualisation, abstraction and categorisation processes.

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The analysis reveals that cloud computing adoption factors can be classified in three main groups namely, technological factors, internal factors and external factors. Technological factors refer to the IT specific requirements, benefits and risks which are associated with cloud adoption. Internal factors refer to the characteristics of the company influencing the cloud adoption. Last group- external factors are the influencers of cloud adoption which exist independent of the company. Each factor is determined to have either a positive or a negative effect on the adoption. Positive effect means that the respondent considers that factor as an advantage of cloud computing. Negative effect means that the respondent has concerns about the factor and is hesitant to use cloud computing because of that factor.

4.1 Technological Factors of Cloud Computing Adoption

Technological factors of cloud computing adoption identified in five research cases and their effects on the adoption are presented in table 2.

Technological Factors	Positive in Case	Negative in Case
Security	A	B, C, D
Reliability	A	C
Availability	A	C
Performance	B	D
Cost	A, B	C, D
Pay-per-use	B	

Table 2. Technological factors of cloud computing adoption

- Security denotes the extent that cloud computing is perceived to be secure and protect data privacy. Current study shows that security of cloud computing is positively related with cloud computing adoption in one of the five participant companies depending on two main reasons: (1) SLAs and (2) provider's reliability. As Participant 1 in Case A pointed out, "there is always a risk of security in all systems. However, you are protected with strong SLA's and contracts in the cloud. When evaluating the security issues, you should consider that you trust people in your company as well. Security is not just about being in the cloud". Participant 1 further explained that, "...we keep our email system in a provider's database which we trust". However, security has found to be negatively related with cloud computing adoption in Case B which has been using SaaS for the email system but not to prefer using it for Hospital Information Systems (HIS) considering the risks that would potentially harm the privacy of patients' information. Similar to Case B, security has a negative influence on cloud computing adoption in Case C with the exception of private cloud services. The IT Manager in Case C explained that "We have a risk point of view that looks for enterprise solutions. Private cloud matches with this perspective in terms of security and infrastructure sustainability". Taking into account the explanations of participants, it can be concluded that private cloud is perceived as a more secure deployment model compare to public cloud. Regarding security issues, the companies in this research either prefer to use private cloud computing services or public clouds for non-critical business processes and applications.

- Reliability denotes the capability to ensure constant operation of the system without disruption (Shubert, 2010). The analysis reveals that reliability of cloud computing is one of the primary reasons for its adoption in Case A. On the contrary, in past adopter company-Case C, the participant explained that they had a "risk point of view" and cloud computing solutions were not reliable enough to move their critical business processes into the cloud environment. In previous studies, Marston et al (2011) also describes a similar reasoning for non-adoption of cloud computing stating that reliability is a concern for large corporations which have built their own IT standards with the experience of years. Therefore, the contrast in two cases leads to investigate other factors of cloud computing adoption which interact with reliability such as business processes of the enterprise.
- Availability is defined as an essential capability for cloud computing services which introduces redundancy for services and data so failures can be masked transparently (Shubert, 2010). The analysis reveals that the availability of services and data is a demand which varies according to the business processes and needs of the companies. Similar to reliability, availability has a positive impact on cloud computing adoption in Case A, while it has a negative correlation with the adoption in Case C where the participant 5 clearly explained that "...we can't put the production in the cloud and take the risk of having a loss due to connection failures... It (cloud) can only be an alternative if the availability is 99,99% and the cost is lower than existing solutions". As it is found similarly in "reliability" factor, this contrast between Case A and Case C leads to search for other factors that influence the availability as an adoption factor.
- Performance denotes the ability of cloud computing to response service level requirements (Stahl et al., 2013). The first case that performance has an influence on adoption is Case B. The participants in Case B expressed that the performance was the main reason of moving their email system into the cloud. However, In Case D, performance is measured with the speed of service and has a negative impact on cloud computing adoption due to the higher demands of speed when compared to Case B.
- Cost is recognised as a positive adoption factor in adopter companies (Case A and Case B) while Case C And Case D consider it as a negative factor that have influence on the adoption. Although cloud computing is often reported as a cost efficient solution, the analysis shows that costs in the cloud can exceed the in-house IT costs in long term. For example in Case C, the reason for moving out of cloud was explained with the hidden costs of cloud which were realised after the demands increased.
- Pay-per-use pricing model of cloud computing is observed as a facilitator of cloud computing adoption in Case B. Participant 3 clearly explained that, "Pay-per-use model of cloud computing is very advantageous. Instead of buying a new server, we pay for what we use". Related to cost and resource efficiency, the pay-per-use model of cloud computing is determined as an adoption factor of cloud computing which has a positive influence.

4.2 Internal Factors of Cloud Computing Adoption

Internal factors of cloud computing adoption identified in five research cases along with their effects on the adoption are presented in table 3.

