Cloud Computing Adoption in Italian SMEs: A Focus on Decision-making and Post-implementation Processes

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Abstract Cloud computing is an emerging model in which machines in large data centres can be used to deliver services in a scalable manner. It allows firms to receive the same internal ICT structure with lower costs and a higher degree of flexibility. With this technology come many disadvantages that can have a major impact on the information and services supported by this technology. This chapter pursues two related aims. First, it investigates the decision-making process of implementing cloud computing by highlighting the drivers and ICT requirements of SMEs. Then, it examines the effects following the migration of the ICT system from an in-house data centre to a cloud-based service. We found specific drivers and ICT requirements, suggesting the implementation of cloud computing in SMEs to oversee specific issues. Moreover, our findings show that the advantages arising post-implementation confirm the expectations created by the management during the decision-making process; meanwhile, at least in the short term, no disadvantages arose.

Keywords Cloud computing • Decision-making process • ICT • Post-implementation process

1 Introduction

The persisting crisis within the Italian manufacturing industry reflects the difficulties that domestic enterprises have encountered in adapting to the external changes that have affected the international economic environment over the past 20 years [1]. The country was unprepared for globalisation and the technological changes that increased competitive pressures on a global scale [2]. The main reasons behind such difficulties relate to a lack of innovation within the country in information and communication technology (ICT) [1–4].

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The dissemination of information systems is usually regarded as a crucial element to guarantee the fast data processing and circulation of information, which in turn favours the creation and maintenance of competitive advantage [4, 5]. Market pressure, cost optimisation and increased productivity appear to be the guidelines that firms adopt to ensure their survival. It seems necessary to adopt an ICT framework that can reduce (fixed and variable) administrative costs and ensure increased productivity while maintaining a flexible structure and enabling a rapid response to market needs [4–7].

According to practitioners, one technology with the potential to solve this problem could be cloud computing [8, 9]. Cloud computing is a distributed computing paradigm that enables access to virtualised resources, including computers, networks, storage, development platforms and applications [10]. These resources can be unilaterally requested, provisioned and configured by the user with minimal interaction with the cloud provider. Furthermore, resources can be rapidly scaled up to meet the user's needs, thus creating the illusion of infinite resources available at any time [11]. Also, resource utilisation can be rapidly measured and controlled by customers because this technology is based on a pay-per-use model [12]. With the support of important industry stakeholders (e.g. Google, Amazon, Microsoft), cloud computing is being widely adopted in different domains. Cloud services such as Google Mail or Dropbox have become everyday useful tools for millions of people. Many firms currently use cloud-based applications (i.e. Salesforce), and small and medium firms are embracing virtual infrastructures offered by cloud service providers (CSP) such as Amazon Web Services (AWS) or Microsoft Azure [13]. The advantages arising from adopting cloud computing are indubitable [14–16]. According to the European Commission (2010) and to Microsoft (2011), this tool could provide many advantages, especially for small and medium enterprises (SMEs). Many authors have broadly identified the strengths associated with the use of cloud computing [13–18], investigating the advantages and disadvantages for firms arising from its adoption. They concluded that cloud computing can be a great opportunity, especially for SMEs; however, these authors identified the advantages and the disadvantages arising from cloud computing without providing any information about the decision-making process that pushes firms to adopt cloud computing and without examining the post-implementation effects to verify whether the expected advantages and disadvantages are confirmed. Therefore, we address these under-investigated issues by pursing the following two aims: (1) investigating the decision-making process of implementing cloud computing by highlighting the drivers and ICT requirements of SMEs and (2) examining the effects of the system 6 months after migration to the ICT system. To reach our aims, we use a multiple case study method. This method allows us to study the information systems in the field, helping us to understand the complexity of the decision-making and implementation process.

We examine three Italian SMEs. Italy is a technologically backward country; indeed, a report published by the Bank of Italy [1, 2] reveals that Italian firms, when compared with their European competitors, show a strong technological gap, and their business is therefore penalised in the competition arena. In this regard, the

Italian government published a 'Digital Agenda' in 2011 encouraging firms to adopt new technologies. According to the document, cloud computing could be a main actor in the Italian technological revolution. Hence, the three Italian SMEs investigated in this chapter could better provide a picture of choosing to implement cloud computing and of the effects following the migration process, which should reveal the benefits.

The remainder of the paper is organised as follows. Section 2 reviews the literature about cloud computing adoption. Section 3 focuses on the research design. Section 4 presents the case studies on three Italian SMEs. Section 5 discusses the results of this study. Section 6 provides concluding remarks.

2 The Extant Literature on Cloud Computing Decision-making and Implementation Processes

The first definition of cloud computing can be found in the document 'Definition of Cloud Computing', which was published by the US National Institute of Information Technology (NIST) [10]. It refers to this technology as 'a network model that allows access to a set of shared information across computing resources (e.g. servers, storage, applications, services) that can be rapidly provided by a provider' [1]. This report also identifies its characteristics, distribution models and architecture, shedding light on the high degree of flexibility, elasticity and cost savings that result from adopting this technology. This view of cloud computing is widely accepted by many authors [8, 14, 15, 19–22]. Indeed, extant literature agrees upon describing cloud computing as a set of technologies that enable, store and process data using hardware and/or software that is distributed and made available virtually on the Internet [23]. Qualified suppliers provide these services to users through a set of technologies and information resources that are available online [24].

The literature on this topic is still limited, and few papers have been published recently. According to Yang and Tate [25], the studies on this topic can be divided into four areas: technology (regarding performance, network, data management), business economics (cost–benefit analysis, market analysis, risks, legal issues), applications (engineering studies) and general studies (non-empirical studies regarding introduction and implementation).

