

Perception or capability? – An empirical investigation of the factors influencing the adoption of social media and public cloud in German SMEs

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SOHAIB S. HASSAN

KONTIKAT, Faculty III, University of Siegen, Germany
Kohlbettstr. 15, 57072 Siegen, Germany
SME Graduate School, Faculty III, University of Siegen
Unteres Schloss 3, 57072 Siegen, Germany
sohaib.hassan@uni-siegen.de

CHRISTIAN REUTER

Science and Technology for Peace and Security (PEASEC)
Technical University of Darmstadt, Pankratiusstraße 2
64289 Darmstadt, Germany

LEVAN BZHALAVA

Finland Futures Research Centre, Turku School of Economics
University of Turku, Rehtorinpellonkatu 3
Turku, 20500, Finland
Caucasus School of Business, Caucasus University
Paata Saakadze 1, Tbilisi, 0102, Georgia

Abstract: *Social media and public cloud computing (SM&PC) have emerged as important resources of small and medium enterprises (SMEs), but not all SMEs use SM&PC. The existing research predominantly focuses on the role of either the features of social media and cloud computing in relation to the perceptions of decision makers or the internal capabilities of organization concerning new innovation adoption. By integrating multidisciplinary literature, we, instead, argues that both the perception- and capability-related factors could play an important role in the adoption of new ICT technology, such as SM&PC. Therefore, we empirically investigated the decision maker's perception-related and SME's capability-related factors that may influence the adoption of SM&PC in SMEs in Germany. We used quantitative research methods to examine the proposed hypotheses on a sample of 2,404 SMEs from 17 industrial sectors. The results demonstrate that the decisions of German SMEs to engage in social media and cloud computing are not only influenced by the perceptions of SME owners about the usefulness, security aspects, and the implementation costs of SM&PC, but also by the internal capabilities of an SME, namely the innovativeness of an SME. The results and potential contributions of our research are discussed.*

Keywords: Social media; cloud computing; SMEs; digital transformation; technology adoption.

Introduction

Digital technologies have altered the business practice and organizational culture across the globe. The convergence of modern digital technologies is widely believed to be the next source of innovation and productivity in organizations (Jung, Na, and Yoon 2013). A plethora of emerging digital technologies and concepts, such as social media, big data, internet of things, cloud computing and mobile technology, are widely employed in the organizations to scale the business processes. No other technology, however, is as mainstream as social media network and cloud computing. Both technologies have gained considerable popularity due to their versatility and adaptability (Motta, Sfondrini, and Sacco 2012; Correia et al. 2014).

Although, social media and cloud computing are two different digital technologies with their distinct usage and applications, the existing overlap between the two technologies (e.g., social cloud, scaling advantages), cost benefits, and their preponderance have made these technologies somewhat essential to the organizational settings. The contemporary literature has demonstrated that organizations are increasingly adopting and relying on social media and cloud computing to enhance their existing features, information exchange, and knowledge sharing as well as creating new values for their businesses. A large body of existing literature explores the opportunities and challenges of social media and cloud computing in large organizations (Krasnova et al. 2009; Risius and Beck 2015), whereas similar research on small and medium enterprises (SMEs) has only started growing recently (Ainin et al. 2015; McCann and Barlow 2015; Ross and Blumenstein 2015; Mikkonen, Khan, and Mikkonen, Ilkka; Khan 2016; Brink 2017; Keegan and Rowley 2017; Delerue and Cronje 2015).

Scholars argue that social media and cloud computing, particularly the public cloud computing (hereafter collectively referred to as SM&PC) could be of particular relevance to the unique features of SMEs (Aljabre 2012; Gupta, Seetharaman, and Raj 2013; He et al. 2015). For instance, by adopting social media applications, SMEs can enhance their consumer base through efficient and cost-effective marketing as well as by providing brand awareness and product improvements through prompt customer feedback (Colliander and Dahlén 2011; Michaelidou and Siamagka 2011). Similarly, while large organizations can afford to have their own cloud platforms, public cloud computing platforms become more relevant to SMEs, and enable them to use their internal resources through efficient collaboration, data management and skill identification in a cost effective manner (Richter et al. 2013; Klier et al. 2015). Subsequently, it increases their competitive positioning in the market (Lau 2011). More

recently, scholars have pointed to the relevance of SM&PC applications for the business continuity management in terms of communication, disaster recovery and information security (Carcary et al. 2014; Reuter et al. 2017).

