How do firms use cloud computing to transform their organization? Evidence from a global survey

Ahmed Bounfour
European Chair on Intangibles, RITM Research Center, Université Paris-Saclay, Sceaux, France
Jean-Michel Etienne and Xiaolin Cheng
RITM Research Center, Université Paris-Saclay, Sceaux, France, and
Alberto Nonnis
European Chair on Intangibles, RITM Research Center, Université Paris-Saclay, Sceaux, France

Received 13 May 2022
Revised 10 June 2022
Accepted 12 June 2022

Abstract

Purpose – The paper aims to address the organizational transformation of firms for value creation resulting from cloud computing (CC).

Design/methodology/approach – With reference to the theory of organizational fit, we modeled organizational transformation as a function of five aspects of CC practice: functionality, data management, roles and competences of information technology services, control and organizational culture. The output variable was tested against a set of input variables defined with reference to the technology–organization–environment (TOE) and technology acceptance model (TAM). Based on a sample of 487 companies in seven countries in Europe, Asia, and the United States, the authors distinguished two groups of firms: transformational and hyper transformational.

Findings – The results highlight the key factors that determine whether a firm falls into one of these two groups, and include perceived usefulness and perceived ease of use, complexity and compatibility of CC technology, and adequacy of resources. Top management support and government policy are found to only play a role for the transformational group while, surprisingly, vendor support had no impact for either group.

Originality/value – This research contributes to the literature on the role of digital transformation in value creation and on digitization of firms and organizational design, notably by considering the contribution of CC to the organizational dimension. To the best of the authors' knowledge, this is the first study to make the link between TOE and TAM models and organizational fit theory, thereby going beyond the general approach to adoption found in information system research.

Keywords Cloud computing, Organizational fit, Technology–organization–environment (TOE), Value creation, Marginal effects, Probit model

Paper type Research paper

1. Introduction

Cloud computing (henceforth, CC) is now considered as a major opportunity to develop innovative services and new ways of organizing for companies, public organizations and citizens in general. For companies, CC can help them to improve the flexibility and smooth operation of their business models. Consequently, it would appear that adopting and

This research has been supported under the CBOD-Cloud Computing and Organisational Design-project, funded under the research programme "Sociétés Innovantes", of the Agence Nationale de Recherche, ANR, France.

Digital Transformation and Society
Vol. 1 No. 1, 2022
pp. 29-47
Emerald Publishing Limited
e-ISSN: 2755-077X
p-ISSN: 2755-0761
DOI 10.1108/DTS-05-2022-0014

migrating to CC is relatively easy. However, CC modalities are still a subject of debate (Khajeh-Hosseini, Greenwood, Smith, & Sommerville, 2010).

CC solutions create a virtual space for infrastructure, platforms and software. Their popularity is primarily due to their ease of use, and has had a further boost in recent times due to the challenges posed by the coronavirus disease 2019 (COVID-19) pandemic (Tuli, Tuli, Tuli, & Gill, 2020; Lin, Carter, & Liu, 2021). As a result, several providers, including Amazon, Microsoft and Google have begun to offer the technology. The most widely used definition of CC is provided by the National Institute of Standards and Technology (Mell & Grance, 2011): "Cloud computing is 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."

In the earlier stages of CC development, the primary focus was on technical factors; now, it is gradually moving towards a business perspective. Recently, the number of companies that have adopted CC services has increased, while companies that are still thinking about adopting the technology are confronted by various challenges, as they must compare several alternatives based on incomplete decision criteria (Martens, Walterbusch, & Teuteberg, 2012).

Numerous research results indicate that the selection of cloud suppliers has become increasingly important (Aissaoui, Haouari, & Hassini, 2007). However, the choice is made difficult by the limited transparency of cloud services (Godse & Mulik, 2009) that make it difficult to judge their quality (Martens *et al.*, 2012), and the fact that various criteria (e.g. cost and performance) must be considered. Cloud customers are faced with the challenge of identifying providers that can satisfy their requirements.

Several strands of literature have focused the attention on different CC aspects. The most popular has concentrated on the issues related to the adoption of CC technologies (Jones & Karsten, 2008; Bhattacherjee & Park, 2014), while others on the economic implications related to decision-making (Etro, 2015; Naldi & Mastroeni, 2016), business modeling (Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011; Garg, Versteeg, & Buyya, 2013; Fahmideh, Daneshgar, Rabhi, & Beydoun, 2019) and value transformation/creation (Bharadwaj, El Sawy, Pavlou, & Venkatraman, 2013; Daniel, Maruping, Cataldo, & Herbsleb, 2018; Schneckenberg, Benitez, Klos, Velamuri, & Spieth, 2021). Despite this, CC research is still in its early days. There is a need for an overall and syncretic view of how CC affects (or might affect) the performance of firms and organizations in terms of cost, value, risk, competences, data and intellectual property rights (IPR) management. The CC literature remains dominated by the technical and, to a lesser extent, security point of view (Afzal & Kavitha, 2019; Li *et al.*, 2021), while business aspects are neglected. There is a need to document the impact of the digital transformation (in particular CC) on company value (Mendling, Pentland, & Recker, 2020). The issue is the focus of this paper, which considers the transformational nature of CC, based on its organizational dimension. Specifically, we go beyond the mere analysis of the elements that lead firms to adopt CC technologies and focus on the way firms use CC to effectively transform their organization to create value. To the best of our knowledge, our work is the first to explore such aspects, bridging the literature on CC adoption and the literature on CC impact on firms' value creation.

The remainder of the paper is organized as follows. A literature review is presented in the following section, while Section 3 describes the research model. Section 4 presents the main results, which are discussed in Section 5. Finally, Section 6 concludes.

2. Theoretical background

The most recent literature has focused on several CC features, such as decision-making (Naldi & Mastroeni, 2016; Yoo & Kim, 2018), business modeling (Guo & Ma, 2018; Sabherwal,

Sabherwal, Havakhor, & Steelman, 2019), uncertainty (Trenz, Huntgeburth, & Veit, 2018), value transformation/creation (Chou, 2015; Lang, Wiesche, & Krcmar, 2018) and adoption (Bhattacherjee & Park, 2014; Chang, Gurbaxani, & Ravindran, 2017; Fahmideh *et al.*, 2019), to which we give particular attention because of the special consideration the literature has given to related aspects over time.

Research on adoption is based on three main theoretical perspectives: the diffusion of innovation (DOI) theory (Rogers, 1995), the technology acceptance model (TAM) (Davis, 1985, 1989) and the technology–organization–environment (TOE) framework (Tornatzky, Fleischer, & Chakrabarti, 1990). Beside these, the political, economic, social, technology (PEST) model proposed by Fahey and Narayanan (1986) was also considered by some researchers for the analysis of CC adoption.

The TAM was first introduced by Davis (1985) and proposes a system of technology acceptance, with a focus on two dimensions of the user's motivation: perceived usefulness and perceived ease of use. Davis's work was the first attempt to develop an overall approach to the issue of adoption in the domain of (information system) (Benbasat & Barki, 2007; Silva, 2007). The model has been refined along different scales (Davis, 1989) and has evolved into different versions (Davis, 1993; Venkatesh & Davis, 1996; Venkatesh, Thong, & Xu, 2012). Despite its widespread diffusion and implementation in IT research, the model suffers from its narrow focus on two main dimensions, while other use factors are ignored [1].