Primitive studies on cloud computing are strictly theoretical. Many authors provided their own definition of cloud computing and highlighted the enormous benefits that this tool could provide to businesses, supporting its adoption [8, 14, 15, 19–22, 26]. The following table compares the definitions of cloud computing found in the literature (Table 1).

According to some authors [19, 20], cloud computing is not a new technology, but instead it is a new use of virtualisation and grid computing. Vouk [22], Plummer et al. [8] and Vaquero et al. [23] do not accept this definition; instead, they define

Table 1 A comparison between different definitions of cloud computing

Definition	Author/s
'Cloud is a pool of virtualised computer resources'.	Boss, Malladi, Quan, Legregni and Hall [20]
'Cloud computing is not a fundamentally new paradigm. It draws on existing technologies and approaches, such as utility computing, software-as-a-service, distributed computing, and centralized data centers. What is new is that cloud computing combines and integrates these approaches'.	Weiss [21]
'A type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service level agreements established through negotiation between the service provider and consumers'.	Buyya [14]
'Cloud computing embraces cyber-infrastructure and builds on virtualization, distributed computing, grid computing, utility computing, networking, and Web and software services'.	Vouk [22]
'A style of computing where massively scalable IT-related capabilities are provided as a service across the Internet to multiple external customers'.	Plummer, Smith, Bittman, Cearley, Cappuccio and Scott [8]
'A large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the infrastructure provider by means of customized SLAs'.	Vaquero, Rodero-Merino, Caceres and Lindner (2009) [23]
'A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction'.	Mell and Grance [10]
'The illusion of infinite computing resources available on demand, the elimination of up-front commitments by cloud users, and the ability to pay for use of computing resources on a short-term basis as needed'.	Armbrust, Fox, Griffith, Joseph, Katz and Konwinski [15]

cloud computing as a new technology. The NIST argue that the difference between cloud computing and other existing technologies is not merely linked to the attribute of virtualisation, but it is primarily about customisation and the possibility of getting 'on-demand' service. Thus, the main difference between cloud computing and other existing technologies is related to its different business model [10]. All of the aforementioned studies provide a theoretical vision of the benefits, costs and risks associated with this tool. Following the increasing level of adoption

of the instrument has allowed other authors to empirically demonstrate the benefits, limitations and problems arising from the adoption of cloud computing in enterprises. In 2009, Rosenthal et al. [27] provided a practical approach for cloud computing implementation by empirically analysing the benefits generated by this technology for the 'biomedical informatics (BMI) community'. In the same period, Velte et al. [28] provided a detailed guide to SMEs' and large firms' migration to the cloud computing system using the case study method. This study highlighted firms' motivations for adopting cloud computing and the difficulties they encountered with its implementation. Hosseini et al. [29] conducted a similar study that analysed the risks and rewards of migration to a cloud-based system by interviewing the end users of a firm in the energy sector. The results showed that cloud computing is potentially able to reduce firms' operating costs. More specifically, they found a reduction of 37 % in ICT costs and a reduction of 21 % of maintenance actions. However, the study also highlighted some significant drawbacks, such as loss of customer confidence, loss of control of data, employees' resistance to changing their routines and transfer costs. Sultan [16] conducted a study based on the application of cloud computing in businesses. More specifically, the author identified the organisational and economic benefits generated by the introduction of this tool in an English medium-sized enterprise in the computer industry. The author pointed out that after cloud computing introduction, the costs of the ICT function were reduced by approximately 80 % (it is important to highlight that the employees were reallocated and the previous ICT structure was sold). This study stresses that this instrument is not suitable for all SMEs because the convenience of its usage depends on the size of the ICT structure, the costs the structure has already incurred (and that cannot be eliminated), the security costs and the degree of risk that the firm's management is willing to accept. Based on these studies, other authors have verified the benefits and disadvantages of adopting cloud computing in SMEs [30–35], emerging markets [36, 37], banks [31, 38], the public sector [39–41], the health-care sector [27, 36, 42, 43] and other relevant sectors [35, 44, 45].

In all of the cited cases, cloud computing is regarded as an important solution to corporate networks' problems. That being said, this tool has important drawbacks. Indeed, while providing a number of benefits not achievable with other technologies, it also creates a number of risks that are 'typical' of the outsourcing of ICT function. Therefore, it is necessary to find a proper method of implementation that balances the disadvantages and advantages to determine when the cloud may be an optimal answer to a firm's needs [16, 46].

However, cloud computing has many weaknesses that must be considered before its adoption, many of which have been covered in the literature. For example, the introduction of cloud computing in business contexts requires redesigning and adapting internal control systems due to the existence of potential dangers, especially those related to the loss of data control within the cloud. In a recent document, the NIST argued that cloud computing, as with any emerging technology, is inappropriate for the majority of firms due to 'open issues' [1]. According to several authors (i.e. [47, 48], there are five open issues that present challenges to the

efficient implementation of cloud computing. The first is computing performance, as different applications within the cloud may require different levels of performance, which in turn requires increasing costs or decreasing system efficiency. Of course, this issue is not exclusively a cloud computing problem [13, 49, 50]. The second issue is cloud reliability, which relates to the alignment of various factors, such as the hardware and software offered by a provider to employees within firms. A cloud solution depends on many factors in terms of the degree of reliability within an environment [13, 51–54]. Third, economic goals can face challenges due to the openness of cloud computing. While cloud computing offers the opportunity to outsource the ICT function, which can come with economic benefits, it also has many disadvantages. The fourth open issue relates to compliance. Many authors have stated that cloud computing providers are in the best position to enforce compliance rules; this can increase disadvantages for end users [26, 49, 54]. The final issue with cloud computing openness highlighted in the literature relates to information security. Moving data into the cloud means potentially losing control of it, which could create many problems in terms of data security and privacy [13, 15, 49, 51–53, 55–57]. Leaving aside the issues of control and the disadvantages related to the adoption of the instrument, as they are beyond the scope of this work, more in-depth study of what motivates firms to migrate to cloud technology is still required. Specifically, it is important to define advantages as the benefits that a firm should expect to achieve.

