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Organizational Factors Affecting Propensity to Adopt Cloud Computing

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Abstract

Cloud computing (CC) is emerging as a new paradigm of ICT resources acquisition and management by firms. This paper empirically investigates and compares the effects of a set of organizational factors on the propensity to adopt CC, based on data from 676 European firms from the glass, ceramics and cement industries, collected through the e-Business Watch Survey of the European Commission. Our results do not confirm the initial expectations that CC would be adopted primarily by the SMEs, as they indicate that the size has a positive effect on the propensity to adopt CC. Furthermore, we have found that the latter is associated with ICT investment reduction strategy (quite usual today due to the existing economic crisis), and only to a lower extent with innovation oriented strategy. Our results also indicate that previous experience of ICT outsourcing and employment of ICT specialized personnel have positive effects on the propensity to adopt CC. Finally, we have found that firms with higher ICT infrastructure sophistication have higher CC adoption propensity.

1. Introduction

Cloud computing (CC) is emerging as a new paradigm of information and communication technologies (ICT) resources acquisition and management by firms [13, 19, 24]. It has been defined by the US National Institute for Standards and Technology (NIST) as ‘..a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of computing resources (e.g., networks, servers, storage, applications, services) that can be rapidly provisioned and released with minimal management effort or service provider interaction’ [14]. In [13] is provided a more detailed and synthetic definition of CC, as a novel information technology service model, where the computing services (both hardware and software) required by a firm are delivered by an external provider on an on-demand basis over the Internet, independent of device and

location; users pay for the service as an operating expense, based on the real use of it, without having to make significant initial capital expenditures (e.g. for servers and software), and also without having to incur operation, support and maintenance costs. The cloud services currently offered can be grouped into three categories: infrastructure as a service (IaaS) (= use of provider’s remote storage and computing facilities), platform as a service (PaaS) (= remote use of provider’s platform, including operating system support and software development environment, for the development and deployment of applications) and software as a service (SaaS) (= remote use of software applications running on provider’s systems and supported/maintained by them) [13, 24]. The CC aims to deliver ICT resources to firms in the form of a utility, similar to water, electricity, gas and telephony [17].

There is a growing recognition that CC can provide significant benefits to firms: lower cost of ICT (in comparison with ‘in-house’ ICT services provision, mainly due to economies of scale achieved by providers), decrease of required ICT capital investments, access to specialized ICT resources, rapid deployment, scalability (dynamic adjustment of the service in order to meet changing needs) and wide accessibility (from anywhere and any kind of platform) [4, 13, 17, 24]; these benefits are expected to be higher for the firms not having highly developed and sophisticated ICT infrastructures, and also for the small and medium enterprises (SME). According to [19], the CC is expected to offer three main benefits: efficiency (ICT and operational cost reduction), support of creativity and innovation, and simplicity (ICT services that are simple to understand and use). However, at the same time there is a growing recognition that CC poses some risks as well, which act as barriers to its adoption: service availability and in general performance risks, and also data security risks (the latter concerning unauthorized access to or modification of firm’s data resources) [4, 17]. These risks have resulted in lower adoption of CC by firms below the initial expectations [12, 10].

It is therefore necessary to investigate and

understand better the adoption of CC, the factors affecting it and the interrelations among them. For this reason, there has been recently research interest in this direction (a review of this research is presented in the following section 2). However, most of this research focuses on the impact of the perceived technological characteristics of CC on the adoption decision; there has been much less research on the impact of organizational factors (i.e. firm's characteristics) on CC adoption decision. Organizational factors (such as firm's size, strategy and resources) shape to a significant extent the perceived technological aspects of CC, and also the magnitude of both the benefits that CC generates and the risks it poses; so we expect that organizational factors will affect the propensity to adopt CC.