Internal Factors of Adoption	Positive in Case	Negative in Case
Organisation Size		A, C
Organisational Structure (Distributed)	A, B, D	
Critical Business Processes		B, C, E
Employee Mobility	B, C, D	
End-user Satisfaction	A, B	
Focus on Core Competencies	A	
Loss of Control over Data and Systems		A
Lack of Knowledge on Cloud Computing		B

Table 3. Internal factors of cloud computing adoption

- Organisation size is the most significant influencer of cloud computing adoption. Most of the research participants are of the same opinion that cloud computing is more beneficial for small sized companies. Companies with less IT resources and capabilities can benefit more from cloud computing by using shared resources for standard and routines services instead of investing for the systems and applications.
- Organisational structure denotes the geographically distributed business and operation model of a company and is positively related with cloud computing adoption. According to the comments of the participants, the more distributed a company's structure, the more likely it is that the company can take advantage of cloud computing. For example, if a company is structured in a way that its employees need to access data from anywhere at any time, cloud architecture provides the necessary platform, applications and infrastructure.
- Critical business processes denote the core business processes that are critical to company. The analysis reveals that critical business processes have negative influence on the adoption in Case B, Case C and Case E. The participants 3, 5 and 7 remarked that their IT systems were comprised of enterprise level integrated systems. These optimised and manageable systems are designed in accordance with the business processes of the companies. For example in Case B, Hospital Information Systems (HIS) were used for the core business process. Although the company was using SaaS for email system, the critical business processes were running on HIS due to security considerations. Similarly, in Case C, IT manager explained that their production related processes were relied on ERP system and they didn't consider to move these processes into an external cloud environment. Additionally, the IT manager in Case E stated that they were not looking for a cloud based solution since they were satisfied with the company's IT/IS infrastructure which was designed to support, develop and monitor the engineering based projects. Therefore, the critical business processes are found to be negatively related with cloud computing adoption with regard to reliability, availability and security of the services.
- Employee mobility denotes the condition of employees working out of office due to the requirements of the job. According to the analysis, this factor has a positive influence on cloud computing adoption. The participants in Case B and Case C explained that cloud solutions can better serve to companies which have employees in the field. Since these employees need to reach the IT services from anywhere at any time, cloud computing's availability enables the employees to work remotely using mobile technologies.
- End-user satisfaction becomes apparent after becoming cloud user and has a positive relation with cloud computing adoption in adopter companies (Case A and Case B). Both of the adopter companies' participants were of the same opinion that cloud computing directly or indirectly provided satisfaction with its users.
- Focus on core competencies denotes the use of both human and non-human resources aligned with the strategic purposes of the company by proving employees with necessary resources to improve their proficiency. The analysis reveals that it has a positive relation with cloud computing adoption. In Case A, participant 1 explained that "We are not involved with the infrastructure works that take too much time. This is a huge advantage". The IT manager of the company supported this argument by indicating how cloud computing helped their IT human resources to be used more effectively. In the words of participant 2, "Cloud computing and the solutions built on cloud are absolutely right to make the good use of human resources, to provide dedicated human resources, to manage these resources".
- Loss of control over data and systems denotes the shift of systems and data management from users to providers which leads to related considerations. Specifically in Case A, participants pointed out their concerns about not having control over their data. This factor has also found to be a negative influencer of cloud computing adoption by Morgan and Conboy (2013), though they named this factor as "IT managers' fear of losing control of their IT environment".
- Lack of knowledge on cloud computing denotes the inadequate knowledge and bias about cloud computing. The analysis reveals that there is a link between cloud computing adoption and the knowledge about cloud computing. For example, when explaining the drawbacks of cloud computing, Participant 3 stated that, "Concerns about cloud computing are also related with the lack of knowledge about cloud computing, e.g. 'how it works?', 'where the data is located?'..."

Therefore, "lack of knowledge on cloud computing" is found to be negatively related with cloud computing adoption in Case B and may influence the widespread adoption as well.

4.3 External Factors of Cloud Computing Adoption

External factors of cloud computing adoption identified in five research cases along with their effects on the adoption are presented in table 4.

External Factors of Adoption	Positive in Case	Negative in Case
Provider's Reputation	A	
Technical Infrastructure of the Region in terms of Power Supply	A	
Technical Infrastructure of the Region in terms of Broadband		B
Sector Specific Regulations		B