Evidentially, the pace of SM&PC adoption among SMEs is slower than that of the large organization (Saldanha and Krishnan 2012) because SMEs, due to their limited resources and skeptical nature, tend to overlook the advantages of emerging information and communication technologies (ICT) and are less inclined to employ new digital technologies in this regard, such as SM&PC (Damanpour 1992; Harland et al. 2007). The puzzle, however, is if SM&PC are so beneficial to SMEs, why do substantial disparities in the SM&PC adoption among SMEs across countries exist? For instance, a relatively larger number of SMEs in the United States of America (USA) are using social media networks and public cloud computing compared to their counterparts in Europe (Clutch 2018; Statista 2018). An imbalance of SM&PC adoption exists even among the European SMEs (Beier and Wagner 2016). For instance, in Germany, according to the Centre of European Economic Research's 2015 German ICT report (ZEW 2015), only 20% of German organization used any type of publicly-available cloud computing, whereas around 44% used social media platforms (Statista 2018).

At the aggregate level, scholars sometime attribute these disparities to the relative difference in the pace of the knowledge economy development in the USA and EU. For instance, the emergence of the knowledge economy in the USA has been faster, when compared to the EU, mainly due to their burgeoning ICT industry and a higher level of investments in the sector (van Ark, O'Mahony, and Timmer 2008). At the firm level, literature in different fields underscore different factors that explain the slower pace of SM&PC adoption in SMEs, and there exists an obvious lack of scholarly consensus. On one hand, the literature in the information systems overwhelmingly focuses on the features (e.g., usefulness, interface, cost, security risks etc.) of a new technology and the behavioral aspects of the decision makers to elicit its adoption in an organization (Davis 1986). The literature in the strategic management, on the other hand, underscores the critical importance of firm-specific capabilities and their relationship to the new technology adoption in SMEs e.g., (Rogers 2003).

Against this background, converging on different strands of literature, we argue that the ICT adoption is a strategic decision within an organization, and such decisions are contingent upon a combination of factors that emerge from the existing entrepreneurial and capability-related aspects of an SME, and their potential compatibility with the new ICT technologies, in this case, SM&PC. Along these lines, we empirically examine our key research question: to what

extent behavioral and capability-related aspects of strategic decision making in SMEs influence the SM&PC adoption.

In order to address our research questions, unlike the previous research, we use quantitative methods to empirically explore the factors that affect the SM&PC adoption among a large sample of German SMEs. The remainder of this study proceeds as follows: In the next section, we present a literature review and develop our hypotheses. In section 3, we discuss our data and explain our methodology to test our hypotheses. In the ensuing section, we present and discuss our results. Finally, in section 5, we conclude.

Literature Review and Hypothesis Development

Social Media and Cloud Computing

Social media network is defined as a set of internet-based digital applications that are built upon web 2.0 and allow the interactive communication, creation and exchange of user generated content among users, and customers (in case of organizations) across a multitude of devices (Murugesan 2007; Kaplan and Haenlein 2010). User generated content ranges from text posts to pictures and videos. Although several social media applications (e.g., Facebook, YouTube, Twitter, and Xing) have gained popularity among the users, Facebook is, by far the largest social media network. The active user base of Facebook was approximately 2.27 billion in 2018 (Statista 2018).

Cloud computing is the delivery of on-demand services through the internet (IBM 2015). These services include, but not limited to, the hosting, backup and collaboration among the users with an access to the cloud network. The storage in cloud-based system, instead of on local computers, is on a remote server. This feature alone enables cloud computing a sought after and cheap alternatives to more costly backup solutions. Cloud computing is offered both through a public medium and a private medium. The current market of cloud computing stands at 130 billion U.S. dollars worldwide (Gartner 2017). The public cloud computing services (e.g., Google drive, Dropbox) are more widespread due to their cost benefits (Columbus 2017). Public cloud services are either offered free of cost to the users or with a premium much lower than private or local cloud storage options. In addition to data storage, cloud platforms, particularly the public cloud platforms, offer a range of scalability services to the SMEs (Gupta, Seetharaman, and Raj 2013; Assante et al. 2016), including but not limited to, data backup, internal collaboration and business continuity management.

Social Media and Public Cloud Computing Adoption in SMEs

Role of Decision Maker's Perceptions

Previous empirical evidence suggests that SMEs adopt new ICT technologies merely due to either the peer pressure or customer demand rather than realizing the real competitive advantage of the strategic implementation of ICT technology in their organizations (Egan, Clancy, and O'Toole 2003). SMEs, compared to the large organizations, are considered strategically flexible (Damanpour 1992; Utterback 1994; Stock, Greis, and Fischer 2002). However, SMEs, due to their limited capabilities and resources, pursue a cautious approach toward adopting and implementing new technologies and processes, especially the ICTs.

The literature in organizational behavior and psychology suggests that the individual decisions in organizations are conscious and determined by the perceptions and beliefs of decision makers (Ajzen 2002). Since the SMEs are largely owner-manager oriented and the strategic decision-making is mostly in the hands of a few individuals, the role of entrepreneurs in the strategic decision making becomes more profound (Thong and Yap 1995). Similarly, the entrepreneurship literature underscores that the psychology of entrepreneurs in SMEs plays a key role in the strategic decision-making process, particularly in relation to the openness to new ideas and innovation adoption (Zhao and Seibert 2006).