The TOE framework is the most widely-used approach in CC adoption research. It identifies various influential factors in technological, organizational and environmental dimensions. Each dimension offers both constraints and opportunities for technology adoption (Tornatzky *et al.*, 1990). It considers adoption and implementation from a "context for change" perspective, rather than individual perceptions. Previous studies have demonstrated that the TOE framework is very useful for understanding critical determinants of adoption (Lian, Yen, & Wang, 2014).

The PEST analysis was proposed by Fahey & Narayanan (1986). It was initially used to analyze markets from a macroeconomic perspective (Lee, Chae, *et al.*, 2013). More generally, PEST is considered as an external environmental analysis framework, and as such does not include micro-environmental and internal factors.

The diffusion of innovation (DOI) theory was developed by Rogers (1995). It explains innovation adoption in an organization from a technological perspective and users' perceptions (Oliveira, Thomas, & Espadanal, 2014). The theory discusses five attributes: relative advantage, compatibility, complexity, triability and observability. Using this model, Lin and Chen (2012) investigated the impact of the five attributes for CC adoption in hospitals in Taiwan. However, DOI does not take into account the impact of the environmental dimension.

CC research has focused on issues of adoption and operation and much less, if at all, on its ability to transform and create value. The question of the transformational nature of CC in relation to the issue of value creation can be addressed from various angles: economic performance, organizational and business models, the consumer, or citizens and society in general. Here, we examine the organizational dimension as a factor in economic performance, and therefore as a critical intangible asset (Lev & Radhakrishnan, 2003; Bloom, Genakos, Sadun, & Van Reenen, 2012). Our aim is to go beyond the traditional approach to adoption as an output factor, and consider the effectiveness of business transformation due to CC. We build on the key dimensions of the theory of organizational fit, notably the seminal work of Soh, Kien, and Tay-Yap (2000), which is developed in the next section.

3. Research model and empirical data

We document the factors influencing the intensity of transformation from an organizational angle. Specifically, our aim is to go beyond adoption questions and look at the

transformational nature of CC. We consider its key dimensions and, subsequently, identify the factors that have the most impact.

3.1 Research framework

Like earlier research (Oliveira *et al.*, 2014), we develop an integrated approach to CC, in order to evaluate the impact of a set of inputs on the organizational transformation of companies. However, traditional research has mostly focused on CC adoption issues, while we rather concentrate of the intensity of transformation. To do so, we consider a series of input variables (CC practices) and relate them to a series of output variables that reflect the intensity of organizational transformation due to CC (Figure 1).

On the input side, we develop a hybrid TOE/TAM framework. The two frameworks are used to identify various influential factors in the innovation adoption process (Tornatzky & Klein, 1982; Tornatzky *et al.*, 1990) as they have features that make it appropriate for the investigation of CC adoption, and for extension on the impact of transformation due to CC on value creation.

Specifically, the TAM framework identifies two main determinants of CC adoption: perceived usefulness and perceived ease of use. Davis defined perceived usefulness as "the degree to which an individual believes that using a particular system would enhance his or her job performance" (Davis, 1985) and suggested that it refers to productivity, performance and effectiveness (Davis, 1989). In our case, perceived usefulness is evaluated using three variables: (1) more efficient task completion with CC compared to existing technologies; (2) reduced operational, maintenance, updating and training costs; and (3) increased company agility.

Perceived ease of use refers to "the degree to which an individual believes that using a particular system would be free of physical and mental effort" (Davis, 1985). It measures the prospective user's assessment of the mental effort required to use the target application (Davis, 1993). Our assessment of perceived ease is based on three factors: (1) CC allows a good internet connection and speed of cloud services; (2) CC allows the ability to use and access cloud tools and data anywhere; and (3) implementing CC requires negligible learning time for all employees.

Therefore, the two hypotheses tested in the TAM part of our framework are:

H1. Perceived usefulness increases the likelihood of organizational transformation due to CC.

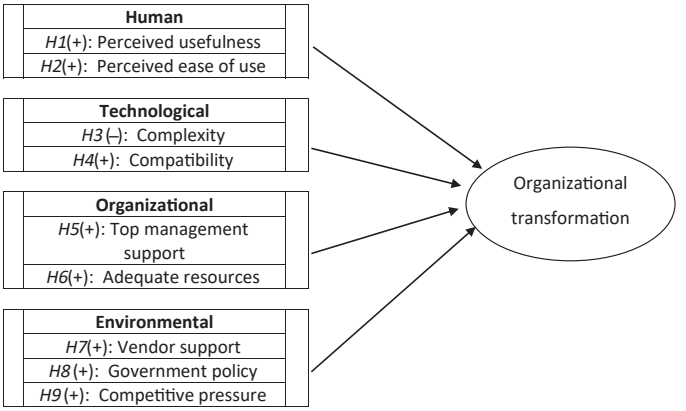

Figure 1.
Research model and hypotheses

H2. Perceived ease of use increases the likelihood of organizational transformation due to CC.

Similarly to the TAM, the TOE framework describes the way the firm context affects the innovation activity of a firm, focusing on the three pillars that influence the adoption of IT: technology, organization and environment. CC services are usually provided to firms and organizations by a third party (cloud service providers). Therefore, unlike conventional innovation, CC innovation involves three main actors: cloud-based services, cloud users and cloud service providers. As a result, its adoption is influenced by three major factors that represent the three pillars of the TOE framework: (1) the characteristics of CC technology, which is a function of technologies that are both internal and external to the company; (2) the characteristics and resources of firms and organizations that provide the context; and (3) the environmental context in which a firm conducts its business, its industrial sector, competitors, access to resources supplied by others and dealings with the government.

Technology assumes a particular relevance for CC, as firms are required to set up their equipment and infrastructure systems using the available technologies they have inside the firm or they obtain from outside. In our modeling, two technological aspects are considered: complexity and compatibility. Complexity is concerned with the firms' perception firms about how complex the implementation of CC is considered. Indeed, the degree to which firms consider complicated to integrate CC into their system has a relevant impact on their use. Rogers (1995) describes complexity as "the degree to which an innovation is perceived as difficult to understand and use". If CC is a seen as a complicated new technology by firms, they may not have the confidence to use it and it may take them a long time to learn and implement. Complexity is therefore a potential barrier to the adoption of new technology (Low, Chen, & Wu, 2011) and can be seen as "the degree to which using the innovation is perceived as difficult" (Lin & Chen, 2012).

We assessed six aspects of complexity: (1) CC is too complex for business operations; (2) the skills needed to adopt CC are too complex for the firm's employees; (3) the additional complexity of migrating current systems to a CC platform; (4) uncertainty about the location of data limits the use of CC services; (5) the risk of a security breach limits the use of CC services and (6) having a full understanding of the conditions of data use in CC.

As for compatibility, the concept reflects the degree to which an innovation is perceived as being consistent with existing values, past experience and the needs of users. Rogers (1995) defined it as "the degree to which an innovation fits with the potential adopter's existing values, previous practices, and current needs". When new technology is considered to be compatible with current systems, its adoption becomes more feasible; when it is incompatible, firms take a long time to learn and reorganize their systems (Low *et al.*, 2011).

In our research, compatibility is assessed in terms of four factors: (1) compatibility with current company practice; (2) compatibility with firm's values and goals; (3) ease of integration into existing IT infrastructure and (4) loose coupling and independence of applications.

Therefore, the first pillar of the TOE part of our model translates in the following two hypotheses.

H3. Complexity decreases the likelihood of organizational transformation due to CC.

