

# Differential Adoption of Cloud Technology: A Multiple Case Study of Large Firms and SMEs

*Completed Research Paper*

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## Abstract

*Firms across the industry segments have been exploring cloud computing to derive benefits out of its technological features. Even though literature pertaining to cloud adoption by firms exists, the factors based on cloud-specific characteristics are mostly anecdotal in nature. Following a multiple case study approach, we identify factors specific to cloud technology adoption by firms. We further explain the differential adoption of the cloud between large and small firms. Overall we obtained 11 variables that differentiate large firms and SMEs in their adoption behavior. We further contribute to theory by mapping the extracted variables of cloud adoption to Diffusion of innovation theory (DOI) and Technology organization Environment framework (TOE).*

**Keywords:** Cloud computing, technology adoption, diffusion of innovation

## Introduction

Cloud computing is considered as a co-evolution of computing technology and business models (Iyer and Henderson, 2010). This new technology based service model has been changing the way IT resources are offered and consumed and has received considerable attention among management research scholars and practicing managers in organizations (Marston et al., 2011; Petrescu, 2012). Many industry sectors are exploring cloud options to derive benefits from its technical characteristics (Lin and Chen, 2012) obtained using various deployment models (public, private and hybrid). These technological features have helped in achieving business model innovation and competitive advantage for the adopting organizations (Marston et al., 2011).

Cloud computing is defined as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and

services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Mell and Grance, 2011). The characteristics of cloud services such as pay-as-you-go pricing model, self-servicing and convenience to scale the services according to consumers need have made them stand out distinct from their traditional counterpart of on-premise IT (Morgan and Conboy, 2013). However the technology environment and business needs are constantly changing and in a rapid pace (Adomavicius et al., 2008). Further, the cloud market has been expanding continually since its inception with both incumbents and new entrants, thus the business ecosystem has become distributed and fuzzy, making vendor selection and integration a huge problem. All these complications make cloud adoption by enterprises a challenging problem.

A recent study reported that determinants of cloud adoption varies across different industry sectors for e.g. manufacturing and services in Portugal (Oliveira et al., 2014). However there are more and further questions on cloud at this stage of its evolution. What are the factors specific to cloud technology which enable could technology adoption by firms? How are these factors same or different for firms with respect to firm size? What explains the potential differential adoption characteristics of small and medium sized enterprises (SMEs) and large firms? As the organizational structure, technological needs, customer base and spread and business needs differ between these entities (Grandon and Pearson, 2004), the determinants of adoption are also expected to vary. Further, differences in IT adoption and benefits between large and small organizations have been recognized in literature (Grandon and Pearson, 2004; Bernroider and Koch, 2001; Buonanno et al., 2005). Large firms exhibit differences in terms of resources and expertise compared to small and medium enterprises. These differences, in turn, may have an impact on the way in which firms perceive technology attributes (Buonanno et al., 2005). Even though there is increase in literature about the cloud adoption and use at organizational level (Yang and Tate, 2011), a majority of studies published were specific to cloud adoption by SMEs and there is now growing literature aimed at cloud adoption by large firms (El-Gazzar, 2014). Yet, there is dearth of study that summarizes the effect of organization size on the perception of cloud characteristics that affects the cloud adoption decisions by firms. Furthermore, from a recent market report (Eurostat, 2014) we observe that cloud adoption by enterprises within the European Union countries is at a different rate (Germany 11 % and Finland 51 %). One possible reason might be the strict data protection act in Germany which restricts the personal data to cross borders. Consequently, there could be other factors that drives and hinders cloud adoption by large and small enterprises in Germany, which our study aims to address.

Apart from contributing to the still emerging area of cloud technology use, our study distinctly addresses the differential adoption of the cloud between large and small firms. Any enterprises that employ between 50 and 250 people and have an annual turnover not exceeding 50 million euro are termed as SME's (Eurostat, 2014). Previous studies have addressed adoption of the cloud using established theories of technology adoption and diffusion, we follow a combination of deductive and inductive approaches to extract compare and contrast adoption characteristics of the two categories of firms. We further contribute to theory by mapping the extracted themes of cloud adoption to two prior theories in technology adoption. Similarly, cloud literature consists of quantitative studies using DOI and TOE to capture the variance of cloud adoption, but why these determinants explain adoption decision are largely based on anecdotal evidence. In our approach using multiple case studies we provide a rich explanation of various factors that impacts adoption decisions based on our case study data.