The literature identifies five major benefits of cloud computing adoption: reduced costs, increased storage, high automation, flexibility, greater mobility and less focus on ICT function. The most immediate for users is certainly cost reduction. Customers pay for a cloud service that is completely customisable and modelled on the firm's real needs. Thus, it is not yet necessary to support large investments in infrastructure. Related to this, there is another advantage resulting from the adoption of this tool: increased storage. The firm can benefit from external memory that is always available to store its data. Another benefit is high automation. Firms that adopt this tool do not require employees in data centres for data backup and control because these tasks are delegated to the provider. This allows firms to become more flexible. The cloud is customisable depending on the changing needs of the customer. The possibility of changing at every moment, and to obtain economies of scale, is the basis of the competitiveness of the cloud. Accessibility from any location provides greater mobility—customers can access their data at any time and from any location, facilitating multinational firms [14, 15].

The literature identifies a number of disadvantages or problems that may arise following the implementation of cloud computing. Specifically, a disadvantage is defined as the charge (not necessarily financial) that the firm has to bear to use a certain technology. The disadvantages discussed in the literature relate to reliability [13, 51–53], economic objectives [13–15, 58], low level of compliance [26, 49, 57] and difficulties of adaptation, performance and data security [13, 15, 49, 51–53, 55, 57]. Below, the reasons for some authors' misgivings about the use of such technology are given.

The first misgiving regards reliability. Several authors [13, 51–53] highlighted problems related to the capacity of the facilities offered by the provider to ensure stable performance over time.

As regards the economic objectives, the literature is clear that, despite that cloud computing offers the opportunity to outsource ICT, there are numerous disadvantages that must be mitigated, which requires incurring additional costs and reducing the convenience of this tool [13–15, 58, 59]. Another point discussed by several authors concerns the degree of compliance. Indeed, the provider is in a good position to enforce the rules of conformity, and this is a limitation for the firm (or at least it makes the control less effective) [26, 49, 57].

A further critical issue identified by several authors is the level of performance. The performance of a cloud network does not depend only on the model chosen, but also on the state of the network and the software that is used. Often, the use of applications other than those supplied by the provider may cause compatibility issues, lowering performance. However, this kind of problem is common to many technological solutions [13, 49, 50]. One of the most discussed topics is data security. Moving data within the cloud can create problems in terms of the firm's security and privacy [13, 49, 51–53, 55–57].

Despite these disadvantages, several authors stated that cloud computing is a technology that is potentially able to provide a competitive advantage to businesses when it is properly adopted and implemented [49, 51–53]. In the light of this literature, in a context in which the technology is revealed as the most appropriate instrument to ensure the flexibility, efficiency and effectiveness to the ICT function, it appears necessary to examine the reasons that cause firms to adopt (or not adopt) cloud computing.

3 Research Design

In order to achieve our objectives, we opted for a qualitative analysis using the multiple case study method, which allowed us to explore and compare the nature of the decisions between different sectors [60–64]. The multiple case study method has been widely adopted in the ICT field [62, 65–70]. The motivation behind the massive use of this method is certainly conducive to not limiting the research to a single sector, analysing the benefits in several areas and highlighting similarities or differences for end users. Specifically, according to Yin [71, 72], multiple case studies are more appropriate when the aim is to examine contemporary events and when it is not necessary to control behavioural variables. The author points out that this method is appropriate if the goal of the research is to describe the same phenomenon in different moments or to test its replicability. Also, observing multiple cases allows researchers to confirm emerging constructs and propositions [65, 71, 72], making the results more robust and generalisable [73]. According to Benbasat et al. [65], with multiple case study designs, researchers are able to study information systems in the field, understanding the complexity of a particular

process, learning the state of the art, generating theories on its practical aspects and enriching their field of study with knowledge contributions.

To enrol cases in the study, we chose Italian SMEs that began using cloud computing within the same period as each other and that operate in different sectors. The decision to select organisations belonging to different sectors is not casual; indeed, it could allow us to shed light on the different motivations firms have for adopting cloud computing, the implementation steps and the advantages and disadvantages of this technology. To prepare for data gathering, to familiarise ourselves with practitioners' perspectives and to identify organisations that have implemented cloud computing in recent years (a very rare phenomenon for Italian SMEs), we interviewed five different cloud provider experts (three ICT consultants and two practitioners) in the fall of 2011. We also used the informal network that our department belongs to as another source to identify potential case study organisations. We approached many contacts during congresses, workshops and seminars where organisations presented their new ICT systems based on cloud computing. Table 2 lists the names of the organisations, their respective sectors, the number of respondents and the number of interviews conducted. We use nicknames for each organisation to protect their privacy.