In addition to the entrepreneurial aspects, the innovation and innovation diffusion literature indicate that organizational decisions can also be drawn from the characteristics of an innovation and perceptions about it (Moore and Benbasat 1991; Rogers 2003). That is to say, the decision makers are inclined to adopt innovations that are perceived by them as useful and compatible with their organizational settings (Tornatzky, Fleischer, and Chakrabarti 1990; Damanpour and Schneider 2009; Hameed and Counsell 2014). In line with the definition of innovation in the extant literature e.g., (Damanpour 1992; Rogers 2003), online social networks (e.g., Facebook) and public cloud computing services (e.g., Google Drive) are essentially new innovations and offer tremendous opportunities and challenges to the businesses.

The literature, further, demonstrates that the compatibility of innovation depends on the potential benefits it offers to the organization, such as relative advantage in performance boost and when the level of complexity (e.g., implementation, maintenance) aligns with their existing skillset (Tornatzky and Klein 1982; Rogers 2003). Similarly, in the context of new technology or innovation adoption in an organization, the literature in information systems accentuates the importance of the perception of the adopter (decision maker). For instance, the Technology

Acceptance Model (TAM) by Davis (Davis 1989) is considered as an influential model to elicit the behavioral aspects of new ICT adoption and acceptance in organizations (Venkatesh and Davis 2000; Rauniar et al. 2014). TAM underscores the critical importance of the perception of decision makers in relation to the adoption of a new information technology in an organization (Davis 1989). Specifically, the key contributors constitute the extent to which a decision maker perceives a new technology as advantageous to the business, and suitable to their extant skill-set, as well as being useful and easy to implement (Venkatesh and Davis 2000; Rogers 2003; Lybaert 1998; Sawang and Unsworth 2011). The perceived advantages can be in terms of performance gains and convenience concerning the adaptability with the existing technological settings in their organizations (Davis 1989; Venkatesh and Davis 2000).

Taken together, a new technology or innovation adoption in an organization is, indeed, a strategic decision and the perception about a new ICT technology would influence its adoption decision in SMEs. A decision maker in an SME would only implement a new ICT technology (a new innovation) when it is perceived to be relatively more advantageous than existing technologies in their organization, thus:

***H1:** The perception of SME decision maker about social media network and cloud computing influences the SM&PC adoption decisions in an SME*

Determinants of Perception in SMEs

A review of the existing literature in the domain of SMEs and new technology/innovation adoption research enable us to identify two main determinants of perception about new ICT innovation in SMEs: 1) security & privacy concerns, and 2) perception about the associated costs.

Security & Privacy Concerns: SMEs generally internalize on their specialized skills and lack necessary, and diversified, capabilities related to the implementation of technologies beyond the scope of their operations. This subsequently leads the decision makers in SMEs to be averse against impending uncertainties associated with the adoption of new technologies or to simply overlook the potential of new technologies, such as ICT, for their businesses (Dixon, Thompson, and Mcallister 2002; Hashim 2007). New innovations, such as social media applications and cloud computing, may present a number of undesirable aspects which can be detrimental to their adoption in an organization, such as lack of control, higher degree of uncertainty, and critical information leakage over the internet (Meyer and Goes 1988; Ahmad, Bosua, and Scheepers 2014; Laursen and Salter 2014). Although the security parameters of

social media applications have been greatly enhanced overtime, the existing empirical evidence demonstrate that SME owners are still found to be concerned about the data security risks associated with the SM&PC adoption in their organizations (Taylor and Murphy 2004; Ahmad, Bosua, and Scheepers 2014; Khan, Swar, and Lee 2014; Beier and Wagner 2016). Along these lines, we posit that:

***H1a:** Concerns about privacy and security influence the SM&PC adoption decisions in an SME*

Perception about the Associated Costs: Although social media tools and cloud computing are arguably more advantageous for SMEs due to their cost-effectiveness (Aljabre 2012; He et al. 2015), SMEs, owing to their limited resources, are still generally wary of unnecessary financial burden in the shape of impending costs and hidden expenses, especially in the absence or shortage of relevant labor (Aldrich and Auster 1986; Drew 2003; Nieto and Fernández 2005; Ghobakhloo, Zulkifli, and Aziz 2010). Further, since SMEs usually do not have the knowledge and human capital beyond their fields of expertise, the decision maker perceive additional cost allocation to hire skilled or relevant labor an unnecessary financial burden, and this often leads to an inability to identify the true potential of emerging technologies or unwillingness to adopt new ICT technologies (Levenburg, Schwarz, and Motwani 2015). In such circumstances, owners believe that the investment might not be cost effective and might not bring any value added to their existing business model (Taylor and Murphy 2004). Against this background, we posit that