## **Literature Review**

As the topic of our study is nascent and in particular adoption studies on cloud are relatively less in extant literature, we conducted a systematic review of literature to identify key empirical studies related to the area by following a systematic process of searching, filtering and classifying related literature (Webster and Watson, 2003). According to Yang and Tate (2011) the number of peer-reviewed journal articles with respect to cloud computing has increased substantially from 2008. Hence our literature search consists of articles published between January 2008 and March 2016. Our search was aimed at peer-reviewed, scholarly journal articles hence, General OneFile, IEEE Xplore, ProQuest (ABI/INFORM), and Science Direct (Elsevier) databases were targeted since these cover forty-four of the top fifty IS journals (Levy and Ellis, 2006). The remaining six journals: Communications of the Association for Information Systems, Journal of the Association for Information Systems, International Journal of Electronic Commerce, Information Systems Journal, Human-Computer Interaction, and Informing Science were then manually

searched with a list of key words (cloud, cloud computing, IaaS, PaaS and SaaS in combination with adoption, innovation and diffusion). We further broadened the scope of our search to include leading conferences of the IS community covering European Conference on Information system (ECIS), Hawaii International Conference on System sciences (HICSS) International conference on Information Systems (ICIS), Mediterranean conference of information system (MCIS), Americas Conference on Information Systems (AMCIS) and Pacific Asia Conference on Information Systems (PACIS).

### ***Theories used in firm level cloud adoption studies***

Our initial search resulted in 48 articles, we further excluded articles: if it is not supported by strong theoretical underpinning and if the type of organization was unknown. Abstract scanning of remaining articles resulted in the following theories used in the adoption studies of cloud services by organizations : technology acceptance model (TAM) (Opitz et al., 2012), Diffusion of innovation theory (DOI) (Nuseibeh, 2011; Oliveira et al., 2014; Lin and Chen, 2012; Wu et al., 2013; Coursaris et al., 2013), Technology Organization and Environment framework (TOE) (Oliveira et al., 2014; Borgman et al., 2013; Lian et al., 2014; Hsu et al., 2014; Low et al., 2011; Nkhoma and Dang, 2013), transaction cost economies model (Nuseibeh, 2011; Petrescu, 2012) and resource dependency model (Nuseibeh, 2011) have been used for addressing different industry sectors, especially of large organizations.

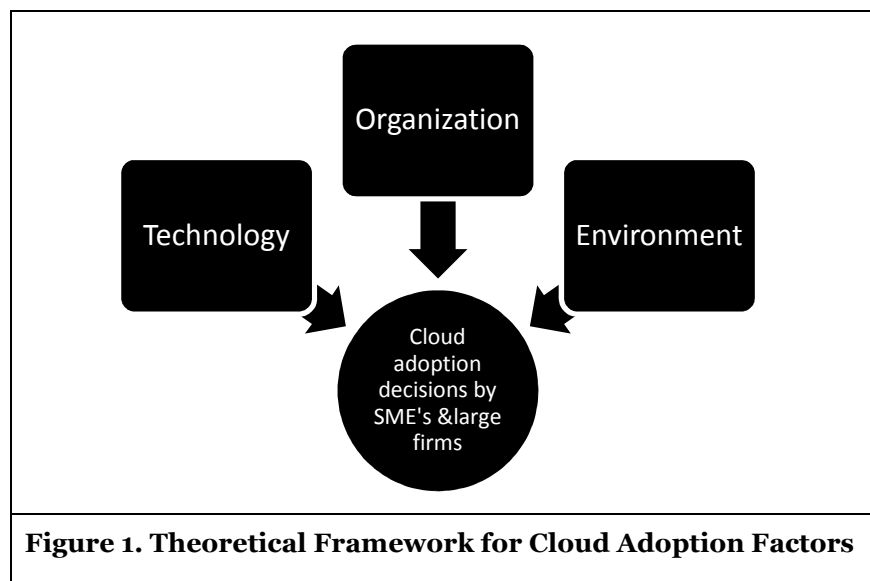
From a comprehensive study of cloud adoption conducted by El-Gazzar ( 2014), we observe that DOI and TOE have been the most widely used theories to study cloud adoption by both the segments. The following are the studies that have used DOI and TOE as their theoretical underpinning: Studies concerning large firm cloud adoption using quantitative approach (Wu et al., 2013; Borgman et al., 2013; Low et al., 2011; Lin and Chen, 2012; Oliveira et al., 2014). In case of SME's cloud adoption the most predominant mode of research is through case study (Saedi and Iahad, 2013; Morgan and Conboy, 2013; Nkhoma and Dang, 2013) , with one study using quantitative approach (Alshamaila et al., 2013). In order to develop understanding about adoption decision by SME's and large firms a comparative study which using the same outcome variables for both segments and the influence of firm size on these variables would be imperative (Buonanno et al., 2005).