For each firm, we interviewed the CEO, the head of ICT (or the person in charge of risk management and ICT processes) and, where possible, the end users. The choice of these subjects is not accidental. While the former are persons who directly or indirectly participate in the final decisions, end users are actually affected by the change in the firm. In some cases, it was possible to interview representatives of the provider to which firms have turned in order to verify the effective exchange of information between the various actors involved in the process.

Furthermore, this analysis takes into account both endogenous and exogenous variables, using internal sources (interviews with managers and internal documents that are usually not accessible to the public) and external sources (reports published by the firm, newspaper articles, other firm publications). However, the primary sources of information were the interviews with the CEOs, who were considered to be the decision-makers.

In order to capture more detail and data, the interviews were conducted using a semi-structured questionnaire consisting of nine questions. The goal was to obtain information about firms' preliminary analyses that prompted them to choose a

Table 2 Firms investigated

Enterprise nickname	Sector	Number of internal interviews	Number of external interviews	Total number of interviews
Alfa Home	Household goods	3	0	3
Beta Insurance	Insurance	2	1	3
Omega Tech	Education	3	1	4

cloud-based system as well as to determine the actual advantages and disadvantages arising from its adoption a few months after the system had been fully implemented.

It is worth noting that the questions acted merely as a guideline, as they included a number of key issues to be discussed during the interview rather than represented binding questions to ask respondents. The interviews were recorded and later transcribed for our analysis. Moreover, when the interviews seemed to be incomplete, we asked the respondents for telephonic integrations. In order to avoid individual bias (i.e. the possibility that a single researcher is influenced in some way, falsifying the results of the study), the interviews were conducted by a team of three researchers who defined the key themes for the interviews. At least two members of the group were involved in every interview. The interviewers consulted several internal documents regarding ICT function and any details that might help them to determine the cost of the function, supporting the respondents' answers. Immediately after the interviews, each researcher transcribed the recordings. The researchers organised the interviews chronologically, discussing the transcripts and summarising the data and opinions around the concepts of expected benefits, adoption motivations and the actual benefits from adopting cloud computing.

The questionnaire was based on a theoretical framework derived from the literature. Many authors assume that there are internal and external drivers that explain cloud computing adoption [8, 14, 21, 31, 38]. Internal pressures include cost pressure and increased productivity, whereas external pressure is mainly related to market pressure. These drivers generate different requirements. Cost pressure creates the need to transform fixed costs into variable costs to ensure better flexibility [14]. With reference to productivity requirements, the literature highlights that firms need speed, flexibility, scalability, security, cost-effectiveness and transparency [13, 51–54]. Further, market pressure creates the need to change the business model to consolidate on existing markets [14, 35]. In many cases, after a deep analysis of the firm's ICT needs, management identifies cloud computing as the best solution. However, previous literature analysing the drivers and the ICT requirements to justify the adoption of a new technology does not verify the post-implementation effects. Therefore, we enrich our framework and analyse the implementation steps, paying particular attention to the phases of cloud introduction and its impact on firms. This allows us to investigate whether there are any similarities in cloud computing implementation between firms operating in different sectors. Then, we investigated the effects arising from this technology adoption a few months after its full introduction to understand if this tool can really provide economic advantages to Italian SMEs (Fig. 1).

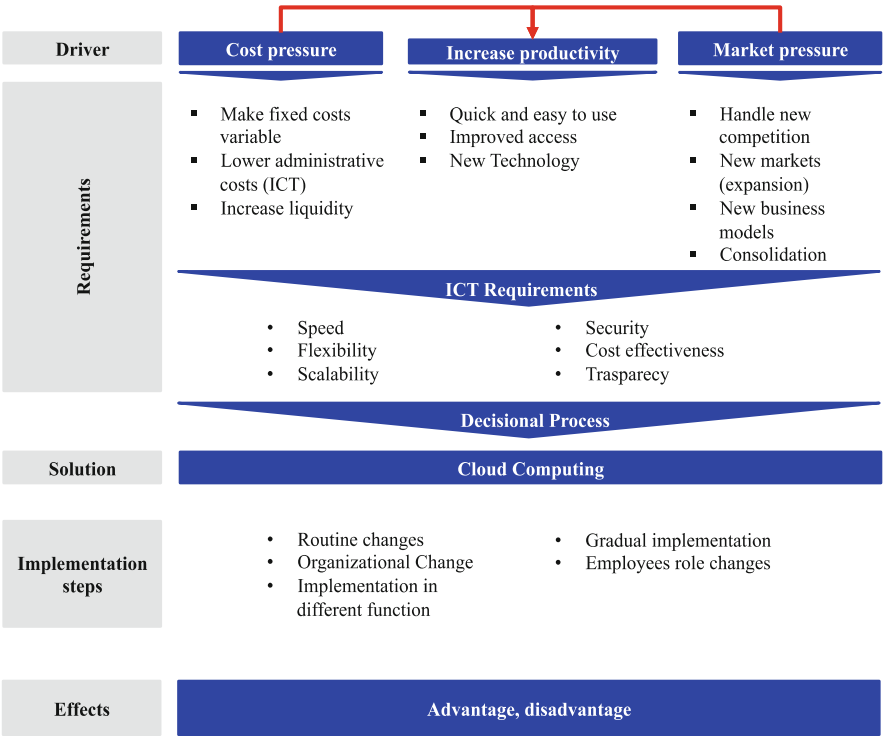

Fig. 1 Framework used to analyse the decision-making process and the post-implementation effects

4 The Multiple Case Study

In this section, we provide evidence on the use of cloud computing in three Italian SMEs.

4.1 Alfa Home

The firm Alfa Home engages in the distribution of household items. Alfa is the largest chain of shops providing products for the home and for wedding registries in Italy, with more than 180 stores in 18 Italian regions.