H4. Compatibility increases the likelihood of organizational transformation due to CC.

The second aspect considered by the TOE framework is the organization context. The internal structures and process are vital for innovation, and strongly affect the adoption decisions that companies undertake. In this sense, there are two aspects that we take into account in our analysis. The first concerns the support from the top management and the second the resources. Top management support can contribute to innovation adoption by

creating a fertile environment and providing resources (Premkumar & Roberts, 1999). The issue is naturally related to its leadership role in digitization (El Sawy, Kræmmergaard, Amsinck, & Vinther, 2020). Abdollahzadehgan, Che Hussin, Gohary, and Amini (2013) defined top management support as "the degree of support provided by the higher management in adopting the new technology for business". In our research, top management support is assessed in terms of two factors: (1) willingness to provide strong leadership and engage in the process and (2) willingness to take risks in the adoption of CC.

Adequate resources are also critical to successful adoption. CC adoption is a large-scale project, and an appropriate budget, adequate human resources and top management support all improve the chance of success (Lian *et al.*, 2014). On the other hand, a lack of resources has the opposite effect.

In our research, we considered five parameters: (1) the provision of appropriate resources to develop CC; (2) the availability of development time; (3) a sufficient budget; (4) sufficient human resources and (5) the fact that CC allows the development of a "shadow" IT department.

Therefore, the two hypotheses that we consider from the second TOE pillar are the following:

H5. Top management support increases the likelihood of organizational transformation due to CC.

H6. Adequate resources increase the likelihood of organizational transformation due to CC.

The third aspect considered in the TOE framework is the environment. This involves the characteristics of the industry to which the firm belongs, the relationship with the providers or the country regulations (Baker, 2012). There are three aspects that we consider in our analysis: vendor support, government policy and competitive pressure.

In CC technology, the customer is highly dependent on the vendor to achieve the desired level of security. As data and applications are usually held on the providers' platform (Safari, Safari, Hasanzadeh, & Ghatari, 2015), vendors must guarantee security, availability and performance through clear service-level agreements (SLAs) and provide support in the form of guaranteed hardware, software and networks (Nkhoma, Dang, & De Souza-Daw, 2013). Here, vendor support is assessed using five parameters: (1) SLA guarantees; (2) on-request return of data; (3) adequate compensation following a vendor breach of the SLA; (4) availability of vendor support and (5) the availability of suitable training.

Government policy is another environmental factor that affects innovation diffusion (Porter, 2011). Companies operating in an environment with restrictive government policies can be expected to have low levels of IT adoption. CC is one example of an Internet-based technology that is subject to government policy (Safari *et al.*, 2015). Here, government support is analyzed using three variables: (1) encouragement given to firms to adopt CC; (2) the presence of mediating organizations that support enterprises in the implementation of CC; and (3) the comprehensiveness of regulations in addressing legal challenges related to CC.

Finally, competitive pressure refers to the degree to which competitors exert pressure on the firm (Oliveira & Martins, 2010). It has long been shown to have a positive effect on, and be a significant determinant of CC adoption, forcing firms to adopt new technology (Lian *et al.*, 2014; Oliveira *et al.*, 2014). Firms react by adjusting their offer, while greater competition forces them to allocate more resources to innovation. We evaluate competitive pressure based on two determining factors: (1) whether the firm thinks that CC, as a managerial practice, has an influence on competition in their industry and (2) whether the firm is under pressure from competitors to adopt CC.

To sum up, the third pillar of the TOE part of our framework can be summarized by the following three hypotheses:

H7. Vendor support increases the likelihood of organizational transformation due to CC.

H8. Government policy increases the likelihood of organizational transformation due to CC.

H9. Competitive pressure increases the likelihood of organizational transformation due to CC.

On the output side, in order to evaluate the degree of organizational transformation of a firm, our model considers the five key dimensions referenced by the organizational fit literature (Soh *et al.*, 2000): (1) *Functionality* of IT services in terms of access, operations, services liability, reversibility, control of tasks, agility, procurement and cost; (2) *Data management,* including access, localization, security, compatibility, bandwidth, IPRs, service reports and delivery; (3) *Competences of IT services*, especially with regard to the clarity of roles, availability of internal competences, alignment of competences and formal roles, and bottlenecks in tasks and workloads; (4) *Control*, and specifically control of tasks, service delivery, task coordination, contractual arrangements and managing contractual risks; (5) *Organizational culture*, with regard to formal rules and standards of behavior, informal rules and the development of a cloud culture (Table 1). As we develop in detail in subsection 3.3, the related questions are aggregated into two indicators that we use as dependent variables in our analysis.

3.2 Data and methods

We developed a database of 487 firms that use CC, in the context of an international research project supported by our National Research Agency. The database comprises seven, country-specific cross-sectional datasets, covering the United States (60 firms), China (83 firms), Japan (73 firms), France (60 firms), Germany (66 firms), Italy (76 firms) and the United Kingdom (69 firms). Data were drawn from a questionnaire that was designed by the project's partners and formed the basis for a survey that was conducted in 2016. The questionnaire consisted of 30 questions divided into the following seven modules: (1) General company information (11 questions); (2) CC practices (4 questions); (3) CC adoption behavior (2 questions); (4) Organizational transformation/fit (6 questions); (5) Regulation, Data & IPRs (3 questions); (6) Governance (3 questions); and (7) Cloud futures design (1 question) [2].

The questionnaire was distributed via a service provider [3]. Organizations with more than 10 employees were targeted, and respondents were CIOs (chief information officers), CEOs (chief executive officers), IT managers and other managers with CC experience. The questionnaire was designed to address the questions at the heart of our research project, namely

(1) Question 1: How mature are firms with respect to CC?

(2) Question 2: What are the main driving forces for firms' organizational design, based on CC?

(3) Question 3: What options can be defined and proposed to firms with respect to their transformation (business models, data and services, IPRs, governance), based on CC?

Modifications to organizational fit due to CC practices were captured by 30 self-assessment questions covering a wide range of issues. Each question corresponded to a variable, and variables were grouped into four dimensions, which reflect the research structure we detailed in subsection 3.1: human, technological, management and environmental (Table 2), where the human category is essentially the TAM part of the model, while the other three represent the TOE part.

Functionality
(1) Access to services (SLA)
(2) Operations/processes
(3) Interoperability & standards (including between cloud providers)
(4) Services liability
(5) Reversibility, migration from one system to another
(6) Control of tasks and services deliverable
(7) Agility
(8) Procurement
(9) Cost
Data management
(1) Data access
(2) Data localization
(3) Data security
(4) Data compatibility
(5) Bandwidth
(6) Data ownership & IPRs
(7) Services reports & delivery
Competences
(1) Clarity of roles (who does what)
(2) Availability of internal competences
(3) Balance of competences (internal vs external)
(4) Alignment of competences and formal roles
(5) Bottlenecks in tasks and workloads
Control
(1) Control of tasks
(2) Services delivery
(3) Task coordination (internal versus cloud providers)
(4) Contractual arrangements
(5) Managing contractual risks
Culture
(1) Formal rules and standards of behavior (formal execution and coordination of tasks, reporting mechanisms)
(2) Informal rules and standards of behavior (informal coordination of tasks, reporting mechanisms)
(3) Development of cloud culture

Table 1.
Variables used to measure transformation due to CC

3.3 Modeling

We constructed the dependent variables as follows. First, a qualitative variable (y_i) was developed for each question (Table 1). It was given a value of 1 if respondents reported "Fully agree" or "Agree" and 0 otherwise. Next, we constructed a positive change score. This score took into account all items and was measured on a 28-point scale, with 28 indicating the highest possible positive change.