Information systems research field has reported extensive research on IT usage covering adoption, diffusion and dissemination over the past 30 years. Jeyaraj et al. (2006) did a detailed study of the theories used in organizational and individual adoption of IT and observed that characteristics of innovation and organizations were good predictors of organizational IT adoption. Rogers (1962) defined innovation as any object, idea, technology, or practice that is new and can be tangible or intangible. Furthermore, innovation is a relative concept and is also defined as the degree to which something is perceived new to the adopting organization or individual (Nuseibeh, 2011). In the context of cloud adoption, cloud computing has been shown to be an innovation which is new to the adopting organization (Lin and Chen, 2012). The diffusion of innovation (DOI) theory by Rogers (1962) primarily explains how perceived characteristics of innovation influence the adoption of that innovation. In the IS context, Moore and Benbasat (1991) extended the adoption factors given by Rogers (1962) and also operationalized the constructs by developing and validating relevant scales for IT adoption. The most widely used innovation attributes in DOI are relative advantage, compatibility, complexity and trialability. Relative advantage has been defined as the degree to which an innovation is perceived as being better than the precursor. Compatibility denotes the degree to which innovation is perceived as being consistent with the existing values, needs and past experiences of potential adopters. Complexity has been defined as the degree to which innovation is perceived as being difficult to use. Finally trialability is the degree to which innovation may be experimented before its adoption.

It has been widely argued that innovation is a complex process and hence it is difficult to use a single theory to capture the multiple dimensions of innovation adoption. It has been noted that the TOE framework is consistent with the theory of the diffusion of innovations (DOI) (Rogers, 1962). TOE explains the role played by the technology, organizational and environmental context of an organization on information technology adoption (Oliveira et al., 2014). The DOI adoption predictors are said to be comparable to the TOE's technological element. There are empirical studies that have used DOI theory along with TOE framework to explain technology and system adoption at organizational level (Dwivedi et al., 2012). Combining these two models will provide a holistic view of the determinants of cloud adoption due to two reasons: (a) since perception of cloud varies between different users and providers of Cloud (Iyer and Henderson, 2010), DOI captures the perception effect (b) TOE will account for concrete

organizational factors in the decision to adopt cloud. TOE has also been used to study adoption of IT in American, European and Asian context (Dwivedi et al., 2012). The most widely used statistically significant determinants of DOI and TOE in cloud adoption studies are relative advantage, complexity, compatibility and firm size (Oliveira et al., 2014; Borgman et al., 2013; Nkhoma and Dang, 2013; Low et al., 2011)

In summary, even though studies using DOI and TOE models are found to explain the variance in adoption, the reason why specific independent variables of DOI and TOE affect adoptions is mostly based on anecdotal evidence (Oliveira et al., 2014; Lin and Chen, 2012; Low et al., 2011; Wu et al., 2013). Further, studies that have taken qualitative approach have analysed the cloud adoption determinants either for SMEs or for large firms but not together to the best of our knowledge. Thus, this presents a research issue which needs further investigation. To address this gap our study follows a comparative approach to explain differential adoption of IT with respect to two industry segments. In case of comparative analysis usually two or more cases are compared with respect to a specific phenomenon to explore the parallels and difference between the cases (Buonanno et al., 2005). Thus we intend to study adoption decisions of cloud computing by comparatively analysing the adoption factors between SMEs and large firms. This approach will help in understanding how the same cloud characteristics will have differential effect based on the size of the firm. Figure 1 show the theoretical framework adopted in our study.



## Research methodology

We used a qualitative approach combining deductive and inductive methods in our data collection and analyses. Cloud computing is a nascent phenomenon and the specific characteristics and its implication for business are still evolving (Marston et al., 2011). In order to find the cloud specific factors we followed a multiple case study design. A case study is a preferred method when the focus of the study is a contemporary phenomenon (Yin, 2009). Further a case study will yield potentially relevant variables related to the phenomenon of interest. We have used expert sampling, a type of purposive sampling to select the interviewees.