The constant evolution of the brand and its development created many organisational complications that have caused the widespread loss of efficiency. The main problem with the ICT function was that it was unable to respond quickly to environmental changes, maintaining a good degree of cohesion between the various business functions. These limits reached a peak in 2011 as a result of the

financial crisis. In this period, in response to external stress, the management imposed cost rationalisation on the organisation, posing a series of questions to the ICT department. The aim was to combine the communication problems between the different stores (generated by the incompatibility of data, documents and reports) that prevented the firm from obtaining a global vision and reducing costs.

The best solution seemed to be to integrate the stores' software, but in the short term, this generated additional costs (many licences had already been bought, and the servers were old), resistance from staff and other implementation issues typical of change [74, 75]. In addition, the managers, in accordance with the ICT function, looked for a solution that would allow them to integrate the digital e-commerce platform, thus ensuring lower costs, the immediate availability of information, flexibility and scalability. Historically, Alfa has always implemented the latest technology—it was one of the first firms to introduce the Enterprise resource program (ERP) system (based on Microsoft Dynamics) as well as systems for data analysis (Microsoft SQL Server).

> We needed something that would allow management to integrate the already used systems without losing time in employees formation. Our servers were old and we could not concentrate all servers in our headquarters because we would have had to bear huge investments in that historical moment were prohibitive.

The solution to all of these problems was found in cloud computing. The management explained that they implemented cloud computing in 2011 when it became necessary to replace the firm's e-mail platform; they switched to a Microsoft Exchange cloud-based solution. Initially, e-mail was the only function for which it was used. The reasons for outsourcing the mail server included the following: the wish to discontinue managing the servers internally (i.e. on the premise), breaking free from maintenance and disaster recovery problems and the significant increase in space for the mailbox/user. The initial results were positive, and the management began considering total migration to the cloud:

> We have to delete old servers, so we carried out a feasibility study and a cost-benefit analysis. All our tests could be reduced to the most classic of economic problems: "Make or buy".

The initial analysis required the involvement of numerous business functions such as ICT, sales, marketing and finance. Its convenience was immediately apparent, rationalising the business processes (order management of the stores, warehouse management of the stores, etc.). After a lengthy discussion between the CEO and the head of ICT, they decided to optimise the management processes by shifting from the old solutions (the physical servers) to virtual servers in the cloud.

In order to reduce the impact of these decisions, the migration was not performed immediately but instead was done in stages. First, the management addressed the choice of cloud provider. They chose Microsoft Azure, which solved their problems with data storage uniformity and allowed all of the shops in the franchise to benefit from a version of Office by sharing documents on a single platform. Next, a hybrid cloud solution using more than 20 virtual machines in Microsoft Azure

(Infrastructure as a Service) for the definition of highly reliable infrastructure for federation with Microsoft Office 365 was integrated. This farm was based on IaaS, deployed with a Microsoft SharePoint 2013 server farm in hybrid configuration with Microsoft Office 365.

> We have also implemented a farm of more than 15 servers on Microsoft Azure, for the use of our portal community, but also for the federation of the Dominion firm with Office365, along with the replica of the entire structure on Cloud AD (Domain controller, ADFS, DirSync) and as a result of the good results, was introduced the entire platform of Office365, complete with Lync Online, Sharepoint, OneDrive for Business and Yammer.

The CEO emphasised that the adoption required consistent effort on the part of the management. The implementation strategy was designed to avoid or at least minimise the impact of changes on the end users (employees). The idea was that the less the end users saw the change, the less the firm would suffer. Also, for this reason, it was decided that the firm would adopt a platform with graphical user interfaces similar to the previous platform and that it would be integrated with the software already in use. The first implementation was a success, and management has begun using the cloud for more and more functions.

> As explained before, we divided the adoption of the Cloud in steps. In order of time, our last operation is the backup of ERP databases on Cloud, as remote disaster recovery.

The adoption of this technology has led to at least three advantages and three disadvantages. First, the reduced reliance upon machines gave rise to a sharp reduction in maintenance costs and energy usage. Another advantage was the high flexibility that allowed users to easily increase or decrease their resources as needed. Finally, the canon of the cloud represents a certain and tractable cost that can be fully expensed in the year without the need for capitalisation.

> This helps to improve certain business ratios of significant importance for society such as ours.

On the other hand, three disadvantages are attributable to the lack of control of the infrastructure, the strong dependence on the internet to use the services and the higher costs from the monthly fee. Nevertheless, it is possible to quantify the savings resulting from the use of the cloud: the firm spent 30 % less than it did previously.

Concerns about security management were not present:

> I believe that reliability and safety are adequate.

Specifically, the directors felt confident relying on structures (or providers) with proven expertise and authority. The effectiveness of internal security policies contributes to the robustness of the system:

> The Cloud is the future of our firm? I would say it will be absolutely the protagonist in the future, as it is already present.

4.2 Beta Insurance

The Beta Insurance Group is an Italian mutual insurance firm. The success of the enterprise is directly connected to an advanced infrastructure network—in fact, the management stated that they have always adopted expensive ICT solutions but that they were not necessarily at the vanguard. Therefore, the ICT function was seen as something 'extra'—a lot of tools that were necessary for the customers' value creation but only sometimes useful for internal process simplification (management practices, quick searches, etc.). Thus, all of the costs arising from this function were seen as 'a necessary effort' in order to reach the firm's final aims.