This paper contributes to filling this research gap. It empirically investigates and compares the effects of a set of organizational factors on the propensity to adopt CC, based on data from 676 European firms from the glass, ceramics and cement industries, collected through the e-Business Watch Survey of the European Commission. In particular, it examines the effects of six organizational characteristics, which have been discussed in previous relevant CC literature: size, ICT cost reduction strategy, innovation oriented strategy, employment of ICT specialized personnel, previous experience of ICT outsourcing and ICT infrastructure sophistication. Using the abovementioned dataset a regression model has been estimated, having as dependent variable the propensity to CC adoption, and as independent variables measures of the above organizational characteristics. We expect that the findings of this research will be interesting and useful to both CC services providers (in order to focus on the appropriate firms' segments, optimize their marketing activities, and also make the necessary improvements and enrichments of their services) and users (in order to make CC related decisions).

The paper is structured in six sections. In the following section 2, a literature review is provided while in section 3 research hypotheses are formulated. In section 4, our data and method are described. Then in section 5 the results are presented and discussed, and finally in section 6 our conclusions are summarized, and future research directions are proposed.

2. Literature Review

As mentioned in the introduction, the lower level of CC adoption by firms, and especially by the SMEs, in comparison with the high initial expectations [12, 10], has motivated research in this direction, aiming to identify factors affecting positively or negatively CC

adoption. This research can be divided into three main streams based on the underlying theoretical foundation.

The first stream is based on the Technology Acceptance Model (TAM) and its extensions [6, 11, 20], making various types of adaptations to the particular characteristics of CC. In [21] has been developed an explorative model of SaaS adoption factors. It includes classical factors from TAM (perceived usefulness, perceived benefits, perceived ease of use, attitude, behavioral intention of future use) and its extensions (social influence, marketing efforts), and also CC specific factors (security and trust). Using data collected from 42 Taiwanese managers a structural equation model was estimated connecting the above factors. It lead to the conclusion that the main factors affecting intention to use CC in the future is perceived ease of use, followed by perceived usefulness, which are both affected by social influences (such as mass media, expert opinions and word-of-mouth) and marketing. In [22] are used data mining techniques (rough set theory) in order to extract relations among the above TAM-based factors of the previous study, using data collected from 246 Taiwanese managers. It lead to the conclusion that expert opinions are very influential for CC adoption, which is also affected significantly by the perceptions concerning CC effectiveness.

The second stream of CC adoption research is based on the Technology, Organization and Environment (TOE) theory [18, 3]. According to this theory the adoption of technological innovations by firms is influenced by three groups of factors: technological (associated with perceived characteristics of the technological innovation), organizational (firm characteristics) and environmental (associated with firm's external environment) ones. In this direction in [18] is examined the effect of a set of technological factors (relative advantage, uncertainty, privacy risk, compatibility, observability, complexity and trialability), organizational factors (top management support, innovativeness and prior similar technology experience) and environmental factors (competitive pressure and external support) on the propensity to adopt CC, based on data from a sample of 104 Greek firms, mainly SMEs. From all the above examined factors only the perceived relative advantage of CC was found to have a significant impact on adoption decisions. A similar empirical study is presented in [12], based on data from a sample of 111 firms in the high-tech industry in Taiwan. It examines the effect of a smaller set of technological factors (relative advantage, complexity and compatibility), organizational factors (top management support, firm size and technology readiness) and environmental factors (competitive pressure and trading partner

pressure) on CC adoption. From this study a wider set of factors affecting CC adoption have been identified: perceived relative advantage, top management support, firm size, competitive pressure and trading partner pressure. A recent TOE-based study based is described in [10], which examines the effect of perceived benefits and business concerns (technological factors), IT capability (organizational factor) and external pressure (environmental factor) on CC adoption intention, based on data from 200 Taiwanese firms. It concludes that the first three of these factors are significant determinants of CC adoption, while the fourth is not.