### Data collection

We selected a total of seven companies consisting of cloud service vendors, consulting companies and a start-up company that uses cloud services in Germany. The rationale for choosing consulting companies was that having maintained and developed services for the clients before and after the cloud era, these companies are best positioned to offer insights about the factors impeding and enhancing cloud adoption

by large firms. Also they play a dual role of being a cloud user. The selected organizations have an experience of more than 10 year in dealing with larger enterprises in providing and maintaining their IT. The details of the key informants are given in Table 1.

<b>Table 1. Key Informants Profile</b>		
<b>Participant code</b>	<b>Position in the organization</b>	<b>Years of Experience</b>
R1	Cloud platform and integration lead	15
R2	Director, Business Planning and Strategy	19
R3	Strategic innovation executive	13
R4	Associate Director, Delivery Partner & Cloud Strategy Lead	16
R5	Lead, business consulting	10
R6	Cloud strategy and platform lead	12
R7	Senior Manager	14
R8	Cloud strategy lead	13
R9	Platform technology architecture lead	11
R10	CEO of the start-up company	12

**Table 1. Key Informants Profile**

In order to draw stronger conclusion from the case-study analysis, Yin (2009) suggested the concepts of literal and theoretical replications. In literal replication the cases were selected in such a way that they corroborate with each other and if the cases are designed to cover different theoretical conditions, it is called theoretical replication. In the latter case, one might expect different results but for predictable reasons. In our study, we chose six cases to identify the determinant patterns for large corporates in particular, because all these companies were specialized in serving large firms, thus serving as instances of literal replication for finding the determinants of large corporates. We used the case of a start-up organization as an instance of theoretical replication logic i.e., we expected results from the start-up firm to be in contrast with the large firms. Table 2 consist of the selected organizations profile describing each organizations' domain, the number of employees, number of countries in which they operate and cloud profile consisting of whether a cloud user or a provider, which segment they serve, replication type and absence or presence of cloud strategy.

Our respondent selection from consulting firms also ensured that the key informants had necessary knowledge about the determinants of cloud adoption by SME's and large firms. Further, the key informants were selected if they had minimum 10 years of experience in IT related decisions or advisory role. We predominantly followed interview method of data collection. For this purpose we developed a semi structured questionnaire to facilitate the interviews. The key areas addressed in the interview included the risks, problems and benefits associated with cloud adoption by enterprises. The interviews were conducted by two researchers from December 2014 to May 2015. Each interview lasted over one hour. All interviews were recorded and transcribed in English. We used RQDA, a computer assisted qualitative data analysis software for coding and analysing the interview data.

### **Data analysis procedure**

According to Yin (2009), pattern matching is the most preferable analytic technique employed in the case study data analysis. The patterns can be related to independent or dependent variables of the study. In a multiple-case study instance pattern matching involves empirically matching patterns across multiple-cases. In our study we searched for independent variables (determinants) of cloud adoption between SME's and big companies across seven organizations (multiple-cases). The internal validity for the

<b>Table 2. Profile of Organizations Selected for Multiple Case Study</b>								
Replication Type	Functionality description	No of employees	No of operating countries	Clients		Cloud Profile		Cloud strategy
				SME's	Large corporates	Cloud User	Cloud service provider	
Literal	Multinational software corporation providing to manage business operations and customer relation	78,230	130+	✓	✓	-	✓	✓
Literal	World's largest consulting, outsourcing and professional service organization	145,000	40	✓	✓	✓	✓	✓
Literal	Multinational consulting, technology services and outsourcing company	319,000	120	-	✓	✓	✓	✓
Literal	A multinational company, second largest software maker by revenue specializing in developing and marketing hardware systems and enterprise software products	115,000	145	✓	✓	-	✓	✓
Literal	Independent international group of companies, providing integrated IT solutions and creative consulting , one of top 25 IT consulting and system-integration companies in German	5500	10+	✓	✓	✓	✓	✓
Literal	Management consulting company based in Germany offering in the areas of market research, design, product development and software solutions for online communities and idea management	200	-	✓	✓	✓	✓	✓
Theoretical	A start-up company based in Germany providing content delivery to target group customers	20	-	-	-	✓	-	✓

**Table 2. Profile of Organizations Selected for Multiple Case Study**

determinants was ensured by cross-case validations, for example, even though the organizations selected for our study are heterogeneous in nature, the procedure of comparing and contrasting similar determinants across the cases ensured the internal validity of our results.