Table 4. External factors of cloud computing adoption

- Provider's reputation denotes the reliability of the provider. The analysis discloses that adoption of cloud computing services are influenced by the reliability of the cloud computing provider in a positive manner. According to the adopters, features such as good reputation and recognition of the provider are considered when adopting cloud computing. The reliability of the provider is usually guaranteed by the quality and security certifications that the provider has. Additionally, the service level agreements (SLAs) are taken into account as secure business agreements between the provider and the customer.
- Technical infrastructure of the region in terms of power supply denotes the stability of power supply in the region. The power outages can cause the entire in-house IT system including data and services to become incapable of working until the generators power on. Such an outage brings out the back-up issues and maintenance cost. However, the participants in Case A explained that cloud computing adoption eliminated the back-up issues and maintenance of the hardware specifically in times of such outages. Therefore, this factor has found to be positively related with cloud computing adoption in Case A. Compared to in-house IT, applications, systems and data are protected when the service is deployed in the cloud. Although the risks are not completely vanished, it may be claimed that the risks related with loss of applications, services and data are shifted from the user to the provider.
- Technical infrastructure of the region in terms of broadband denotes the adequacy of broadband access in the region. According to the analysis, the internet connection of Turkey in terms of broadband access hasn't been developed enough to satisfy the user needs. Although, wireless connection is an alternative, its additional cost is intimidating. Therefore, technical infrastructure in terms of broadband has a negative impact on cloud computing adoption.
- Sector specific regulations denotes the regulatory rules and frameworks specific to an industry. The analysis reveals that this factor has a negative impact on cloud computing adoption in health-care sector. Case B runs the business in accordance with Joint International Commission (JCI)'s regulations which enforce the member hospitals to fulfil specific standards for improving the quality and patient safety in all clinical and managerial functions. Therefore, protecting patient's data becomes a critical issue for IT department. Although the company uses a cloud based email service, they don't have a plan to move their critical information and processes such as HIS into the cloud.

4.4 Comparison of the Findings of Current Study with Related Research

A comparison of the findings of current study with the previous work on cloud computing adoption shows that some factors found in the current study match with the findings of previous work. Table 5 shows the adoption factors of cloud computing which reoccur in the current study.

Adoption Factor	Related Research
Security	Morgan and Conboy (2013)
Cost	Tan and Lin, (2012), Borgman et al. (2013), Morgan and Conboy (2013),
Fear of losing control over data and systems	Morgan and Conboy (2013)

Table 5. Cloud computing adoption factors matching with the prior studies' findings

The comparison of the adoption factors found in the related research with the ones identified in the current study shows that cost and security are significant adoption factors where a common agreement is reached. Another matching factor-"fear of losing control over data and systems" is a relatively new adoption factor found in Morgan and Conboy's (2013) work. Although given names are different, this factor has the same content with "loss of control over data and systems" identified in the current study. On the other hand, the factors which are not covered by related research while present in the current study are reliability, availability, performance, organisation size, organisation structure, employee mobility, focus on core competencies, provider's reputation, lack of knowledge on cloud computing, sector specific regulations and technical infrastructure of the region in terms of power supply and broadband. There are two main reasons why many cloud computing adoption factors found in this research do not appear in the related research. First, related research is based on TOE framework and DOI theory which limit the findings with pre-determined factors. Second, related research is focused on the companies based in Europe and APAC regions where the use of IT in business is ranked higher than it is Turkey (The Global Information Technology Report, 2013). Furthermore, most of the countries in related research meet minimum requirements for advanced cloud services while Turkey falls into the category of countries which meet the minimum requirements for basic cloud services (UNCTAD, 2013). In this context, cloud computing adoption factors can vary in different countries. Meaning that, there are country-specific factors such as "lack of knowledge on cloud computing" and "technical infrastructure of the region in terms of power supply and broadband" which influence the adoption of cloud computing services in Turkey and apply to countries of similar economies.

5 CONCLUSION

This study presents the adoption factors of cloud computing in five large scale Turkish enterprises operating in Turkey. Providing insights from cloud adopters, non-adopters and a past adopter, it has been found that cloud computing adoption in large scale Turkish enterprises is influenced by the advantageous technological features that are inherent in cloud computing. However, these features are only able to function when the business requirements are fulfilled and environmental conditions are convenient. Cloud computing adoption in Turkish large scale enterprises is mainly influenced by security, cost, reliability and availability as technological factors, organisation structure, end-user satisfaction, loss of control over data and systems and critical business processes, lack of knowledge on cloud computing as internal factors and technical infrastructure of the region as an external factor. Although, security, cost and loss of control over data and systems are the factors which overlap with the findings of related research in developed countries, current study addresses the country-specific factors which are unobserved in the related research. Specifically, the inadequate bandwidth and broadband accessibility in Turkey are considered as obstacles for cloud computing adoption. In order to promote cloud computing adoption and pave the way for potential benefits offered by cloud, it is necessary to develop the technical infrastructure of Turkey which takes political will and constant effort from both government and private sector. The findings of the current study are of the interest to researchers and practitioners for at least two reasons. First, this study shows the factors influencing cloud computing adoption in Turkey that would also cover economically, technologically and culturally similar countries. Second, this study presents insights from large scale enterprises which provide decision makers with a better understanding of the cloud computing adoption in practise.

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