We adopted two measures of change in organizational fit that were considered to be representing organizational transformation:

(1) The first qualitative variable ($output_{1i}$) took the value 1 for firms that declared at least 14 positive changes (in any combination of dimensions), and 0 otherwise.

(2) The second qualitative variable ($output_{2i}$) took the value 1 for firms that declared a 50% positive change for each dimension [4].

A firm was considered as transformational if it recorded at least 14 positive changes in its organizational fit. The hyper-transformational group was characterized by at least 50% positive changes in each dimension.

Human	
Perceived usefulness	
perceived_usefulness1	Compared to current technologies, CC enables us to accomplish our tasks more efficiently
perceived_usefulness2	CC technology will help us to reduce our operational, maintenance, updating and training costs
perceived_usefulness3	CC will contribute to the agility of the enterprise
Perceived ease of use	
perceived_ease_of_use1	CC allows a good internet connection and speed of cloud services
perceived_ease_of_use2	CC allows the ability to use and access cloud tools and data anywhere
perceived_ease_of_use3	Implementing CC necessitates negligible learning time for all employees
Technological	
Compatibility	
compatibility1	CC technology is compatible with our current practices
compatibility2	CC technology is compatible with our firm's core values and goals
compatibility3	CC can easily be integrated into our existing IT infrastructure
compatibility4	Our applications are loosely coupled and independent
Complexity	
complexity1	CC is too complex for business operations
complexity2	The skills needed to adopt CC are too complex for the firm's employees
complexity3	Transfer current systems to a CC platform is too complex
complexity4	Uncertainty about the location of data limits the use of CC services
complexity5	The risk of a security breach limits the use of CC services
complexity6	We fully understand the conditions of data use in the cloud (terms of use, local regulations, etc.)
Management	
Top management support	
management_sup1	The company's top management provides strong leadership and engages in the process when it comes to information systems
management_sup2	The company's top management is willing to take risks in the adoption of CC
Adequate resources	
adequate_res1	Our firm has enough resources to support the development of CC technology
adequate_res2	Our firm has enough time to develop CC technology
adequate_res3	Our firm has a budget that is sufficient to develop CC technology
adequate_res4	Our firm has enough human resources to develop CC technology
adequate_res5	CC facilitates the development of a "shadow" IT department
Environmental	
Vendor support behaviors	
environment_vend1	The service level agreement (SLA) is guaranteed by the vendor
environment_vend2	The vendor would cooperate in returning my data if I wanted to replace them
environment_vend3	Our firm would receive adequate compensation for a vendor breach of the SLA
environment_vend4	We can easily obtain support from CC vendors during our CC implementation
environment_vend5	We can be trained in CC in appropriate sessions provided by vendors
Government policy	
policy1	The government encourages firms to apply CC
policy2	There are mediating organizations that support enterprises in the implementation of CC
policy3	There are enough regulations to deal with legal challenges related to CC
Competitive pressure	
competitive_pressure1	Our firm thinks that CC has an influence on competition in their industry
competitive_pressure2	Our firm is under pressure from competitors to adopt CC

Table 2.
Survey questions and variables grouped into four dimensions

As the change in organizational fit index was a binary dependent variable, we test our hypotheses via probit regression equations, estimated with the maximum likelihood estimator (MLE) method. Our benchmark specification takes the following form:

$$Output_i = \alpha X_i + \beta Z_i + \varepsilon_i$$

where $Output_i$ is either one of the two above mentioned indicators of positive change in the organizational fit of firm i; X_i represents CC adoption or practice by firm i; Z_i represents a variety of company characteristics including sector, size, economic growth and the size of the IT budget and ε_i is an error term.

4. Results

4.1 Preliminary analysis

Of the overall sample of 487 companies, 272 (56.86%) were found to be transformational, while 158 (32.44%) were hyper-transformational. The latter is unexpectedly high and suggests that CC has become a more widespread transformational practice than is generally accepted.

Table 3 shows the results of the equality of proportions tests comparing the characteristics of the two groups. The first three columns refer to the transformational group, while the last three to the hyper-transformational group. The first two of the three columns of each half of the table show the percentage of firms in the control group (non-transformational or non-hyper-transformational, respectively), and in the test group (transformational or hyper-transformational, respectively). The other column (Diff.) shows the difference between these two percentages, with the marginal significance level [5] indicated. This analysis reveals that transformational and hyper-transformational groups differ in terms of their characteristics.

In particular, in the transformational group, differences are found in the manufacturing (*sector_manu*) and financial (*sector_finan*) sectors. Financial service firms are overrepresented in the transformational group (16.5%) compared to the non-transformational group (9.3%). Conversely, firms in the manufacturing sector are more numerous in the non-transformational group (14.9%) than in the transformational group (8.1%).

Similar results were found for all variables describing human, technological, organizational and environmental dimensions of CC. The two human dimensions are "perceived usefulness" and "perceived ease of use". In the transformational group, 91.9% of firms perceived CC as useful, and 91.2% perceived it as easy to use. The two technological dimensions are "compatibility of technology" and "complexity of technology". In the sample, 89.7% of companies perceived CC as compatible, and 54.4% as complex. The two organizational dimensions are "top management support" and "adequate resources". The analysis showed that 86.4% of firms thought that they had adequate resources. The three environmental dimensions are "vendor support behaviors" (88.6% perceived a positive change), "government policy" (75%) and "competitive pressure" (87.9%). Similar results are found in the hyper-transformational group. However, here, firms in the public (*sector_public*) and manufacturing (*sector_manu*) sectors are more numerous in the non-hyper-transformational group (7.9%, 12.8%) than in the hyper-transformational group (3.8%, 5.2%), respectively.

4.2 Probit estimation results

The marginal effects from the probit models are presented in Table 4. In particular, in the first two columns, the dependent variable is $Output_1$ (transformational group), while in the second two is $Output_2$ (hyper-transformational group). Country-specific fixed-effects are included in specifications 2 and 4.