As our goal was to identify the adoption factors related to cloud characteristics from data corpus we followed an inductive approach to code the data. We have followed coding procedure given by Strauss and Corbin (2008) to identify the determinants cloud adoption. The analysis was done in two phases; the first phase of the analysis consisted of open coding followed by line-by-line analysis of the transcribed data. This resulted in 70 different codes, labelled by two researchers independently; after consolidation the codes were reduced to 21 using in-vivo coding technique. In the second phase the codes were further consolidated using axial and selective coding techniques in order to map the factors derived from our data to the theoretical framework initially proposed in the study. Investigator triangulation was used by having two researchers analyse the categories and themes by grouping the results separately, and then comparing the findings jointly.

## **Analyses results**

Table 3 shows the factors that emerged as the determinants of cloud adoption in SME's and large firms. The factors that were negatively related to cloud adoption are indicated by a (-) and those that were positively related are indicated by (+). The relative impact of these factors between the two segments has been captured using the labels High and Low. From the Table 3 we observed that the factors vary in both directions in strength between large firms and SME's. In order to capture these variations in details we have built two 2x2 matrices. Table 4 captures the direction of the factors, while Table 5 captures the strength of the determinants of cloud adoption.

### ***Direction Matrix***

We observe that among the 21 factors, 9 determinants are positively related to both SME and big firms and another 9 determinants that are negatively to both, while 3 are positively related to SME and negatively related to large firms. It is interesting to note that we do not have a category where the determinants are positively related to SME and negatively related to big firms. This is consistent with the notion that SME's benefit more from cloud adoption compared to large firms (Marston et al., 2011). However, the real distinction in variation between SMEs and large firms lies with the third category where the directions are opposite.

### **First category (+ +): Determinants that are positive for both SME's and big firms**

The determinants fall into two categories, one that are enabled due to technological characteristics of cloud such as scalability, on-demand servicing, easier IT operations, reduced setup time, easy to use services, trial and testing, cost reduction and the other due to external factors such as standardization observed across the cloud models (IAAS, SAAS and PAAS) and market pressure influence on cloud adoption. The descriptions of these determinants are given in the Table 3 . From the data we observe that cloud solutions and services are perceived to be beneficial compared to the traditional on-premise solutions.

### **Second category (- -): Determinants that are negative for both SME's and big firms**

In the case of cloud all the services are accessed through the internet. Although internet usage has become ubiquitous there are still outage, access and speed issues. Thus organizations perceive the lack of know-how on bandwidth requirement to operate their firms' IT and the lack of performance measurement model of cloud as barriers for adoption. Further we observe that use proprietary languages for the cloud services makes the users to depend on the vendors thus leading to lack of interoperability which ultimately involves switching cost. Lack of specific business processes (lack of customization), and several legal issues like taxation issues, on-premise IT (existing installations) , data protection issues and security issues are also perceived to be barriers of cloud adoption.

**Table 3. Impact of Adoption Factors between SME's and Large Firms**

Item No.	Code	Description	Large Firms			SME's		
			Direction	High	Low	Direction	High	Low
1.	Trial and Testing services	Option to try new services such as CRM, ERP and also to test standalone application on Cloud platform and infrastructure	+	✓		+	✓	
2.	Scalability	Option to increase or decrease the required cloud resources	+	✓		+	✓	
3.	On demand servicing	Provision of obtaining cloud resources whenever they are required	+	✓		+	✓	
4.	Easier IT operations	Cloud offer back-up services, access control and single sign-on features , reducing hassle of maintenance of complete systems and server configuration	+	✓		+	✓	
5.	Reduce setup time	Setting-up services in cloud takes few days as compared to years in on-premise setup	+	✓		+	✓	
6.	Easy to use services	The interface to select and obtain the services are extremely user friendly and takes few clicks to sign-up and obtain services	+	✓		+	✓	
7.	Standardisation in data exchange, IAAS & development language	Presence of data exchange standards e.g. ODATA, REST, SOAP, Infrastructure standardization e.g. Open stack , development languages de facto standards like JAVA	+	✓		+	✓	
8.	Market Pressure	Influence due to competing organizations adopting cloud and increasing adoption trend across industry sectors	+	✓		+	✓	
9.	Cost reduction	Reduction of transaction costs and initial technology investment	+		✓	+	✓	
10.	Lack of know-how on bandwidth requirement	Insufficient knowledge about the amount of network bandwidth capacity required to run their business in cloud	-		✓	-		✓
11.	Lack of performance measurement model	Anomalies and defects results in a performance degradation of the cloud, there is lack of transparent measures to evaluate cloud performance	-		✓	-		✓