However, in 2011, the difficulties of the socio-economic context influenced the firm's growth objectives and its methods to reach these objectives. The management had to choose between a 'pure cost reduction' (cutting expenses) and a strategy to increase market share. The managers' idea was to redesign the strategy, adapting to the environmental changes and moving ahead of competitors. Unfortunately, redesigning a strategy representing one of the keys to success in a context characterised by the objective of 'efficiency' is also important to limit the costs of carrying out internal operations and ICT function. So, in the event of a transfer to new headquarters and with the aim of aligning their infrastructure services to the objectives of growth and innovation dictated by business lines, Beta launched an outsourcing project for its technological infrastructure. The main reason for this was to find greater agility, cost optimisation, service continuity and effectiveness response. Despite the great advantages that emerged in the analysis step, the management was sceptical, so the first implementation included just the creation of a secondary backup site aiming to avoid disaster recovery problems. This project outsourced the data centre and represented an opportunity for a radical technological renewal: the firm has gone from 'homemade' solutions to many services provided by a 'carrier class' provider and aligned to the newest technology. The technology upgrade is guaranteed by the cloud service provider for the entire contractual life (7 years) with the same costs. After the first migration, the management asked the same provider to activate a new primary site, transferring the secondary site to another city:

> When we implement a new technology we always are cautiously. There is always a strong scepticism about what is new and the people are afraid of changes...but when it was necessary to deploy new servers for backups, we said "Why not?" And then we tried.

With this implementation, the management avoided any problems with disaster recovery, but there were still several operational duties inherent in the ICT function (i.e. extending service availability to 24/7, increasing flexibility in relation to the demands of the business lines, introducing a logic of service level agreements [SLA] both internally and externally, constant innovation and openness to mobile services).

In the same year, based on the new strategic lines, the management started to renovate the firm's ICT function. The ICT manager created a study group in order

to compare the different technological possibilities offered by the market with the goal of maintaining a defined and predictable ICT budget:

> We needed a service that could be 24×7, which would guarantee at the same time operational simplicity and flexibility.

For each technology, management carried out a cost–benefit analysis and a technological analysis. After a few months, a preliminary report identified the cloud technology as being ideal to satisfy the firm's technological needs. In fact, by using a cloud technology service, availability and assistance were guaranteed 24/7, the system was easy to update (scalability) and use and the new working logic was dedicated to the autonomy and abatement of logistical constraints. The management, after a discussion with the ICT manager, opted to implement cloud computing. As with any new technology, the introduction of cloud computing could have disastrous effects, so the administrators made a plan for its gradual implementation. With the provider's help, the management implemented a cloud-sourcing platform (articulated in the following points):

- Phase of due diligence for detailed definition of the scope.
- Employees have the option to access their own virtual terminal through a thin client.
- Definition of a single fee includes the scope of the growth the firm agreed upon.
- Activation of cloud sourcing, which is integrated and delivered by a carrier-neutral data centre/carrier class located in Italy to manage infrastructure environments (systems, equipment, connectivity and security) and application in the field.
- Maintenance technology and operations via platforms, expertise and operational management procedures that are constantly updated with respect to market standards and best practices.
- Management and optimisation of software licences.
- Service desk for performance monitoring and incident management.
- Management of change requests to the service (change management).
- Government services and verification of SLA for customers.
- Full integration with disaster/recovery service and evolution towards a mode of business continuity.
- Consistency and synergy with side project of virtualising jobs.

In 2012, in the same period of the first implementation, Beta sold its old workstations to the same provider to facilitate the centralized management of the new servers. The adoption of this solution, whose service includes the rental of equipment and user assistance, allowed employees to use their virtual workstations from anywhere via thin clients, eliminating the constraints of physical location and greatly simplifying the ICT assistance services as well as reducing the costs of internal transfers between jobs during reorganisations or individual journeys to zero. Nevertheless, the adoption process encountered many difficulties. The implementation required a redesign of the ICT function governance, reallocating

redundant resources to other functions and keeping only a few workers for internal control.

The new platform was implemented in a series of steps. An organisation phase followed the completion of these steps (completed in the last quarter of 2014), finalising the migration. This provided Beta with a solution called 'business continuity in cloud sourcing' (i.e. all of the services are always active in the cloud).

The cloud-sourcing service (complete with directional connectivity, security, systems, equipment, services and application infrastructure) allowed Beta to complete the following:

- Migrate from in-house to total outsourcing without discomfort and with total transparency for the approximately 2500 users managed by ICT services
- Systemically govern and oversee the entire chain of service (directional network, security, systems, basic services and middleware) with a service orientation towards the end user
- Have a single directional connectivity manager, infrastructure services and perimeter security, with clear identification of roles and responsibilities
- Preside over all outsourced services through a single service desk
- Develop a roadmap for standardisation and best practices for adaptation to the existing architecture with a view towards simplification, increased performance and improved security
- Obtain an average annual savings on IT costs and energy costs of more than 20 %
- Guarantee service availability (up to 24/7 and business continuity), greater operational simplicity and speed in obtaining additional resources if required due to the scalability offered in the cloud

Beta achieved substantial cost savings: less need for space enabled by the disposal of the previous data centre allowed it to recover 600 square metres of physical space, now intended for other uses, while at the same reducing energy consumption from the air conditioning system and other utility systems. The switch to cloud computing was made at the end of the useful life of the data centre in-house infrastructures, avoiding the large cost that would be required for their technological renewal.