***H1b:** Perception about implementation costs influences the SM&PC adoption decisions in an SME*

Role of Organizational Capabilities

The behavioral aspects of decision maker's perceptions about an emerging technology are not considered the only factors that might determine the actual adoption of new technologies in an organization, particularly when it comes to the adoption of ICT applications (Rauniar et al. 2014). Scholars in the strategic management literature have underscored the role of endogenous organizational attributes of firms in facilitating their technological trajectories and capabilities (Pavitt 1984). Scholars have argued that firms internal capabilities, such as innovativeness, skilled labor and productivity, are essential to firms to gain and maintain their competitive positions in the markets, locally and beyond (Porter 1980). Similarly, the resource-based view of a firm suggests that firms employ their distinct strategic resources to gain a competitive

advantage in the market through constant learning and experience over time (Wernerfelt 1984; Caldeira and Ward 2003).

The future strategic decisions of firms are also determined by their previously acquired strategic resources and capacities (Cohen and Levinthal 1990; Penrose 1995). Such resources and capacities of a firm are accumulated overtime through previous related experience, human capital and knowledge, and leads it to develop abilities, such as innovation capabilities, to recognize knowledge value, appropriation, and assimilation (Cohen and Levinthal 1990; Zahra and George 2002; Lawson and Samson 2001; Unsworth et al. 2012). Such abilities thus enable firms to identify the potential of an emerging technology and to predict its relative success in their organization (Cohen and Levinthal 1990).

Further, the innovation diffusion literature suggests that the entrepreneurial orientation drawn from their previous successful experience might establish a tendency among entrepreneurs to adopt new technologies (Rogers 2003). The entrepreneurship literature also asserts that, due to the closely knitted communication and controlling mechanisms in SMEs, an entrepreneur's innovation orientation is decisive in implementing new ideas and adopting new innovations, thus shaping the capabilities of their organizations over time (Zhao and Seibert 2006). Similarly, the literature in evolutionary economics also underscores that the implementation of new technologies in a firm is history-dependent, that is, firms with a positive prior experience with new technologies, their successful assimilation among the labor force, and the motivation of the workforce to learn new technologies, are more open to the acceptance of new innovations (Nelson and Winter 1982). Moreover, increased collaboration in this regards with other SMEs, coupled with accumulated experience, leads to an increased knowledge sharing across organization (Ferreira and du Plessis 2009) and hence openness to new technologies and innovations (Flaig and Stadler 1994).

In the strategic management literature, scholars have argued that the existing organizational culture and the organizational capabilities facilitate the strategic application of new technology in an organization. It is because the strategic implementation of emerging technologies in organizational settings in the past might have led to an increase in firm productivity (Black and Lynch 2001). Further, firm managers remember from their previous experience with the skilled labor in hand and the successful usage of ICT in the past (Nelson and Winter 1982; Hempell, van der Wiel, and van Leeuwen 2004). Furthermore, based on internal capabilities, it is widely acknowledged that more innovative firms are relatively more open to adopting new technologies compared to less innovative organizations (Flaig and Stadler 1994). In terms of

new ICT adoption, such internal resources and experience might provide them with the capacities of increased collaboration and a low-cost maintenance compared to costlier content management systems. Consequently, through strategic implementation of their resources based on their internal capabilities (Nelson and Winter 1982), more capable firms are able to tap the market through an efficient mix of innovation, related labor and production inputs to meet their customers' demands and expand business operations (Wilson 2009; Tornatzky, Fleischer, and Chakrabarti 1990; Damanpour and Schneider 2009).

Therefore, against the presented background, we argue that the strategic implementation of new ICT technologies is associated with the internal capabilities (innovativeness, skilled labor and firm productivity) of the organizations, that is to say, the existing organizational culture and the organizational capabilities, in addition to the behavioral aspects of technology adoption, facilitate the strategic application of new technology in an organization. Therefore, we posit that:

H2: Internal capabilities of an SME influence its decision to adopt SM&PC

Data and Methodology

Data

The dataset used in this study comes from the Centre of European Economic Research (ZEW)'s 2015 ICT survey. The survey was part of the project — ZEW ICT Survey: Diffusion and Use of Information and Communication Technologies. The survey aimed to get a representative overview of the usage and the diffusion of ICT among German firms.

The ICT survey consists of four waves (2003, 2005, 2007, 2010, and 2015). The population of the ICT survey encompasses all firms based in Germany with a minimum of 5 employees. The final sample of the survey of about 4,134 firm (out of the total population of 359,367 German firms at the start of the survey) is then drawn using a stratified sampling design, with stratifications in terms of size and 17 industrial sectors (ZEW 2015; Bertschek, Ohnemus, and Viete 2018). We, however, use only the data from the latest wave (2015), as the questions pertaining to our research were available only in this survey.