12.	Lack of interoperability	Cloud service providers offering proprietary API interfaces to develop software's, there by the switching between providers become difficult in terms of technological compatibility	-	✓		-		✓
13.	Switching cost	The cost involved in switching between providers increases	-	✓		-		✓
14.	Lack of customization	Lack of industry specific processes	-	✓		-		✓
15.	Taxation issues	Determining where and whether a CSP has a taxable presence is difficult due to the global footprint of cloud offerings	-	✓		-		✓
16.	Existing Installations	On premise IT base such as servers, storage and applications makes it difficult to integrate or migrate to cloud based environment	-	✓		-		✓
17.	Data protection issues	Data protection requires the information of where personal data is located, by whom it is processed and who is responsible for data processing. Cloud computing appears to fundamentally conflict with this evidence	-	✓		-		✓
18.	Security issues	Lack of data safeguards and compliance standards	-	✓		-		✓
19.	Self-service	Provision where users are able to access cloud services without relying on their service provider doing it for them	-		✓	+	✓	
20.	Organization structure	SME's generally had fewer layers of management than larger businesses. Small business organizational charts are often flat	-		✓	+	✓	
21.	Employee behaviour	The way in which employee's respond to specific circumstances or situations in the workplace	-	✓		+		✓

**Table 3. Impact of Adoption Factors between SME's and Large Firms**

Table 4. Adoption Factors Direction Matrix		
<div> <div>SME's</div> <div>Large Firms</div> </div>	+	-
	<div>++</div> <div>(9)</div>	<div>+-</div> <div>(0)</div>
	<div>+-</div> <div>(3)</div>	<div>--</div> <div>(9)</div>

Table 4. Adoption Factors Direction Matrix

**++** : scalability, on-demand servicing, easier IT operations, reduced setup time, easy to use services, Trial and testing, cost reduction standardization and market pressure

**--**: Lack of know-how on bandwidth requirement, lack of performance measurement model, lack of interoperability, switching cost, lack of customization, taxation issues, existing installations, data protection issues and security issues

**+-**: Self-service, organization structure and employee behavior

Table 5. Adoption Factors Strength Matrix		
<div> <div>SME's</div> <div>Large Firms</div> </div>	High (H)	Low (L)
	<div>HH</div> <div>(8)</div>	<div>HL</div> <div>(8)</div>
	<div>LH</div> <div>(3)</div>	<div>LL</div> <div>(2)</div>

Table 5. Adoption Factors Strength Matrix

**HH**: Trial and testing, scalability, on-demand servicing, easier IT operations, reduced setup time, easy to use services , standardization and market pressure

**LL**: Lack of know-how on bandwidth requirement, lack of performance measurement model

**HL**: Lack of interoperability, switching cost, lack of customization, taxation issues, existing installations, data protection issues and security issues

**LH**: self-service, organization structure and cost reduction

### Third category (+ -): Determinants that are positive for SME's and negative for large firms

Self-service, organization structure and employee behaviour are the factors under this category. From the definition of cloud by NIST (Tim Mell, 2009) self-service is one the essential characteristic of cloud. But since larger firms have been accustomed to traditional outsourcing concepts, it has negative influence on adoption by large firms. This is highlighted by one of our key informants,

*"First, we tried that the customers (big firm) can configure their cloud version of our software themselves. It did not work, unfortunately. So we removed this process for our customers. When a customer calls, we ask him for specific information and we enter it for him in the configuration process" R2*

While for the smaller firms self-service option is the convenient mode for accessing cloud services.

*"...like any infrastructure you have to learn how to use it. We use different cloud services and so far, we have selected them on our own and we are very happy" R10*

Also in the case of large firms, there is an inertia and fear observed among the employees that prevents them from acquiring this new type of service model.