The third stream of CC adoption research is based on the synthesis of different theoretical frameworks. Such a study is presented in [17], based on the institutional theory and the real options theory. Using data collected from 101 ICT professionals from Singapore and Japan a four layers' structural equation model has been estimated. It indicates that institutional influences (e.g. from government, customers, suppliers, competitors, strategic partners, industry and trade organizations, professional bodies) affect organizations' perceptions about the technological characteristics of CC (perceived accessibility, scalability, cost effectiveness and lack of security), and through them the perceptions on the provided real options (concerning growth, abandonment and deferral) and finally the intention to adopt CC. Also, in [4] is described a study of the effects of SaaS opportunities (cost advantages, strategic flexibility, focus on core competencies, access to specialized resources and quality improvements) and risks (performance, economic, strategic, security and managerial ones) on the intention to increase the level of its adoption, which is based on the theory of reasoned action in combination with previous research on ICT outsourcing and application service provision (ASP). It has been concluded that the cost advantages have the strongest effect on the perceived level of positive opportunities provided by SaaS, followed by strategic flexibility and the quality improvement; on the contrary the focus on core competencies and the access to specialized resources do not have statistically significant effects. Furthermore, the security risks have the strongest effect on the perceived level of risk posed by SaaS, followed by the performance, economic and strategic risks; on the contrary the managerial risks do not have statistically significant effects. Finally in [23] is presented an interesting recent study of the effects of two information processing requirements factors (business process complexity and entrepreneurial culture) and two information processing capacity factors (applications' functionality and compatibility) on the intention to adopt CC. It is based on the

innovation diffusion theory (DOI) (focusing mainly on its relative advantage and compatibility perspectives) and the information processing view of the firm, and uses data from 289 USA manufacturing and retail firms. It concludes that business process complexity and also applications compatibility have positive effects on CC adoption intention, while on the contrary business process complexity and applications functionality have negative effects.

Also, it should be mentioned that in [15] is developed a theoretical model for the research of CC adoption by organizations, which is based on the combination of the transaction cost theory, the resource dependency theory and the diffusion of innovation theory. Similarly, [7] develops a CC adoption research model based on the DOI and TOE theories.

From the above literature review it can be concluded that most of the empirical research that has been conducted on the adoption of CC by firms focuses on the impact of the perceived technological characteristics of CC (e.g. relative advantages/benefits, complexity, risks, cost advantages) on the adoption decision. There has been much less research on the impact of various types of organizational factors (e.g. firm's strategic orientations, ICT infrastructure and personnel) on CC adoption decision. This perspective can be quite useful, as on one hand it will reveal for which types of firms CC is more suitable (so that CC providers can focus on them their activities and marketing efforts), and on the other hand it will provide guidance for improvements of current CC offerings (so that it can be adopted by additional firm's segments as well). Also, most of these empirical studies are based on rather small datasets, mainly from Asian countries (while there is limited research in the European context). Our study contributes to filling the above research gaps, by investigating and comparing the effects of a wide set of organizational factors (firm size, ICT investment reduction strategy, innovation oriented strategy, ICT personnel employment, previous experience of ICT outsourcing and ICT infrastructure sophistication) on the propensity to adopt CC, based on a large dataset from 676 European firms from the glass, ceramics and cement industries.

3. Research Hypotheses

Previous literature on CC argues that it can offer significant economic benefits, which are higher for the smaller firms [13, 19, 9]. Due to economies of scale that CC providers can achieve, through the development and highly professional operation of big data centers that serve numerous user firms, it can offer to CC user firms ICT cost reductions, and access to

specialized ICT resources, personnel and applications. However, some large firms due to their size might already have – or can have - such large datacenters, specialized ICT resources, personnel and applications (even at a higher cost than the CC provider), and can achieve to some extent economies of scale in their ICT operations; on the contrary these are not possible at all for smaller firms. Therefore SMEs are expected to have higher benefits from the adoption of CC than the smaller ones. Also, the reduction of the needs for upfront ICT investments, and the required capital for them that CC offers, is much more important for the smaller firms in comparison with the larger ones, as they it is much more difficult for the former to raise capital (e.g. from banks or investors) [1, 16]. The CC technologies lower the entry barriers of SMEs in new markets, products and services, which were feasible in the past only for the larger firms, flattening the competitive arena. For the above reasons our first research hypothesis is:

H1: *Smaller firms have higher propensity to adopt CC than the larger ones.*

Many firms are following a strategy of ICT investment reduction, mainly due to existing economic crisis, or other sector or firm related conditions. Using CC services can be quite appealing to them, as enables the exploitation and use of new emerging technologies and novel types of applications (e.g. CRM or business analytics), which are important for remaining competitive, without having to make additional ICT investments [13, 19]. CC transforms a significant part of firms' ICT costs from 'capital expenses' (cap-ex) to operating expenses (op-ex), and this is quite useful for firms following ICT investment reduction strategy, so we expect that it will increase their motivation and propensity for CC adoption. Therefore our second research hypothesis is:

H2: *Following an ICT investment reduction strategy has a positive effect on the propensity to adopt CC.*

Previous CC literature argues that it can provide benefits associated not only with ICT cost reduction, but also with innovation support and facilitation as well [13, 19, 2]. Innovation is quite important in modern economy for the competitiveness -or even for the survival - of firms. However, many innovations require the development of sophisticated ICT infrastructures. This can be quite expensive, necessitate significant ICT investments, and also time consuming, using the classical 'in-house' ICT development and operation paradigm; on the contrary the use of CC can enable reducing both the development costs and time,

and therefore the whole innovation cost and time to market. According to [19] in the rapid pace of a global economy the use of CC services allows cutting the innovation cycle down at least by several weeks, and this translates into cost savings and also significant business opportunities that could lead to competitive advantages. In the same direction [5] argues that 'an overly simplistic reliance on the utility model risks blinding us to the real opportunities and challenges of cloud computing'. An analysis of the economic impact of CC on business creation, employment and output in Europe presented in [8] concludes that CC will foster new business creation and competition thanks to the reduction of the required fixed costs of entry in ICT capital. All the above arguments indicate that CC can be not only a means of ICT cost reduction, but also a strong support and facilitator of innovation. Therefore we expect that following an innovation oriented strategy will increase firm's motivation and propensity for CC adoption. Therefore our third research hypothesis is:

H3: *Following an innovation oriented strategy has a positive effect on the propensity to adopt CC.*

Previous literature has emphasized the importance of the employment of specialized ICT personnel for ICT-based innovation, and its critical role in transferring knowledge on new ICT to firm's employees, and in combining it with domain specific knowledge of the latter (e.g. concerning business processes, customer needs, competition), in order to identify and formulate ICT-based innovations [2]. In this vein ICT personnel through their knowledge and skills can be quite useful for the effective and beneficial introduction of this innovative paradigm of ICT resources acquisition and management. In particular, ICT personnel is important for examining on one hand the existing CC services and providers in the market, their strengths and weaknesses, and on the other hand the needs of the firm; then for selecting the most appropriate CC services and providers, for formulating the contacts, and for monitoring and managing these relations; and finally for integrating the CC services with existing in-house ICT infrastructures. On the contrary, lack of the above will give rise to uncertainty concerning CC, which might have negative impact on the propensity to adopt it. For the above reasons our fourth research hypothesis is:

H4: *The employment of specialized ICT personnel has a positive effect on the propensity to adopt CC.*

As CC is a form of ICT outsourcing, existing previous experience of the latter can be useful for the

effective adoption and use of the former [4]. In particular, previous experience of other types of ICT outsourcing creates awareness and trust concerning external ICT services provision, and also knowledge of how to monitor and manage such relations, and corresponding internal processes and practices, which can be quite useful for the effective and beneficial introduction and use of CC. Therefore our fifth research hypothesis is:

H5: *Previous experience of ICT outsourcing has a positive effect on the propensity to adopt CC.*

Our final research hypothesis has to do with the effect of firm's ICT infrastructure sophistication on its propensity to adopt CC. In previous literature [13, 19] there are arguments concerning the usefulness and value of CC for firms not having sophisticated ICT infrastructures, as it enables such firms to gain access to more ICT capabilities and functionalities (using mainly SaaS services) at a low cost, without the need for ICT investments, and in a short time. On the other hand there are arguments pointing to the other direction as well: CC can be quite useful and valuable also for firms having highly sophisticated ICT infrastructures in order to reduce their ICT operations, support and maintenance costs (using both IaaS and SaaS services). For these reasons we have formulated two alternative research hypotheses on this, so the empirical analysis will show which of them is confirmed:

H6a: *The degree of sophistication of firm's ICT infrastructure has a positive effect on its propensity to adopt CC.*

H6b: *The degree of sophistication of firm's ICT infrastructure has a negative effect on its propensity to adopt CC.*

4. Data and Method

This study was based on data collected through the "e-Business Survey 2009". The survey was conducted by the e-Business Market Watch (www.ebusiness-watch.org), which is a well established organization, supported by the European Commission. The objectives of this survey are to assess the business implications for companies and the economic impact of ICT for three European industries - glass, ceramic and cement, and to suggest action lines for strategic responses, addressed to industry and policy. Data was collected through interviews that were conducted using computer assisted telephone interview (CATI)

techniques, among 676 enterprises from six European countries (Germany, France, Italy, Poland, Spain, UK). The target group included organizations that operate in one of the abovementioned sectors, and covered all firm sizes. Finally 53.8% of the sample firms were small (with 1-49 employees), 33.6% medium (with 50-249 employees) and the remaining 12.6% were large firms (with more than 250 employees).

In order to test our abovementioned research hypotheses H1 – H6, we estimated the following regression model:

$$\text{Prosp_Cloud} = b_0 + b_1*d_large + b_2*d_medium + b_3*prodinn + b_4*ICT_invest_red + b_5*ICT_pers + b_6*ICT_outs + b_7*ICT_Infr_Soph \quad (2)$$

The dependent variable *Prosp_Cloud* is binary (yes/no) and concerns the relevance or not of CC for the firm. With respect to the independent variables, have been included the following binary variables (yes/no): ICT investment reduction strategy (*ICT_invest_red*), product innovation strategy (*prodinn*), ICT personnel employment (*ICT_pers*), ICT outsourcing (*ICT_outs*). Also we have included an ICT infrastructure sophistication variable (*ICT_Infr_Soph*), which is calculated as the average of the following four binary variables (concerning the use or not by the firm of four important types of enterprise systems): use of ERP (enterprise resource planning) systems (yes/no), use of SCM (supply chain management) systems (yes/no), use of CRM (customers relationships management) systems (yes/no) and use of SRM (suppliers relationships management) systems (yes/no). Additionally, we have included two dummy variables for the firm size: *d_medium* and *d_large*. These variables are set according to the number of employees: variable *d_medium* takes value of 1 for medium-sized firms with 50-249 employees and value 0 for all others; variable *d_large* takes value of 1 for large firms with more than 250 employees and value 0 for all others (so small firms with less than fifty employees are our base class). In the Appendix are shown all e-Business Survey questions used in this study, providing the exact definitions of all variables.

5. Results and Discussion

In Table 1 we can see (in the second column) for all variables the relative frequencies of the 'yes' value (e.g. the percentages of the sample firms having the particular characteristic); also we can see (in the third column) for all independent variables their correlations with the dependent variable - the statistically significant ones are shown in bold. All independent

variables have positive and statistically significant correlations with the dependent variable, with the only exception of the *d_medium* variable. We remark that ICT infrastructure sophistication has the highest correlation with the propensity to adopt CC (0.191), followed by ICT investment reduction strategy (0.165) and ICT personnel employment (0.160); lower are the correlations of the previous experience of ICT outsourcing (0.124) and innovation oriented strategy (0.115).

Table 1. Relative frequencies and correlations

	Relative Frequency (%)	Pearson Correlation
Prosp_Cloud	12.4	1
<i>d_large</i>	12.6	.101
<i>d_medium</i>	33.6	.055
ICT_invest_red	23.2	.165
prodinn	36.5	.115
ICT_pers	26.5	.160
ICT_outs	16.4	.124
ICT_Infr_Soph		.191
ERP	32.0	
SCM	13.5	
CRM	23.5	
SRM	12.1	

In Table 2 are shown the estimated models of propensity to adopt CC (for each independent variable is shown exp(b) – in bold the statistically significant ones). Due to high levels of correlation among the intendant variables (problems of multi-collinearity) initially we estimated the model with only the size variables (*d_large* and *d_medium*) and the strategy variables (ICT_invest_red and prodinn) (model 1 shown in the second column). Then in a second stage we entered the remaining independent variables (model 2 shown in the third column).