Variable	Transformational			Hyper-transformational		
	N_T	T	Diff	N_HT	HT	Diff
size_1_9	0	0	0	0	0	0
size_10_249	0.181	0.199	−0.017	0.188	0.196	−0.008
size_10_249	0.181	0.199	−0.017	0.188	0.196	−0.008
size_250_4999	0.656	0.618	0.038	0.644	0.614	0.03
size_5000_etplus	0.163	0.184	−0.021	0.167	0.19	−0.023
sector_manu	0.149	0.081	0.068**	0.128	0.076	0.052*
sector_ICI	0.172	0.173	−0.001	0.155	0.209	−0.054
sector_engin	0.144	0.151	−0.007	0.155	0.133	0.022
sector_const	0.065	0.055	0.01	0.061	0.057	0.004
sector_dist	0.07	0.081	−0.011	0.073	0.082	−0.009
sector_finan	0.093	0.165	−0.072**	0.122	0.158	−0.037
sector_ICT	0.149	0.162	−0.013	0.149	0.171	−0.022
sector_public	0.074	0.059	0.016	0.079	0.038	0.041*
sector_other	0.084	0.074	0.01	0.079	0.076	0.003
perceived_usefulness1	0.465	0.908	−0.443***	0.593	0.962	−0.369***
perceived_usefulness2	0.535	0.853	−0.318***	0.623	0.899	−0.276***
perceived_usefulness3	0.535	0.919	−0.384***	0.66	0.937	−0.277***
perceived_ease_of_use1	0.437	0.871	−0.434***	0.565	0.918	−0.352***
perceived_ease_of_use2	0.526	0.912	−0.386***	0.638	0.956	−0.317***
perceived_ease_of_use3	0.474	0.805	−0.331***	0.571	0.842	−0.270***
compatibility1	0.479	0.89	−0.411***	0.605	0.924	−0.319***
compatibility2	0.488	0.897	−0.409***	0.617	0.924	−0.307***
compatibility3	0.451	0.871	−0.42***	0.59	0.886	−0.296***
compatibility4	0.442	0.79	−0.349***	0.568	0.778	−0.21***
complexity1	0.656	0.54	0.115***	0.62	0.532	0.088*
complexity2	0.698	0.544	0.154***	0.635	0.563	0.072
complexity3	0.67	0.537	0.133***	0.629	0.525	0.104**
complexity4	0.553	0.471	0.083*	0.529	0.462	0.067
complexity5	0.516	0.438	0.079*	0.483	0.449	0.034
complexity6	0.53	0.147	0.383***	0.407	0.127	0.281***
management_sup1	0.423	0.882	−0.459***	0.562	0.924	−0.362***
management_sup2	0.409	0.853	−0.444***	0.55	0.88	−0.33***
adequate_res1	0.465	0.864	−0.399***	0.593	0.886	−0.293***
adequate_res2	0.419	0.798	−0.379***	0.532	0.835	−0.304***
adequate_res3	0.377	0.849	−0.473***	0.514	0.905	−0.391***
adequate_res4	0.442	0.79	−0.349***	0.541	0.835	−0.294***
adequate_res5	0.447	0.787	−0.34***	0.541	0.835	−0.294***
environment_vend1	0.451	0.835	−0.383***	0.565	0.873	−0.308***
environment_vend2	0.4	0.787	−0.387***	0.514	0.829	−0.315***
environment_vend3	0.405	0.801	−0.397***	0.52	0.848	−0.328***
environment_vend4	0.488	0.886	−0.398***	0.623	0.892	−0.269***
environment_vend5	0.507	0.868	−0.361***	0.611	0.911	−0.300***
policy1	0.381	0.732	−0.35***	0.498	0.741	−0.242***
policy2	0.358	0.75	−0.392***	0.483	0.772	−0.289***
policy3	0.367	0.699	−0.331***	0.468	0.728	−0.26***
competitive_pressure1	0.377	0.879	−0.502***	0.532	0.918	−0.386***
competitive_pressure2	0.405	0.695	−0.29***	0.508	0.69	−0.182***

Note(s): Values correspond to marginal significant effects thresholds. Significance levels are: * 10%, ** 5%, *** 1%

Table 3. Equality of proportions tests

4.2.1 The human dimension. In all four models, three independent variables were statistically significant at the 10% level: *perceived_usefulness1*; *perceived_ease_of_use1*; *perceived_ease_of_use2*; p*erceived_ease_of_use2* is instead significative in only one model.

Variable	transformational (1)	transformational (2)	hyper-transformational (3)	hyper-transformational (4)
	Marginal effects		Marginal effects	
perceived_usefulness1	0.425 (0.225)+	0.356 (0.233)	0.853 (0.298)**	0.862 (0.309)**
perceived_usefulness2	−0.106 (0.196)	−0.142 (0.207)	0.212 (0.225)	0.213 (0.233)
perceived_usefulness3	0.187 (0.225)	0.254 (0.235)	0.008 (0.269)	0.067 (0.277)
perceived_ease_of_use1	0.347 (0.207)+	0.482 (0.217)*	0.419 (0.246)+	0.509 (0.258)*
perceived_ease_of_use2	0.390 (0.219)+	0.459 (0.232)*	0.717 (0.284)*	0.803 (0.302)**
perceived_ease_of_use3	0.221 (0.192)	0.132 (0.201)	0.438 (0.207)*	0.351 (0.214)
compatibility1	0.086 (0.236)	0.128 (0.249)	0.072 (0.297)	0.071 (0.309)
compatibility2	0.186 (0.224)	0.254 (0.242)	−0.072 (0.263)	0.027 (0.279)
compatibility3	0.086 (0.208)	0.115 (0.216)	−0.436 (0.256)+	−0.463 (0.265)+
compatibility4	0.407 (0.198)*	0.396 (0.207)+	−0.014 (0.208)	−0.019 (0.215)
complexity1	0.253 (0.215)	0.264 (0.226)	0.082 (0.237)	0.084 (0.250)
complexity2	0.293 (0.199)	0.201 (0.206)	0.555 (0.226)*	0.607 (0.234)**
complexity3	0.070 (0.193)	0.059 (0.202)	−0.115 (0.211)	−0.173 (0.218)
complexity4	0.082 (0.207)	0.040 (0.217)	−0.342 (0.244)	−0.376 (0.251)
complexity5	0.160 (0.189)	0.134 (0.198)	0.240 (0.206)	0.273 (0.213)
complexity6	−0.431 (0.199)*	−0.312 (0.212)	−0.252 (0.216)	−0.176 (0.227)
management_sup1	0.271 (0.208)	0.359 (0.222)	0.263 (0.259)	0.361 (0.270)
management_sup2	0.563 (0.204)**	0.575 (0.215)**	0.258 (0.227)	0.170 (0.237)
adequate_res1	0.033 (0.211)	−0.038 (0.221)	−0.181 (0.252)	−0.193 (0.261)
adequate_res2	−0.053 (0.201)	−0.166 (0.213)	−0.149 (0.214)	−0.244 (0.222)
adequate_res3	0.581 (0.184)**	0.574 (0.191)**	0.813 (0.226)**	0.824 (0.230)**
adequate_res4	−0.206 (0.204)	−0.126 (0.210)	0.036 (0.217)	0.093 (0.224)
adequate_res5	0.199 (0.194)	0.132 (0.204)	0.549 (0.211)**	0.426 (0.219)+
environment_vend1	−0.319 (0.234)	−0.339 (0.244)	−0.108 (0.249)	−0.079 (0.255)
environment_vend2	−0.161 (0.21)	−0.108 (0.222)	0.120 (0.216)	0.115 (0.224)
environment_vend3	0.082 (0.195)	0.050 (0.204)	0.217 (0.210)	0.212 (0.218)
environment_vend4	0.093 (0.219)	0.020 (0.234)	−0.281 (0.257)	−0.307 (0.266)
environment_vend5	−0.051 (0.206)	0.032 (0.216)	0.154 (0.247)	0.162 (0.254)
policy1	0.368 (0.192)+	0.355 (0.203)+	0.047 (0.201)	0.057 (0.210)
policy2	0.308 (0.188)	0.274 (0.198)	0.079 (0.197)	0.132 (0.202)
policy3	−0.229 (0.195)	−0.159 (0.208)	−0.217 (0.196)	−0.181 (0.204)
competitive_pressure1	0.681 (0.189)**	0.752 (0.207)**	0.632 (0.225)**	0.641 (0.238)**
competitive_pressure2	−0.157 (0.199)	−0.070 (0.211)	−0.337 (0.198)+	−0.196 (0.206)
FR		0.145 (0.293)		0.395 (0.277)
UK		−0.144 (0.271)		0.155 (0.263)
GER		0.247 (0.293)		0.012 (0.285)
IT		1.138 (0.312)**		0.832 (0.271)**
JAP		−0.154 (0.296)		−0.102 (0.314)
USA		0.488 (0.302)		0.652 (0.257)*
_cons	−3.109 (0.404)**	−3.531 (0.482)**	−3.918 (0.482)**	−4.500 (0.571)**
N	487	487	487	487
Log Likelihood LL0	−334.22	−334.22	−306.89	−306.89
Log Likelihood LL	−187.56	−174.39	−208.94	−199.76