Our dataset contains information about firm characteristics, location, innovation, and ICT-related behaviors. Since we based our analysis only on SMEs, we removed all firms with more

than 250 employees (large organizations) from our sample. We have used the European Commission's definition of an SME to structure our data (European Commission 2003).

Our final sample consists of 2,404 German SMEs. Most of the sample firms are from the service sector (58%), whereas around 42% of the sample consists of manufacturing SMEs. A further breakdown of the sample according to the industrial sectors is presented in Table 1. An industrial distribution of our sample shows that the highest proportion of the sample consists of the manufacturer of consumer goods (14.23%) and medical engineering industry (11.19%), whereas the lowest proportion of the sample consists of automobile industry (2.7%).

Table 1. Industrial Distribution: Sector

Industry	Frequency	Percentage
Consumer goods	342	14.23
Chemistry and Pharmaceutics	85	3.54
Raw materials	198	8.24
Metal industry	157	6.53
Electronics industry	145	6.03
Engineering	123	5.12
Automobile industry	65	2.7
Medical engineering	269	11.19
Retail trade	128	5.32
Wholesale trade	109	4.53
Transportation service	123	5.12
Media service	89	3.7
Telecommunication services	112	4.66
Financial service	94	3.91
Management consulting	136	5.66
Technological services	100	4.16
Corporate services	129	5.37
Total	2,404	100

Table 2 presents the geographical distribution of the sample. A significantly large number of the sample SMEs are in the largest federal states of Germany, i.e., North Rhine-Westphalia (17.76%), Bavaria (16.47%) and Baden-Württemberg (12.27%). Our sample also demonstrates

a clear disparity between the former East Germany and former West Germany, as most of the SMEs (72%) are from the former West Germany.

Table 2. Geographical Distribution: German Federal States

Federal states	Frequency	Percentage
Schleswig-Holstein	52	2.16
Hamburg	39	1.62
Lower Saxony	199	8.28
Bremen	19	0.79
North Rhine-Westphalia	427	17.76
Hessen	172	7.15
Rhineland-Palatinate	97	4.03
Baden-Württemberg	295	12.27
Bavaria	396	16.47
Saarland	25	1.04
Berlin	88	3.66
Brandenburg	88	3.66
Mecklenburg-Western Pomerania	48	2.00
Saxony	219	9.11
Saxony-Anhalt	97	4.03
Thuringia	143	5.95
Total	2,404	100

Variables

Our dependent variables are binary variables of decision to use public cloud computing and social media network, and they measure whether an SME has implemented cloud computing and social media network in the year preceding the survey, or not. Table 3 presents the list of all the variables that we have used in this study.

Perception-specific Variables: We use three explanatory variables to test our first set of hypotheses pertaining to the behavioral aspects of decision maker’s perception. Namely, we use perceived usefulness, security & privacy concerns and implementation costs. Our variables are measured through the binary responses of SMEs about the possible influence of said aspects on the implementation of social media and cloud computing in their organizations. Our variables are binary variables (1,0) where, where “1” indicates the presence of attribute and “0”

indicates usually the absence of attribute. That is to say, with a variable taking value of “1” for each observation, it exerts an influence on the SM&PC adoption decision.

Table 3. Variables

Variable	Description	Measurement
Dependent Variables		
Cloud Computing	Use of public cloud computing for collaboration (e.g., OneDrive, Google Drive)	Binary [0 (no) - 1 (yes)]
Social Media Network	Use of social media network (public profile on a social media website such as Facebook)	Binary [0 (no) - 1 (yes)]
Independent Variables		
Perceived Usefulness	Management concerns and perception about the usefulness or need in the organization	Binary [0 (no) - 1 (yes)]
Security & Privacy Concerns	Content control and privacy aspects of social media and public cloud networks	Binary [0 (no) - 1 (yes)]
Implementation Cost	Potential and unforeseen costs	Binary [0 (no) - 1 (yes)]
Innovativeness	Product or process innovations in the previous years	Categorical Variable (0: no innovation, 1: product or process innovation, 2: both product and process innovation)
Skilled Labor (ICT)	Share of ICT specialists in an SME	Log (number of full-time employees with ICT-related qualification)
Productivity	Labor productivity	Log (sales/employee)
Control Variables		
Size	Size in terms of number of employees	Categorical Variable (1. Micro, 2. Small, 3. Medium)
Sector (d)	Main industrial sector of an SME	Dummy, (1. Service, 0. Manufacturing)
Exporter (d)	Sales market of an SME	Dummy (1. Exporter, 0. Non-exporter)
End customer (d)	Target customers of an SME	Dummy (1. Consumer, 0. Business)

Capability-specific Variables: We test our second hypothesis pertaining to the capabilities of SMEs by using three variables. Our variable “innovativeness” is a categorical variables and measures how innovative an SME is, and it corresponds to the question in the survey whether an SME has innovated (product innovation, process innovation or both) in years prior to the survey. Our variable, “skilled labor” measures the number of ICT specialists in an SME as an indicator of an SME’s ICT skill-base. Our variable “productivity” measures the labor productivity of an SME (as sales per employ) in the previous year.