From the first model we can see that firm’s size (at least for large firms) has a statistically significant positive effect on the propensity to adopt CC. In order to examine this further we performed a crosstabulation analysis combined with an X^2 independence test; the former is shown in Table 3, while in the latter the independence hypothesis has been rejected, indicating dependence between firm size and propensity for CC adoption.

Table 2. Estimated models of propensity to adopt cloud computing.

	Model 1	Model2
<i>d_large</i>	2.089	1.225
<i>d_medium</i>	1.511	1.193
prodinn	1.619	1.395
ICT_invest_red	2.268	1.867
ICT_pers		1.612
ICT_outs		1.735
ICT_Infr_Soph		3.079

From Table 3 we can see that propensity to adopt CC have 21.2% the large firms, but only 15% of the medium ones, and 8.8% of the small ones. Therefore our first research hypothesis H1 is not supported. This is in agreement with the findings of [12]. The above result does not confirm the initial expectations that CC would be adopted primarily by the SMEs [13, 19, 1], enabling them to reduce their distance from the larger firms with respect to ICT capabilities, and therefore to become more competitive. On the contrary, the larger firms seem to have a higher propensity to adopt CC technologies; this might lead to a further increase of their distance from the SMEs in ICT capabilities. A possible explanation for this is that smaller firms lack the managerial capacity, knowledge and specialized personnel required in order to examine and understand in depth the existing CC services, to select the most appropriate ones for their needs, and to monitor and manage the relation with the CC provider; on the contrary larger firms are stronger in all the abovementioned aspects, so they are much better positioned in order to adopt and exploit CC.

Table 3. Size versus cloud propensity crosstabulation

	Propensity	No Propensity
Small	8.8%	91.2%
Medium	15.0%	85.0%
Large	21.2%	78.8%

Total	12.4%	87.6%
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From the same model we can see that following ICT investment reduction strategy or innovation oriented strategy both have statistically significant positive effects on the propensity to adopt CC, with the effect of the former being stronger than the effect of the latter. Therefore our second and third research hypotheses H2 and H3 are both supported. These results indicate that firms of these three sectors (glass, ceramics and cement) view CC as a means on one hand to reduce ICT investment, and on the other hand – but to a lower extent - to support innovation. The above provide evidence for both the main service dimensions of CC proposed in [19], efficiency and innovation/creativity.

In the second model we can see that due to multicollinearity the coefficients of the two firm size variables, and the innovation strategy variable are not anymore statistically significant. Furthermore, we can see that the effects of all three additional variables of this model, concerning the sophistication of ICT infrastructure, the previous experience of ICT outsourcing and the employment ICT personnel, on the propensity to adopt CC are statistically significant and positive. Therefore research hypotheses H4, H5 and H6a are all supported. We remark that the stronger of these effects is the one of ICT infrastructure sophistication. This indicates that firms with highly sophisticated ICT infrastructures have a strong propensity to use CC services in order to reduce their high ICT operations, support and maintenance costs (possibly using both IaaS and SaaS services).

6. Conclusions

Cloud computing is an emerging new paradigm of ICT resources acquisition and management by firms. It can offer significant benefits, however at the same time it poses some risks as well, which act as barriers to its adoption. Therefore it is important to research the adoption of CC, the factors affecting it and the interrelations among them. In this direction in the previous sections of this paper has been presented an empirical study of organizational factors (i.e. firm characteristics) that affect the propensity to adopt CC. This type of factors has been only to a very limited extent investigated in previous CC adoption empirical literature, despite its importance for both CC service providers and users. In particular, we investigated and compared the effects of a set of organizational factors discussed in previous CC literature (but not empirically investigated), such as firm's strategic orientations,

technological and human resources, size, and previous similar outsourcing experiences, on the propensity to adopt CC. Our study has been based on a large dataset from 676 European firms from the glass, ceramics and cement industries, which has been collected through the e-Business Watch Survey of the European Commission.