In addition, beginning in 2015, when the services became fully operational, cloud sourcing enabled new payment methods (i.e. pay-per-use), resulting in 20 % lower costs over 5 years. The cloud also varied the duties of the staff. The service inside was eliminated, as it was deemed to be no longer necessary (due to the standardisation of the equipment and the virtualisation that has transferred many of the operations to the server). The ICT staff was reallocated to different functions (some in internal functions), thus ensuring an increase in productivity via ICT tasks to support the design and development of the principles of governance, which previously were not adequately covered.

In this sense, the firm maximised the effort cloud deployment, obtaining a double benefit: it enjoyed increased productivity and solved a number of problems its previous ICT function had.

For these reasons, in a short time, the firm has begun to use more and more features of the cloud computing platform:

> In scope we experienced some years solutions PaaS / SaaS for human resource management, document management and CRM. Now we are venturing in developing solutions in mobile, collaboration, social, from time to time integrating components with Cloud components in-house, possibly made to services from legacy applications. It is believed that this is the best strategy to pursue innovation, safeguarding the investments made in the past and not exposing the firm to risks of choices monolithic.

There are certainly issues related to security. In this case, the provider guaranteed the possibility of access, security, privacy, backup and anything else required by the regulations in full agreement with the requirements of the monitoring organisations. The choice of provider to ensure information security is crucial (as well as using certifications that attest to the quality of the control process, such as ISO).

4.3 Omega Tech

Omega Tech was founded in 2000. It is focused on two kinds of activities: e-learning and technology services. Since 2006, the firm has been partnered with the world's largest open-source online training platform: modular object-oriented dynamic learning environment (known as Moodle).

The fast expansion of the firm on the market has led, in a short amount of time, to an exponential growth of its ICT needs—the existing structure was not suitable to satisfy the increasing demand. For this reason, in 2011, Moodle's managers began investigating alternate technological solutions that would meet the firm's needs without overburdening it financially. The management was not new to virtualisation experiences. For example, in 2010, they opted for several solutions similar to cloud computing for their secondary functions (i.e. employees' e-mail). The success of this experience persuaded the management to move decisively to cloud computing. The choice of an ideal model initially worried corporate leaders.

> It was about the determination of the right trade-off between the need of privacy and the security of information, that pushed us toward the private cloud and, on the other hand, the need to reduce costs and benefit from economies of scale (public cloud).

Omega managers carried out a deeper analysis on the needs and the characteristics that the ICT structure must have to satisfy all of the firm's needs. Therefore, the management opted to adopt a double solution: a public cloud solution for the less relevant information (e-mail, website, etc.) and a private cloud solution for the most sensitive data (internal data, development data, customer portfolios). This solution saved money while providing a great deal of security for the most sensitive information (that would have been stored in the private data centre). Once the management knew what kind and level of service was needed, they moved to the implementation phase:

> We use public cloud for more standard infrastructure, while we use private cloud for specialised infrastructure. Cloud infrastructure have certainly helped us to get the desired results.

There is a significant difference in the implementation time between the two different services. Indeed, the service provider could activate the public cloud very quickly, with several benefits in terms of optimisation of cost/performance. It gives the possibility to scale vertically with 'pay-as-you-go' models. On the other hand, the private cloud, which is based on specific applications, has a longer activation time because it requires a set of tests. These tests are important in order to ensure quality performance while maintaining an elastic structure, with the possibility of scaling both vertically and horizontally. The difference, in terms of technical and economic performance, was perceived immediately:

> The business processes are improved immediately. With this type of infrastructure we were able to simplify and automate a number of processes by increasing the value of the services provided.

There are many differences between the models. Indeed, the advantages of the private cloud include consolidation of services and the ability to create an ad hoc infrastructure, while the advantages of the public cloud include a higher speed of deployment and flexibility, which are reflected in customers' proactivity, leading to a greater overall availability of infrastructure for end users. The principal business functions to migrate into the cloud were the ICT department, technical support and the sales department. During this time, numerous other implementations that transferred all business functions to the cloud have been performed:

> Actually, the implementations are in constant evolution.

With specific reference to the economic benefits, the management stated that, in the early stages of cloud computing adoption, the costs increased. Indeed, during the implementation phase, the function was duplicated: they preferred to make the new solution functional before deleting those already in use. In addition, some business processes were reviewed and optimised with new multi-purpose software, and the staff, first allocated in the ICT, was moved to other functions to increase productivity.

> In reality, our main intent was not to decrease investment but the ROI maximisation and the improvement of the perceived services quality. At the moment the feedback about our services exposed to the public through consolidation, optimisation and automation of processes is positive.

These objectives have been largely achieved. Eliminating the old server has reduced operating capital, while replacing electrical charges and maintenance with the fees to be paid to the provider increased operating income; thus, there is an improvement in the return on investment. Savings in ICT, without considering the costs of replacing the servers, total about 25 % annually. The savings would be higher if the firm only used the public cloud. Finally, the administrators are confident about questions of security.

> Although we were initially sceptical, we have not found security issues in our cloud infrastructures.

5 Discussion

In this section, we discuss the results of our case studies in the light of the previous literature based on our analysis of the case data via our framework. We discuss the key drivers and ICT requirements, the decision-making process in terms of expected advantages and disadvantages, the migration process and the post-implementation effects. However, we should note that the three examined SMEs operate only in Italy and that they have all existed for the same number of years. This is relevant because in many cases, different life cycles of firms may have an effect on their motivations for migration [28].