Control variables: We also control for the factors that could otherwise affect our results. We control for the size (small, medium or micro), industrial sector (Manufacturing or service industry), sales market (exporter and non-exporter) and the end-customer base (B2b or B2C) of the SMEs in our sample.

Research Methodology

We consider a simplified decision-making process for an SME. We assume that an SME’s decision to adopt social media and public cloud computing is contingent upon perception-based and capability-based factors. Since our dependent variables are binary in nature, a discrete choice model is the most suitable one. In our dataset, the implementation of social media network and that of cloud computing are potentially interdependent. Given this scenario, if we estimate two separate equations for our dependent variables, a pairwise correlation can possibly emerge from the error terms of two independent equations. This, in return, can make our estimates biased and inconsistent. We address this issue by using the bivariate probit estimation technique. In contrast to other logistic model, bivariate probit techniques enables us to model our two binary dependent variables as functions of the same set of explanatory variables. Further, keeping in view our sample size, this way, we expect to get more reasonable estimates with a reduced level of endogeneity (Chiburis, Das, and Lokshin 2012). Finally, by using bivariate probit,¹ we can estimate a simultaneous system of two equations and allow the error terms to correlate across equations freely and obtain unbiased estimates (Freedman and Sekhon 2010).

Results

Descriptive Statistics

Table 4 presents the descriptive statistics of the sample. The Variance Inflation Factor (VIF) values of all the explanatory variables and the mean VIF (1.21) are far below the acceptable threshold of 10 (Neter, Wasserman, and Kutner 1985), indicating that the multicollinearity is not a serious concern in the estimations.

Table 4. Descriptive Statistics

Variable	VIF	Mean	Std. Dev.	Min.	Max.
Perceived Usefulness	1.39	0.616889	0.486246	0	1
Security & Privacy Concerns	1.22	0.583611	0.493062	0	1
Implementation Cost	1.36	0.537438	0.4987	0	1
Innovativeness	1.14	0.759151	0.427688	0	2
Skilled Labor (ICT)	1.09	2.14	8.337114	0	150
Productivity	1.09	-2.203	0.792316	-5.07517	1.791759
Size	1.11	2.105241	0.730517	1	3
Sector	1.2	0.424293	0.494338	0	1
Exporter	1.39	0.453827	0.497967	0	1
End Customer	1.08	0.197171	0.397946	0	1
Mean VIF	1.21				

Estimation Results

Table 5 reports the results of our bivariate probit estimation models for public cloud computing (Model 1) and social media network (Model 2). The models predict the likelihood of cloud computing and social media network adoption among the decision makers of the sample.

In terms of the perceptions of the decision maker, the results reveal that ‘perceived usefulness’ positively and significantly influences both the decisions to use public cloud computing and social media network among the sample SMEs (β 0.249, $p < 0.01$ and β 0.679, $p < 0.001$, respectively), i.e., higher the perceived usefulness, more likely a decision maker to adopt public cloud computing and social media network.

Table 5. Bivariate Probit Regression Results

	Public Cloud Computing (1)	Social Media Network (2)
Role of Perception		
Perceived Usefulness	0.249*** (3.64)	0.679*** (10.28)
Security & Privacy Concerns	-0.144* (-2.25)	-0.255*** (-4.02)
Implementation Cost Concerns	-0.305*** (-4.55)	-0.611*** (-9.31)
Role of Capabilities		
Innovativeness	0.594*** (7.03)	0.483*** (5.81)
Skilled Labor (IT)	0.00457 (0.16)	0.0503 (1.63)
Firm Productivity	0.0324 (0.84)	-0.0585 (-1.52)
Controls		
Size	-0.267** (-3.14)	0.141 (1.66)
Sector (d)	0.284*** (4.33)	0.321*** (4.94)
Exporter (d)	0.301*** (4.38)	0.0733 (1.06)
End Customer (d)	-0.0860 (-1.08)	-0.0228 (-0.29)
N	2404	
Log likelihood	-2390.6905	
rho	0.2429664***	

t- statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The coefficients of ‘privacy & security concerns’ are negative and significant for public cloud computing (β -0.144, $p < 0.05$) and social media network (β -0.255, $p < 0.001$). The results reveal that the prospects of ‘implementation cost’ has a significant and negative influence on the likelihood of public cloud computing adoption (β -0.305, $p < 0.001$) and social media networks adoption (β -0.611, $p < 0.001$) in the sample.

In terms of the firm’s capabilities, ‘innovativeness’ shows a significant positive effect on the likelihood of public cloud computing adoption (β 0.594, $p < 0.001$) and social media network adoption (β 0.483, $p < 0.001$). These results show that more innovative SMEs are more likely to adopt SM&PC. Moreover, the coefficients of ‘skilled labor’ and ‘productivity’ are not significant for the decisions pertaining to SM&PC adoption in the sample.