Note(s): Significance levels are: + $p < 0.1$; *$p < 0.05$; **$p < 0.01$

Table 4.
Marginal effects for the transformational and hyper-transformational groups

This means that the probability for a firm to be (hyper-)transformational increases as the perceived usefulness of CC moves from "Disagree" to "Completely agree". Therefore, from the perspective of the human dimension, a transformational company has to consider both cost optimization types, including maintenance and training and ubiquity of access related to CC. Firms need to pay attention to the ubiquity of CC services and a high level of adaptation of their human capital (with marginal costs). High-quality CC services go hand in hand with high-quality human capital.

We conclude that the results support hypotheses H1 and H2 for both groups. H1 is supported by the variable *perceived_usefulness1*. This means that, to be classified as transformational or hyper-transformational, a firm needs to use CC to improve task efficiency. Here, perceived usefulness is understood as the usefulness of CC in accomplishing tasks more efficiently. H2 is also supported for both groups, but with slightly different scope. Two variables were statistically significant for both groups, *perceived_ease_of_use1* and p*erceived_ease_of_use2*. This means that to be transformational or hyper-transformational, a firm needs to make effective use of their Internet connection, and benefit from the speed and the ubiquity of access offered by CC. For the hyper-transformational group, a third variable was also statistically significant: *perceived_ease_of_use3*. This means that for hyper-transformational group, the ability of employees to learn is an important factor in digital transformation.

4.2.2 The technological dimension. Here, we find different results depending on the dependent variable used. In models (1) and (2), two variables were statistically significant. The first is *compatibility4*, where change in the variable increases the probability by 40.7% in model 1, and 39% in model 2. The second was *complexity6*. As expectable, this variable has a negative effect and is only significant in model 1. These two variables are important as they reflect the autonomy of applications and a real understanding of how data could be used, especially given the heterogeneity of regulations at the international level.

In models (3) and (4), the two statistically significant variables are instead *compatibility3* and *complexity2*, for which the shift from "Disagree" to "Fully agree" leads to a decrease (increase) in the probability of a company being hyper-transformational by 43.6% and 22.6%, respectively. The negative sign of the first is somewhat unexpected, and means that hyper-transformational profile is not associated with the straightforward integration of CC into legacy infrastructure.

Therefore, H3 and H4 are supported, but by different variables in the two groups. This means that the conditions of data use are particularly relevant for the transformational group, while transfer issues dominate for the hyper-transformational group. From the technological point of view, both dimensions are critical for digitization. The looseness of applications is important for the transformational group, whereas the easiness of integration into existing infrastructure is important for the hyper-transformational one.

4.2.3 The organizational dimension. With respect to management and resources, two independent variables were significant at the 1% level for both models: *management_sup2* is significant in the first two models, while *adequate_res3* is significant in all four. Coefficients are relatively high for both variables, which suggests that CC is, above all, a management and resource issue. To be transformational, firms need clear and strong support from their top management, including in terms of budget.

In the last two models, besides *adequate_res3,* also *adequate_res5* was statistically significant. The marginal effects of these two variables are 0.813 are 0.549, respectively, suggesting that for the management dimension a unit change in these variables leads to an increase in the probability of the event by about 81.3% and 54.9%, respectively.

Therefore, the findings were again mixed. Only H5 is supported for the transformational group for the variable *management_sup2*, while it is rejected for the hyper-transformational group. This means that for the first group the involvement of the top management, especially with regard to risk, is essential, while this is not the case for the hyper-transformational group. This could suggest that risk-taking is already embedded in hyper-transformational firms.

H6 is instead fully supported: budgetary aspects are important for the two groups. One further variable is to be considered for the hyper-transformational group: the facilitation of the development of a shadow IT department.

4.2.4 The environmental dimension. Here, *policy1* is significant in the first two models, and *competive_pressure1* is significant in all models. These results indicate that government support has an important role to play in encouraging firms to deploy CC. This is probably through both facilitating standards and creating a suitable regulatory framework (Porter, 2011).

Moreover, *competive_pressure2* is significantly negative in model (3). This means that although hyper-transformational firms are insensitive to competitive pressures, they are probably the first movers in CC programmes. Finally, vendor support variables were not significant in either model.

We conclude that, for H7, the null hypothesis cannot be rejected for either group. This means that vendor support does not impact the likelihood of being transformational or hyper-transformational. It appears that companies do not need to rely on vendor support as a condition for their digital transformation.

H8 is instead supported for the transformational group for the variable *policy1*, while the null hypothesis cannot be rejected for the hyper-transformational group. This attests to the importance of governance policy for transformational but not hyper-transformational companies.

Finally, H9 is supported by the variable *competive_pressure1* for both groups. This attests to the role of CC as a competitive lever and in value creation (Bharadwaj *et al.*, 2013), and highlights its importance as a strategic resource.

5. Discussion

5.1 Hybridization of theories

Several scholars have called for the hybridization of theories, in order to understand the mechanisms underlying the adoption of digital artifacts (Venkatesh, Brown, & Sullivan, 2016). In line with these arguments, our model allows us to explain the transformational nature of CC. The model and its results expand upon research that sees organizational capital as a complement to investment in IT artifacts (Brynjolfsson, Hitt, & Yang, 2002).

5.2 Digitization and digital transformation

Bharadwaj *et al.* (2013) considered CC to be a key digital trend and called for a renewal of digital business strategy based on four axes: its scope, its scale, the speed of decision-making, and as a source of value creation and capture. While these scholars consider CC as an external factor, our research suggests that it is also a source of value creation and capture, notably from the perspective of organizational design and fit. Specifically, our research contributes to the characterization of the digital transformation by identifying its key factors: functionality, data management, roles and competences, control and culture, together with its four determining dimensions: human, technological, organizational and environmental. A second contribution is modelling value capture based on CC. Our work suggests that CC is more than a driving external factor; it is a transformational factor that should be embedded into firms' digital strategies.

5.3 Research into CC adoption

The adoption of IT technology has been a major field of research in IS, especially around the TAM model and its variations. For CC, in particular, several researchers have considered the issue of adoption from various angles, including the determinants of CC adoption in industries and services (Oliveira *et al.*, 2014), the issue of risk (August, Niculescu, & Shin, 2014), the evaluation of specific components of CC (Lee, Park, *et al.*, 2013), organizational design (Choudhary & Vithayathil, 2013) and dynamic capabilities (Iyer & Henderson, 2010;

Battleson, West, Kim, Ramesh, & Robinson, 2016). Our research contributes to the emerging field of research into CC adoption by examining the determining factors in four dimensions (human, technological, organizational and environmental) and analyzing their respective and relative importance for transformation. It therefore goes beyond the issue of adoption and makes a bridge with another important issue in IS research: digital transformation.