Our study has identified an interesting and useful set of organizational factors/characteristics that increase the propensity to adopt CC. The most impactful of them is the sophistication of firm's ICT infrastructure: due to the high operating and maintenance costs of sophisticated ICT infrastructures the use of CC services (such as IaaS and SaaS services) is viewed as quite beneficial for reducing these costs. The second most impactful organizational factor/characteristic identified is a strategy of ICT investment reduction: if such a strategy is followed (which is quite usual today due to the existing economic crisis) then the use of CC is viewed as a means of accessing and using new emerging technologies and novel types of applications (e.g. CRM or business analytics), which are important for remaining competitive, without having to make additional ICT investments. Also, we have found that an innovation oriented strategy has positive impact on the propensity for CC adoption as well, however not as strong as an ICT investment reduction strategy: firms to some extent view CC as a good solution for developing the ICT infrastructures required for various innovations (e.g. new innovative products), which is characterized by lower costs and rapid implementation. Furthermore, the employment of specialized ICT personnel and also previous experience of ICT outsourcing have been found to have positive impact on the propensity to adopt CC.

Another interesting finding of our study concerns the effect of firm's size on CC adoption propensity. Despite the expectations that CC would be more beneficial for the smaller firms than for the larger firms, and therefore it would be adopted primarily by SMEs, our results indicate that larger firms show a higher propensity to adopt CC. Therefore an interesting lesson learnt from our study is that though initially the main target groups of CC were the smaller firms, and also the firms with limited and deficient ICT infrastructure, our findings indicate that (at least in the three examined industries (glass, ceramics and cement)) it is mainly the large firms and also the firms with highly sophisticated ICT infrastructures that show more interest in propensity for using CC. Therefore CC services providers should rethink their offerings, and probably transform them in order to attract more interest from its initially targeted groups (e.g. make

their offerings more appropriate and easy to use by SMEs).

Our study has interesting implications for research and practice. It contributes to the empirical literature on factors affecting the adoption of CC, investigating a set of organizational factors concerning firm's strategic orientations, technological and human resources, size, and previous similar outsourcing experiences. It opens up new directions of future research concerning the impact of firm characteristics on the perceived benefits and risks of CC, which determine its adoption, and at the same time provides a framework for this research. With respect to practice, our findings offer useful guidance to the management of firms thinking about the adoption of CC as to for which types of firms it is regarded more appropriate. Furthermore, they offer useful guidance to the management of CC provider firms as to which firms have stronger propensity to adopt CC, in order to focus their marketing and sales activity on them; also, as mentioned above our findings provide to them directions for improvements of their offerings.

The main limitation of this study is that it is based on data from only three manufacturing sectors (glass, ceramics and cement), so findings may have been influenced to some extent by their particular characteristics and context. So further research is required concerning the effect of wider sets of organizational factors/characteristics on the propensity to adopt CC in various sectoral contexts. Also, it would be useful to distinguish between different categories of CC services (IaaS, PaaS, SaaS), as they might differ in the factors affecting their adoption. Finally, it would be interesting and useful to identify and investigate mediating factors of the above effects (such as various types of benefits and risks) using structural equations modeling techniques.

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Appendix

Table 4. E-business survey questions used

Variable	Definition
Prosp_Cloud	How relevant is cloud computing for your company (very relevant, partly relevant, or not relevant)?
d_medium	Dummy variable for medium firms: 50-249 employees
d_large	Dummy variable for large firms: more than 250 employees
ICT_invest_red	Have you cancelled or significantly downsized any ICT or e-business projects in the last 12 months? (yes/no)
prodinn	During the past 12 months, has your company launched any new or substantially improved products or services? (yes/no)
ICT_pers	Does your company currently employ ICT practitioners? (yes/no)
ICT_outs	In the past 12 months, has your company outsourced any ICT services to external service providers, which were previously conducted in-house? (yes/no)
ICT_Infr_Soph	Does your company use an ERP system, that is Enterprise Resource Planning? (yes/no)
	Does your company use a SCM system, that is Supply Chain Management? (yes/no)
	Does your company use a CRM system, that is Customer

	Relationship Management? (yes/no)
	Does your company use a SRM system, that is Supplier Relationship Management? (yes/no)