Referring to key drivers and ICT requirements, all three firms reported their need to increase the dimensions of their ICT structures, reducing the related costs (i.e. storage, maintenance, software, disaster recovery) and increasing flexibility. In two of the cases, cloud computing was used to avoid new ICT investment (Alfa Home, Beta Insurance). This is consistent with Amrbrust et al.'s [15] and Buyya et al.'s [14] statement that this was firms' main motivation to adopt cloud computing. These authors argued that this new technology could help firms to increase flexibility and avoid new investments, providing the required level of service without any empirical results. This allows firms to use expensive technologies at affordable prices [12]. After a deep analysis of the firms' ICT needs, all of the firms identified cloud computing as the best solution. This technical analysis that the management carried out was supported by a cost–benefit analysis of cloud computing implementation.

Referring to the decision-making process, we discuss the expected advantages and disadvantages separately. The expected advantages of the three firms included cost savings (i.e. reduction of investment in software and hardware, employee reduction), scalability, ease of use and flexibility. Despite the great number of subjects interviewed, the expected advantages were the same independent of the interviewees' positions in the firm, their education level and their personal experiences, which are the main variables that influence personal behaviour [76–78]. This supports Buyya et al.'s [14], Armbroust et al.'s [15] and Sultan's [16] claims, all of whom only theoretically discuss the benefits of cloud computing adoption without giving any empirical results. Further, these results are aligned with case studies carried out by many authors [30–35, 79–81] that show the motivations towards cloud computing adoption in different sectors (i.e. banking, oil and gas). Our results show that Italian SMEs, who are not competitive in the international arena, pay particular attention to cost savings.

The main expected disadvantages include the loss of governance of data, the loss of sensitive information, increased control risks and all of the typical disadvantages arising from outsourcing and shared technologies. All of these disadvantages

support Weinhardt et al.'s [26], Chow et al.'s [49] and DaSilva et al.'s [54] argument that cloud computing is not a tool for all firms and that its implementation requires a strong level of control to avoid operational problems.

Despite this perceived disadvantage, the three firms chose different migration processes. In two cases (Alfa Home, Beta Insurance), the migration process was defined as having a high degree of complexity and was divided into different steps to ensure a successful implementation, to avoid internal resistance to the change and to avoid potential disadvantages, such as the loss of efficiency [28]. This behaviour is compliant with many authors' findings about secure cloud implementation [35, 44, 45]. What should be noted is that in the third case (Omega Tech), there was full implementation. The company employees were well oriented to the cloud computing implementation, and the management opted for a fast implementation process. The results of the study on this firm show that cloud computing can be rapidly introduced without causing organisational problems if the company's employees are well inclined towards the new technologies.

With reference to the post-implementation effects, what should be noted is that the three firms saw a strong reduction in their ICT investment (hardware and software), completely outsourcing this function to the cloud. More specifically, the SMEs had the following energy savings: 25 % (Omega Tech) and 30 % (Beta Insurance). Also, two of the firms saw a reduction in their general ICT costs of about 22 % (Omega Tech) and 31 % (Alfa Home). This is consistent with Velte et al.'s [28], Hosseini et al.'s [29] and Sultan's [16] findings of similar cost reductions in other European countries and in different kinds of SMEs. Moreover, all of the firms reassigned a portion of their ICT employees to other functions, increasing productivity. For example, Beta Insurance, which needed to enlarge its ICT service, achieved this goal without hiring new personnel. These results are consistent with many other studies carried out by different authors in different countries, highlighting that cloud computing, if implemented properly, can lead to significant cost savings for Italian SMEs [36, 37] and banks [31, 38].

With reference to the post-implementation disadvantages, what should be noted is that 6 months from the first implementation, there were no negative events. The management's fears (i.e. loss of control of data or data leakage) were completely unfounded. All of the interviewees stated that the cloud computing structure was safe and that they had not encountered any problems or disadvantages.

6 Conclusions

In this chapter, we addressed under-investigated issues by pursuing the following two aims: (1) investigating the decision-making process of implementing cloud computing by highlighting three Italian SMEs' driver and ICT requirements and (2) examining the implementation effects 6 months after the firms' migration to their new ICT systems.

We found that each firm had specific drivers and ICT requirements, which suggests that the implementation of cloud computing in SMEs must be done carefully to avoid any issues. Moreover, the advantages arising post-implementation confirm the expectations created by the management during the decision-making process, while at least in the short term, no disadvantages arose. More specifically, the firms needed ICT function reorganisation, cost savings and increased flexibility. After a deep analysis of all of the possible ICT solutions, the management identified cloud computing as the best option. Their analyses showed that cloud computing can be a significantly cheaper alternative to purchasing and maintaining a private system infrastructure. Also, this technology improves operating efficiency, reallocating ICT employees and reducing focus on ICT.

This chapter contributes to the existing literature by providing a clear observation of cloud computing adoption from the decision-making process to the final economic advantage mensuration. We share the same view of many authors [30–35] that cloud computing can be a great opportunity for firms.

This chapter also has practical implications. First, this study is useful for firms in which managers are considering migrating to cloud computing. Thanks to this paper, managers can identify the problems and key drivers to determine whether cloud computing is a good solution for their company. Further, we show how firms decide to implement cloud computing, highlighting the main expected advantages and disadvantages that influenced their final decision. This fills a knowledge gap in the existing literature.

The main limitation of this study is that the cost analysis only focused on system infrastructure costs, so we cannot know the real cost savings or efficiency improvement from reallocating the ICT employees. Also, there are many longer term costs associated with cloud computing (i.e. costs arising from migration to another provider) that we did not take into account. Our post-implementation analysis was only short term. These aspects should be taken into account when analysing the benefits of adoption only a long time after the end of the implementation process.

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