5.4 Organizational fit/capital

The research field of organizational design is undergoing a metamorphosis due to the ubiquity of digital technology. The question of organizational fit (Venkatraman, 1989; Burton & Obel, 2004; Soh *et al.*, 2000) has been studied in IS research notably in terms of enterprise systems. In particular, Soh *et al.* (2000) proposed taxonomy of misfits divided into several dimensions, including data and functions. Our research builds on this taxonomy and adapts it to the CC context. Furthermore, it provides the foundations for the identification and characterization of the key variables in organizational transformation. Our research indicates that these dimensions are key components of a company's organizational capital and complement CC as an IT artifact (Brynjolfsson *et al.*, 2002; Lev & Radhakrishnan, 2003).

6. Conclusion

Our research developed a framework for characterizing the organizational transformation of firms due to CC and identified its main determining factors. It proposed a hybrid model that articulates three models found in IS research: the TAM and TOE (for independent variables), and the organizational fit model (for the dependent variable). The model was used to develop nine hypotheses divided into four dimensions: human, technological, organizational and environmental. This research supplements previous work on CC adoption, and extends it to organizational fit. The results contribute to the emerging field of digitization and the transformation of companies by digital artifacts.

6.1 Managerial implications

Our research provides a framework for understanding the determinants of organizational transformation due to CC. For companies that seek to become transformational or even hyper-transformational, it indicates the key, determining factors. With respect to the human dimension, it shows the importance of perceived usefulness and perceived ease of use, notably with respect to the efficiency of CC and ubiquity of access. For the technological dimension, it highlights the importance of having a clear understanding of the conditions of data use (especially for large enterprises), and the fact that applications should be loosely coupled and independent. In terms of organizational aspects, top management support is important (at least for transformational companies) as is having adequate resources (with respect to the budget, for the transformational group, and a "shadow" IT department, for the hyper-transformational group). Finally, for the environmental dimension, vendor support appears as having no impact on becoming either transformational or hyper-transformational. Competitive pressure is another determining factor, while government policy is only somewhat important.

6.2 Limitations and future directions

While our study provides an overview of CC adoption factors and dimensions of organizational fit, there are some specific limitations. The first relates to the fact that the conclusions are based on survey data that mainly address the organizational dimension of CC. Further research should focus on other dimensions of value creation, such as products, services and digital business models. Another limitation is related to the technology, in

particular, the CC architecture. It would be interesting to identify the determinants of different CC technologies. Finally, country effects were only seen for Japan (for the transformational group) and Italy (for the hyper-transformational group). It would be interesting to document country-level specificities in more detail.

Notes

1. For a review of the origins of the TAM model and its evolution see Chuttur (2009).
2. The reliability of the survey questions has been tested via Cronbach's alpha tests, which indicated highly consistent and reliable measures.
3. Lightspeed GMI.
4. Specifically, this means: 4 positive changes for functionality; 3 positive changes for data management; 2 for competences; 2 for control and 2 for culture.
5. The marginal significance level corresponds to the probability of falsely rejecting the null hypothesis, the latter being equal proportions.

References

Abdollahzadehgan, A., Che Hussin, A. R., Gohary, M. M., & Amini, M. (2013). The organizational critical success factors for adopting cloud computing in SMEs. *Journal of Information Systems Research and Innovation*, *4*(1), 67–74.

Afzal, S., & Kavitha, G. (2019). Load balancing in cloud computing – A hierarchical taxonomical classification. *Journal of Cloud Computing*, *8*(1), 22.

Aissaoui, N., Haouari, M., & Hassini, E. (2007). Supplier selection and order lot sizing modeling: A review. *Computers and Operations Research*, Elsevier, *34*(12), 3516–3540.

August, T., Niculescu, M. F., & Shin, H. (2014). Cloud implications on software network structure and security risks. *Information Systems Research*, Informs, *25*(3), 489–510.

Baker, J. (2012). The technology–organization–environment framework. In Y. K. Dwivedi, M. R. Wade, & S. L. Schneberger (Eds), *Integrated series in information systems. Information systems theory* (pp. 231-245). New York, NY: Springer New York.

Battleson, D. A., West, B. C., Kim, J., Ramesh, B., & Robinson, P. S. (2016). Achieving dynamic capabilities with cloud computing: An empirical investigation. *European Journal of Information Systems*, Springer, *25*(3), 209–230.

Benbasat, I., & Barki, H. (2007). Quo vadis TAM?. *Journal of the Association for Information Systems*, *8*(4), 7.

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. V. (2013). Digital business strategy: Toward a next generation of insights. *MIS Quarterly*, *37*(2), 471-482.

Bhattacherjee, A., & Park, S. C. (2014). Why end-users move to the cloud: A migration-theoretic analysis. *European Journal of Information Systems*, Springer, *23*(3), 357–372.

Bloom, N., Genakos, C., Sadun, R., & Van Reenen, J. (2012). Management practices across firms and countries. *Academy of Management Perspectives*, Academy of Management Briarcliff Manor, NY, *26*(1), 12–33.

Brynjolfsson, E., Hitt, L. M., & Yang, S. (2002). Intangible assets: Computers and organizational capital. *Brookings Papers on Economic Activity*, JSTOR, *2002*(1), 137–181.

Burton, R. M., & Obel, B. (2004). *Strategic organizational diagnosis and design: The dynamics of fit*, (Vol. 4). New York: Springer Science & Business Media.

Chang, Y. B., Gurbaxani, V., & Ravindran, K. (2017). Information technology outsourcing: Asset transfer and the role of contract. *MIS Quarterly, Society for Information Management and The Management Information Systems*, *41*(3), 959–973.

Chou, D. C. (2015). Cloud computing: A value creation model. *Computer Standards and Interfaces*, Elsevier, *38*, 72–77.

Choudhary, V., & Vithayathil, J. (2013). The impact of cloud computing: Should the IT department be organized as a cost center or a profit center? *Journal of Management Information Systems*, Taylor & Francis, *30*(2), 67–100.

Chuttur, M. (2009), "Overview of the technology acceptance model: Origins, developments and future directions", Working Papers on Information Systems, pp. 9-37.

Daniel, S.L., Maruping, L. M., Cataldo, M., & Herbsleb, J. (2018). The impact of ideology misfit on open source software communities and companies. *MIS Quarterly*, *42*(4), 1069-1096.

Davis, F. D. (1985), *A technology acceptance model for empirically testing new end-user information systems: theory and results*. PhD Thesis. Massachusetts Institute of Technology.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340.

Davis, F. D. (1993). User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, Elsevier, *38*(3), 475–487.

El Sawy, O. A., Kræmmergaard, P., Amsinck, H., & Vinther, A. L. (2020). How LEGO built the foundations and enterprise capabilities for digital leadership. *In Strategic information management* (pp. 174-201). New York: Routledge.

Etro, F. (2015). The economics of cloud computing. *In Cloud technology: concepts, methodologies, tools, and applications* (pp. 2135-2148). Hershey, PA: IGI Global.

Fahey, L., & Narayanan, V. K. (1986). *Macroenvironmental analysis for strategic management*. St. Paul, MN: West Publishing.

Fahmideh, M., Daneshgar, F., Rabhi, F., & Beydoun, G. (2019). A generic cloud migration process model. *European Journal of Information Systems*, Taylor & Francis, *28*(3), 233–255.

Garg, S. K., Versteeg, S., & Buyya, R. (2013). A framework for ranking of cloud computing services. *Future Generation Computer Systems*, Elsevier, *29*(4), 1012–1023.