*"Sometimes it has to do with the age of the employee team on the customer side, for example if they had an optimized way of doing accounting for the past 10 years, it will be hard for them to move into a cloud system. This is the special complication for bigger companies" R4*

With the organization structure, the smaller companies can immediately adopt cloud since the adoption decision does not span across several hierarchical layers which is the case of larger firms.

*"Unlike the big corporates, we just have only one IT guy, so we go straight ahead and take up services (cloud) "R9*

### Strength matrix

Similar to the direction matrix we observe 8 determinants have high impact on both SME and large firms (HH), 2 factors have low impact on both (LL), while 8 have high impact on big firms and low impact on SME's (HL) and 3 have high impact on SMEs and low impact on large firms (LH). Even though the 2x2 direction matrix classification scheme yielded three factors that differentiate the adoption implication by SMEs and large firms, by analysing the impact matrix we observe that there are few more factors that adds up to the differentiation between the two segments. These are captured by cells HL and LH from this matrix (Table 5. Adoption Factors Strength Matrix). The factors in HH and LL have already been discussed in the above section. Hence we elaborate more of the differences (HL and LH).

#### High-Low (HL)

All of the factors here negatively influence adoption decision and we find that the impacts of these factors are high on larger firms. These include lack of interoperability, switching cost, existing installations issues along with lack of customization issues. From the analyses we found that large firms have existing on-premise IT base which makes the integration and migration to cloud difficult.

*"And bigger companies who have much higher installed base and might be much more difficult to actually move all your current processes into a cloud" (R8)*

Large firms have been keen on securing customized solutions which are often lacking in cloud solutions. Also, the large firms with a global footprint and existing regulations and standards are impacted more by the legal issues (taxation issues, data protection issues and security issues) involved in cloud compared to SME's. All of these have negative impact on the adoption decision and the impact of these factors is relatively higher in large firms.

#### Low-High (LH)

Having explained self-service and organization structure in the previous section, now we focus on cost reduction. Although it is widely reported that cost reduction is the most important driving factor in cloud

adoption, results from our analysis show that even though the initial investment cost is reduced, the larger firms attributed the integration and migration costs add to the total cost which makes it equal to on-premise solution. However, with SMEs this is not a major issue and cost advantage remains the key imperative for them to adopt cloud.

*“...if you take the Y Cloud platform you can cut the cost of development by x%” (R10)*

Combining the results from both the matrices we were able to finally extract 11 specific factors that discriminate large firms and SMEs with respect to their cloud adoption behaviour and are given in Table 6. The quotes given by the respondents throw more light on how and why these factors vary between SMEs and large firms.

<b>Table 6. Cloud Adoption factors discriminating Large firms and SMEs</b>	
<b>Factors</b>	<ol style="list-style-type: none"> <li>1. Existing installations</li> <li>2. Lack of interoperability</li> <li>3. Lack of customization</li> <li>4. Switching cost</li> <li>5. Data protection issues</li> <li>6. Security issues</li> <li>7. Taxation issues</li> <li>8. Cost reduction</li> <li>9. Self-service</li> <li>10. Organization structure</li> <li>11. Employee behaviour</li> </ol>

**Table 6. Cloud Adoption Factors Discriminating Large Firms and SMEs**

## Mapping of empirical findings to theoretical constructs

During the previous phase of this study we found the factors that act as drivers and barriers of cloud adoption. In this phase we further categorize the codes using the axial and selective coding techniques. Essentially we offer a logic map of the factors that are found from our data analysis to the existing determinants of DOI and TOE. Even though a number of variables are found to be suitable for cloud adoption, we have explained only the variables that matched with our interview data. Relative advantage, compatibility, ease of use and trialability are DOI variables used for comparison and technology integration, competitive intensity and regulatory support are variables used from TOE framework. The table 7 below explains the logical map.

<b>Table 7. Logical Map between DOI-TOE Determinants and Coded Case Study Results</b>		
<b>Selective Coding</b>	<b>Axial Coding</b>	<b>Open Coding</b>
Technology	Relative advantage	Scalability, On-demand services, Reduce setup time & Self-service
	Compatibility	Employee's behavior, Lack of customization & Security issues
	Complexity	Lack of know-how on bandwidth requirement, Lack of performance measurement model,

		Lack of interoperability & Switching cost
	Ease of use	Easier IT operations & Easy to use services
	Trialability	Trial and testing services
	Technology integration	Existing Installations
Organization	Firm size	Organizational structure
Environment	Competitive intensity	Market Pressure
	Regulatory support	Taxation issues & Data protection issues