The coefficients of the control variables in the analysis demonstrate that ‘firm size’ has a significant negative influence on the likelihood of public cloud computing usage and no influence on the adoption of social media network. These results suggest that larger an SME gets, less likely it is to adopt cloud computing, as larger organizations resort to in-house private cloud setups. ‘Sector’ dummy displays positive and significant effects on our dependent variables, which shows that, in regard to SM&PC adoption, there exist a significant variation between the SMEs from the manufacturing sectors and service sector. The propensity to engage in SM&PC is higher in the service sector SMEs relative to the base-group: SMEs in the manufacturing sector. Moreover, the coefficient of ‘exporter’ is positive and significant for the adoption of cloud computing among our sample, implying that exporter SMEs are more prone to adopt public cloud computing, whereas the coefficients of ‘end customer’ dummy are insignificant.

Discussion

Main Findings

The results of this study exhibit that, instead of considering only the features of an innovation (perception aspects) or the capabilities of organizations (internal capabilities), both the perception of the decision makers in SMEs (Davis 1989; Rogers 2003) and the capabilities of the SMEs (Nelson and Winter 1982; Cohen and Levinthal 1990; Caldeira and Ward 2003; Wilson 2009) are significant in delineating the decisions to adopt social media network and cloud computing applications in the organizational settings. These results also empirically support the theoretical developments presented in the literature review section of this study.

However, behavioral aspects in terms of perception of new ICT are still more important than the capability-related aspects of SMEs. Specifically, our study indicates that the perceived usefulness about SM&PC as new technologies (H1), perceptions about the potential risks associated with the SM&PC adoption (H1a) and the perceptions about the impending costs to implement SM&PC (H1b), all have a profound impact on the adoption of social media among German SMEs. This aspect is in line with the existing theory. The literature has underscored that due to the limited resources of SMEs, decision makers in SMEs are wary of unforeseen outcomes with regard to the implementation of new innovations in their respective organizations (Damanpour 1992; Thong and Yap 1995; Harland et al. 2007). If the decision makers in SMEs perceive that SM&PC applications are not going to bring any added benefit to their organization, or they do not find SM&PC useful or needed for their organizations, they are less likely to implement these in their organizations (Davis 1989; Rauniar et al. 2014). Further, existing literature underscores that SMEs are generally risk-averse, particularly with regard to ICT adoption (Taylor and Murphy 2004; Ahmad, Bosua, and Scheepers 2014; Beier and Wagner 2016). We also find this aspect in our results, where potential costs and security threats discourage SMEs to adopt SM&PC.

In addition, among the capability factors, our results demonstrate that only SMEs' innovativeness appears to prominently influence the extent of SM&PC engagement, and lend some support to our second hypothesis (H2). literature has demonstrated that innovative organizations are more open to new ideas and implementation of new technologies (Rogers 2003; Zhao and Seibert 2006). Our results indicate that the decision makers in more innovative SMEs are more likely to adopt SM&PC. Other scholars have also reported the similar findings. e.g., (Wamba and Carter 2014).

Two of our capability-related variables did not show any influence on SM&PC adoption decisions. We expected that SMEs with higher labor productivities and larger ICT skill base should be more likely to adopt SM&PC. Our results show that this is not the case, and the innovativeness of an SMEs is the most important capability factor that influence its SM&PC adoption decision.

Our study also provides some additional inputs. The literature has demonstrated that the firm size could influence the motivations of organizations to implement new ICT (Lee and Xia 2006; Zhu et al. 2006; Wamba and Carter 2014). This seems to be a case when it comes to the adoption of cloud computing in SMEs. Our results indicate that a larger SME is less likely to adopt cloud computing. This is apparently because the larger a firm gets, the more resourceful it becomes,

and it is more probable to rely on private cloud computing solutions than the publicly available ones. Further, our results indicate that SMEs in the service sector are relatively more likely to adopt SM&PC compared to the ones in the manufacturing sector. This result confirms the ongoing trend that service sectors SMEs are more engaged on social media and public cloud computing services.