Godse, M., & Mulik, S. (2009). An approach for selecting software-as-a-service (SaaS) product. In *2009 IEEE International Conference on Cloud Computing*, (pp. 155–158). IEEE.

Guo, Z., & Ma, D. (2018). A model of competition between perpetual software and software as a service. *MIS Quarterly, Society for Information Management and The Management Information Systems*, *42*(1), 101–120.

Iyer, B., & Henderson, J. C. (2010). Preparing for the future: Understanding the seven capabilities cloud computing. *MIS Quarterly Executive*, *9*(2), 117-131.

Jones, M. R., & Karsten, H. (2008). Giddens's structuration theory and information systems research. *MIS Quarterly*, *32*(1), 127-157.

Khajeh-Hosseini, A., Greenwood, D., Smith, J. W., & Sommerville, I. (2010). The cloud adoption toolkit: Addressing the challenges of cloud adoption in enterprise. ArXiv:1003.3866 [Cs]. Available from: http://arxiv.org/abs/1003.3866 (accessed 4 May 2022).

Lang, M., Wiesche, M., & Krcmar, H. (2018). Criteria for selecting cloud service providers: A Delphi study of quality-of-service attributes. *Information and Management*, Elsevier, *55*(6), 746–758.

Lee, S., Park, S. B., & Lim, G. G. (2013). Using balanced scorecards for the evaluation of 'software-as-a-service'. *Information and Management*, Elsevier, *50*(7), 553–561.

Lee, S.-G., Chae, S. H., & Cho, K. M. (2013). Drivers and inhibitors of SaaS adoption in Korea. *International Journal of Information Management*, Elsevier, *33*(3), 429–440.

Lev, B., & Radhakrishnan, S. (2003). *The measurement of firm-specific organization capital, no. w9581*. Cambridge, MA: National Bureau of Economic Research. doi: 10.3386/w9581.

Li, W., Wu, J., Cao, J., Chen, N., Zhang, Q., & Buyya, R. (2021). Blockchain-based trust management in cloud computing systems: A taxonomy, review and future directions. *Journal of Cloud Computing*, SpringerOpen, *10*(1), 1–34.

Lian, J. W., Yen, D. C., & Wang, Y. T. (2014). An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan hospital. *International Journal of Information Management*, Elsevier, *34*(1), 28–36.

Lin, A., & Chen, N.-C. (2012). Cloud computing as an innovation: Attitude, and adoption. *International Journal of Information Management*, Elsevier, *32*(6), 533–540.

Lin, J., Carter, L., & Liu, D. (2021). Privacy concerns and digital government: Exploring citizen willingness to adopt the COVIDSafe app. *European Journal of Information Systems*, Taylor & Francis, *30*(4), 389–402.

Low, C., Chen, Y., & Wu, M. (2011). Understanding the determinants of cloud computing adoption. *Industrial Management and Data Systems*, *111*(7), 1006-1023.

Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J., & Ghalsasi, A. (2011). Cloud computing – The business perspective. *Decision Support Systems*, Elsevier, *51*(1), 176–189.

Martens, B., Walterbusch, M., & Teuteberg, F. (2012). Costing of cloud computing services: A total cost of ownership approach. In *2012 45th Hawaii International Conference on System Sciences* (pp. 1563–1572). IEEE.

Mell, P., & Grance, T. (2011). *The NIST definition of cloud computing*. Computer Security Division, Information Technology Laboratory, NIST Special Publication 800–145. Gaithersburg, MD: National Institute of Standards and Technology.

Mendling, J., Pentland, B. T., & Recker, J. (2020). Building a complementary agenda for business process management and digital innovation. *European Journal of Information Systems*, *29*(3), 208-219.

Naldi, M., & Mastroeni, L. (2016). Economic decision criteria for the migration to cloud storage. *European Journal of Information Systems*, Springer, *25*(1), 16–28.

Nkhoma, M. Z., Dang, D. P., & De Souza-Daw, A. (2013). Contributing factors of cloud computing adoption: A technology-organisation-environment framework approach. In *Proceedings of the European Conference on Information Management & Evaluation*, (pp. 180–189).

Oliveira, T., & Martins, M. F. (2010). Understanding e-business adoption across industries in European countries. *Industrial Management and Data Systems*, *10*(2010), 1337-1354.

Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information and Management*, Elsevier, *51*(5), 497–510.

Porter, M. E. (2011). *Competitive advantage of nations: creating and sustaining superior performance*. New York: Simon and Schuster.

Premkumar, G., & Roberts, M. (1999). Adoption of new information technologies in rural small businesses. *Omega*, Elsevier, *27*(4), 467–484.

Rogers, E. M. (1995). *Diffusion of innovations*, (Vol. 12). New York: Free Press.

Sabherwal, R., Sabherwal, S., Havakhor, T., & Steelman, Z. (2019). How does strategic alignment affect firm performance? The roles of information technology investment and environmental uncertainty. *MIS Quarterly, Society for Information Management and The Management Information Systems*, *43*(2), 453–474.

Safari, F., Safari, N., Hasanzadeh, A., & Ghatari, A. R. (2015). Factors affecting the adoption of cloud computing in small and medium enterprises. *International Journal of Business Information Systems*, *20*(1), 116.

Schneckenberg, D., Benitez, J., Klos, C., Velamuri, V. K., & Spieth, P. (2021). Value creation and appropriation of software vendors: A digital innovation model for cloud computing. *Information and Management*, *58*(4), 103463.

Silva, L. (2007). Post-positivist review of technology acceptance model. *Journal of the Association for Information Systems*, *8*(4), 11.

Soh, C., Kien, S. S., & Tay-Yap, J. (2000). Enterprise resource planning: Cultural fits and misfits: Is ERP a universal solution? *Communications of the ACM*, ACM New York, NY, *43*(4), 47–51.

Tornatzky, L. G., & Klein, K. J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, IEEE, (1), 28–45.

Tornatzky, L. G., Fleischer, M., & Chakrabarti, A. K. (1990). *Processes of technological innovation*. Lexington, KY: Lexington books.

Trenz, M., Huntgeburth, J., & Veit, D. (2018). Uncertainty in cloud service relationships: Uncovering the differential effect of three social influence processes on potential and current users. *Information and Management*, Elsevier, *55*(8), 971–983.

Tuli, S., Tuli, S., Tuli, R., & Gill, S. S. (2020). Predicting the growth and trend of COVID-19 pandemic using machine learning and cloud computing. *Internet of Things*, Elsevier, *11*, 100222.

Venkatesh, V., & Davis, F. D. (1996). A model of the antecedents of perceived ease of use: Development and test. *Decision Sciences*, Wiley Online Library, *27*(3), 451–481.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly*, *13*(1), 157-178.

Venkatesh, V., Brown, S. A., & Sullivan, Y. (2016). Guidelines for conducting mixed-methods research: An extension and illustration. *Journal of the AIS*, *17*(7), 435–495.

Venkatraman, N. (1989). The concept of fit in strategy research: Toward verbal and statistical correspondence. *Academy of Management Review*, Academy of Management Briarcliff Manor, NY, *14*(3), 423–444.

Yoo, S.-K., & Kim, B.-Y. (2018). A decision-making model for adopting a cloud computing system. *Sustainability, Multidisciplinary Digital Publishing Institute*, *10*(8), 2952.

Corresponding author
Ahmed Bounfour can be contacted at: ahmed.bounfour@universite-paris-saclay.fr