**Table 7. Logical Map between DOI-TOE Determinants and Coded Case Study Results**

## Discussion

Relative advantage explains how cloud is perceived to be beneficial compared to the traditional on-premise solutions and services. From our analysis results it can be observed that except for the self-servicing option, both SMEs and large firms perceive cloud applications (SAAS, PAAS and IASS) to have relative higher advantage over on-premise technology. Technology adoption studies define ease of use as the degree to which using a particular system would be free of physical and mental efforts (Moore and Benbasat, 1991). In the specific context of cloud adoption, ease of use maps to hassle free method of signing up and acquiring services in cloud. Further, trialability which involves the option to try and test services and competitive intensity defined as “the degree that the company is affected by competitors in the market (Zhu et al., 2004) were found to have positive impact on the cloud adoption decision of both SMEs and large firms. We observed differential effects for the other variables (Zhu et al., 2004). Large firms perceive that there is lack of compatibility, technological integration and regulatory support for cloud. In particular, technology integration which here involves integration of existing applications to cloud has been perceived difficult. However, in the case of SME’s compatibility and technology integration have positive impact on cloud adoption. Furthermore, the lack of regulations does not impact SME adoption decision. We also found that the data protection issues are being solved in recent times in German data centers by enforcing strict data protection measures.

Overall this comparative study of SMEs and large firms has found that adoption benefits and disadvantages vary with size of a firm. For large firms existing installations, lack of interoperability, lack of customization, switching cost, data protection issues, security issues, taxation issues, organizational and employee behaviour negatively affect cloud adoption decisions. However, these issues did not impeded small firms adoption decisions. Even the most prominent self-servicing feature of cloud, was materialized to have detrimental effects on cloud adoption by large firms. The reduction in cost had moderate effect on large firm’s adoption decisions, while cost reduction was the main driving factor for SMEs to adopt cloud. It would therefore seem that smaller firms do indeed view cloud computing as an opportunity for improving their performance. Large firms considered cloud to be more complex compared to the SMEs. The study also found SMEs believed that they had achieved greater benefits from cloud services. Only in the area of improved operational efficiency and ability to try and test applications, the larger businesses express greater interest in adopting cloud. There is a general agreement that larger organizations are generally more likely to adopt innovations due to the availability of slack resources (Dwivedi et al., 2012). Contrary to this, our results show that the sheer size of the companies makes it difficult to adopt cloud. The last step of applying selective coding shows that contexts (technological, organizational and environmental) are connected to each other thus confirming our theoretical framework.

## Conclusions

Cloud computing technology characteristics are widely publicized to have potential benefits for adopting firms across all sectors. Our research contributes to the body of knowledge in cloud technology adoption in particular our study identified that 11 specific factors (Lack of interoperability, switching cost, lack of customization, taxation issues, existing installations, data protection issues, security issues, self-service, organization structure and cost reduction) had differential effects on small and large firm's cloud adoption decisions. Further our research also proposed potential explanation for differential adoption. For instance SMEs have different characteristics in terms of resources and IT expertise than large organizations, certain features of cloud such as ability to trial and test the services, scalability of resources, ease of using cloud and IT maintenance job shifted to the service provider have been found to have positive effects on adoption decisions regardless of the size of firms. But we observed that the selection process and the implementation of the cloud solution incur less time and expenses for small organizations compared to large firms. We identified specific variables pertaining to cloud adoption which we further mapped to the theoretical constructs of DOI and TOE.

Our research has generated insights for practise in particular, the practicing managers can focus on the 11 context-dependent differential factors and build cloud portfolios to segment and target the customers to improve adoption rate. The impact of cloud computing technological characteristics on the organizational and regulatory environments exhibits both benefits and risks, which should be evaluated by managers exploring cloud adoption. Cloud providers must focus on improving data protection, interoperability and security standards. These factors can act as a check-list for large adopting firms to prevent unrealistic expectations due to the hype surrounding the business value of cloud technology.

Our study is based on the methodological principles of qualitative approach in management research, primarily enabling theory building and generation of insights for further investigation. The limitation of the study includes small sample size and geographical scope of case sites which is specific to Germany. Future studies could address these limitations by extending sample size, geographical and sectoral boundaries. Cloud adoption characteristics by different industry domains will have more value in theory and practice as two categories of firms have demonstrated differential adoption based on our study.

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