Conclusions

Social media and cloud computing have transformed into ubiquitous elements of societies across the globe. Individuals and organizations alike have increasingly engaged in SM&PC applications due to the array of their benefits. However, despite the potential advantages of social media and public cloud computing for SMEs, their adoption among SMEs is gradual, and little quantitative empirical research has been done as to which factors influence the adoption of SM&PC in SMEs. Our study's aim was to fill this gap by empirically identifying the factors that affect the decisions pertaining to the SM&PC adoption in SMEs. Our study has addressed the research question from a consolidated perspective. Previous research has explored the process of new technology adoption from different dimensions. For instance, literature in organizational behavior, informatics, and entrepreneurship focus on the characteristics and psychology of individuals (e.g., owners, managers), whereas literature in strategic management and innovation studies underscore the importance of firm capabilities and resources (e.g., innovation, related labor) for the strategic decision-making process (e.g., SM&CP adoption). On the contrary, the premise of our research is that both the individual perceptions and the organizational capabilities can potentially influence the social media adoption among SMEs. One benefit of such research settings is to explore the relative influences of perception-based and capability-based attributes in the adoption of new ICT technologies in SMEs. Our results have revealed that although both the factors influence the decisions of technology adoption in SMEs, the perception-based factors play a more important role.

The perceptions about new innovation or technologies in SMEs are believed to be driven from the entrepreneurial orientation, experience and skills of the owner-managers (Powell and Dent-Micallef 1997; Zenebe, Alsaaty, and Anyiwo 2018), which subsequently influence the organizational structures and performance of SMEs (Penrose 1995; Mahoney 1995; Bassellier, Benbasat, and Reich 2003; O. Jones et al. 2007). Further, perceptions of decision makers are evolved over time as a result of their social (e.g., social networking, working environment,

professional interactions) and structural (e.g., previous education, training) experiences (Carson and Gilmore 2000; Keh, Der Foo, and Lim 2002; O. Jones et al. 2007). In the case of ICT technologies, the roles of owner-manager's perceptions (Carson and Gilmore 2000; Grant et al. 2014; Nguyen 2009) and digital orientation are believed to be very important in identifying and implementing the opportunities offered by the new technologies (Grant et al. 2014; Quinton et al. 2018; Khin and Ho 2019; Annosi et al. 2019; Moeuf et al. 2019).

Since the decision making in SMEs is limited to one or few individuals (Thong and Yap 1995), and it relies mostly on the individual and behavioral attributes of the decision makers (Rogers 2003; Carson and Gilmore 2000; Damanpour and Schneider 2006; Fuller-Love 2006), the perception about emerging technologies might play even a stronger role. The research in innovation diffusion and information technology has also shown that in the presence of entrepreneurial skills and digital orientation, decision makers in SMEs are better-off in assessing and identifying the value and relevance of new innovation for their organization (Rogers 2003; Premkumar, Ramamurthy, and Nilakanta 1994; Khin and Ho 2019). In such scenarios, informed decision makers in SMEs also facilitate technology adoption in their respective organizations, provide active support to their employee and adjust the skill level of their workforce to emerging ICT technologies as well as empowering their workforce in the decision-making process (Teo and Pian 2003; Soliman and Janz 2004; Ramsey, Ibbotson, and McCole 2008; Crowley and Bourke 2017; Moeuf et al. 2019; Keh, Der Foo, and Lim 2002). As a lack of such entrepreneurial effort and digital orientation might yield negative perception in decision-makers about the emerging digital technologies which explains the higher influence of perception-related aspects in our empirical analysis. Similarly, such behavior might also lead to a certain undermining of the employees' entrepreneurial abilities, where employees are discouraged against using new ICT technologies at their jobs, and are not allowed a full freedom in terms of their entrepreneurial abilities in identifying and implementing emerging changes (Damanpour and Schneider 2006; Jones, Jimmieson, and Griffiths 2005).

Future Research

There are a few limitations of our study. First, due to the nature and security parameters of the data, we could not identify the type of public cloud computing service or social media network used by the sample firms. Further, we have used the ICT survey 2015 of ZEW as our data source. The data collection year is relatively older in relation to the rapidly changing technological environment. However, the social media and cloud computing had well evolved

by the time of the ICT 2015 survey, and evolving ever since. Further, in our study, we intended to examine the underlying research question from a quantitative point of view, with a larger set of observations and at an aggregate level to identify the pattern of SM&PC adoption in German SMEs. Therefore, while latest data could have been more meaningful, with the collection year of our data source, we are still able to draw some valuable insights. Another data limitation is with regard to the types of variables. Most of the variables we have used in this study are binary in nature. Although, with categorical variables, one can expect to obtain detailed responses, the usage of binary variables does not limit the scope of our study, especially in regard to adaption decisions. Future research should employ modern and detailed datasets to examine the relevance of the research issue over time. Furthermore, we have only looked into the firm-specific internal factors that may impede or facilitate the SM&PC adoption in SMEs. An important avenue for the future research is to also focus on the external factors (e.g., market factors, government support). Finally, we have structured our data using survey responses to quantitatively examine the SM&PC adoption in SMEs. We have only carried out a one year-cross sectional analysis due to the data limitations. Survey responses are always prone to endogeneity issues. Although we have addressed this issue to some extent by employing relevant empirical techniques, future research should benefit from a time-series analysis and a use of more detailed variables. This would enable us to identify the gradual impact of factors that facilitate the adoption of SM&PC in SMEs.

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