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"Cloud computing for Italian SMEs: risks, benefits and open issues"

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Introduction

In the last few years, *information and communication technologies* (ICT) become increasingly important for enterprises. The constant intensification of technological needs, combined with the market renewal generated an increase in requests for information services and, as a consequence, an increase of the number of servers used in the companies data centers. This phenomenon generated a sharp increase in costs for companies that, not always, a corresponding improvement in terms of effectiveness and efficiency.

More recently, companies approached to virtualization as data storage technique. The result of this development has contributed to the introduction of a new type of technology: cloud computing.

This tool represents an alternative of virtualization. It is a relocation and abstraction of computational resources, storage and content distribution and reachable over the network. More specifically, this tool leads to an increase of the storage capacity and processing possibilities, passing from a computation based on individual and independent machines, to a calculation model obtained on unified and centralized positions. This new technology leads to obtain greater flexibility, resource optimization and cost containment, but mainly introduces the *"pay-as-you-go"* (Ibrahim et al., 2011) (or the ability to pay for a measured service).

It seems clear that in a context of crisis, in which the increase of the internal efficiency of enterprises necessarily passes by cost reduction, this tool, perceived as one of the key technologies of the 21st century by many authors (Buyya et al., 2004 and 2008; Sultan, 2010 and 2011; Marston et al., 2011; Kaiserswerth et al., 2012; Lee and Mautz, 2012), is able to offer many benefits to companies. Despite, cloud computing has a large number of risks that limit its implementation especially among small and medium enterprises (SMEs) which, according to numerous authors Lawler et al., 2012; Brender and Markov, 2013; Gupta et al., 2013; Mahmood et al., 2014 ; Oliveira et al., 2014; Son et al, 2014), would be the

main beneficiaries of this technology. For this purpose, as well as agreements with the enterprise customer, this work focuses on the issue of the benefits and risks arising from the implementation of cloud computing within small and medium-sized Italian companies.

The thesis consists of three chapters, organized as research articles, related yet independent in their structure.

Specifically, the first chapter introduces and describes cloud computing.

The first section provides relevance to the topic describing the trend of Italian studies in ICT with particular reference to strategic change and the value generated by computer systems within companies. The second paragraph describes the evolution of cloud computing in Italy. The focus is on the state of the technological infrastructure of Italian SMEs, the evolution of the ICT and cloud market and on the growing attention given to the instrument. The third section outlines the reasons behind the adoption of cloud computing. It provides a clear overview of the benefits provided by the instrument to companies bringing to support numerous articles of ICT professionals and cloud-provider. The fourth paragraph explores the usefulness of the tool for the public administration. In truth, its usefulness is also widely recognized by the public sector in which, with the Digital Agenda, enhanced the quality and recognizes it as a tool potentially sufficient to solve the problems of efficiency, transparency and speed at which the government must be imprinted. However such a tool not only generates benefits but can also be a source of risk for the end user. These risks have been thoroughly described in the fifth paragraph that also discusses the protocols identified as suitable to avoid potentially damaging events or otherwise reduce its magnitude.

The second chapter discusses the issue of benefits and risks arising cloud computing implementation in Italian small and medium enterprises. Recently, this argument had a great relevance for practitioners and also for ICT authors. First and foremost, the study analyzes the cloud computing as a tool potentially suitable to improve the internal practices of the companies and to increase the effectiveness and efficiency. After, in the third section, it is analyzed the existing literature and the various strands of research. It is also highlighted the gap present

in literature. What should be noted that it was thorough literature on the benefits and risks of cloud computing arising cloud computing adoption. With specific reference to the second, were analyzed articles, books and monographs concerning both the literature on the general risks of ICT that the specific risks of cloud computing. From a detailed analysis showed that, although the issue of the risks present a strong relief by many authors and industry experts, there are no empirical studies regarding the measurement of their perception of a tool such as cloud computing. So, the purpose of this chapter is to bridge this gap by measuring the expected benefits and the perception of risks associated with the use of cloud computing by Italian SMEs identified as first-time adopters through the method of survey. To this end, a survey was conducted on a sample of 250 individuals belonging to the divisions of Accounting and Information Communication Technology working in 125 small and medium-sized Italian companies. The companies target the research work in different sectors and have opted for the adoption of this new technology in 2013. The administration took place electronically and allowed to obtain 130 completed questionnaires covering 65 companies. The survey, as a result of statistical processing, enabled to provide a gradation of the expected benefits and to create a map of the perceived risks in which were showed the expected probability and potential impact of all risks. Furthermore, the data obtained were recalculated to obtain a matrix "likely impact" in the fifth paragraph. Analysis performed shows clearly that there is a strong perception of the risks inherent in the adoption of cloud computing within enterprises and that the main expected benefit is the reduction of the costs of the ICT function.

The third chapter is focused on the motivations of cloud computing implementation and on the expected benefits. More specifically, using the method of multiple case studies, were analyzed the reasons that led four small and medium-sized Italian companies to adopt this tool. Also were discussed the implementation issues, the implementation steps and the benefits (economic and not) provided by this tool. The second paragraph explains the issue of cloud computing architectures and deployment models available to the final user. The

third paragraph collects literature about the expected benefits and the disadvantages arising the implementation of this tool. The fourth section explains the research design. The method used was the multiple case study on a sample of four companies. For each company were conducted at least two interviews on the CEO and manager of ICT. Also were analyzed further internal documents (reports, cost / benefit analysis, analysis of the reallocation of staff) and external (financial statements and other voluntary disclosure). The fifth section presents the cases of Italian SMEs and discusses the results obtained. What should be noted is that all the companies expressed skepticism in the initial migration, in fact all of them have made a change in stages. Furthermore, in all cases the implementation of cloud computing has enabled a reduction in costs of ICT function (which is around 30%) and a recovery efficiency due, in large part to the reallocation of staff in other functions.

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Chapter 1: Cloud computing in Italy: an Overview

Abstract

The aim of this chapter is to provide a comprehensive look at the emerging paradigm of Internet-based enterprise applications and services. It provides also a clear view on the information and communication technologies (ICT) in Italy highlighting the role a new emerging technology: the cloud computing. Cloud computing is set of resources and services offered through the Internet. Cloud services are delivered from data centers located throughout the world and facilitates its consumers by providing virtual resources via internet. So we discuss the state of the Italian ICT market, the state of the art of cloud computing, the benefits expected and the main risks arising this tool adoption.

1. The role of ICT in Italian companies

In the last '60 years, the development of information and communication technology, changed significantly the operating global environment in which companies operate (Airoldi, Brunetti e Coda, 1989, Francesconi, 2011). The continuous innovations offered by new technologies to companies requiring to management the constant innovation of the internal information processes and of the organizational structures. Therefore firms required to adapt their business models in order to achieve the benefits offered by new information technology.

Despite the economic backwardness that characterized the Italian companies in last years (Banca d'Italia, 2004), even Italian companies adopted these

instruments trying to maintain the competitive gap with foreign enterprises. in recent years, Italian companies have, reduced their propensity for innovation and is very difficult to understand why. To address to this crucial issue for the competitiveness of our country, many authors changed their focus passing from the innovative potential of new technologies to the practical use of ICT in the company (Bugamelli e Pagano, 2004).

Therefore, many other authors stated that information and communication technologies can have significant positive effects on the productivity and competitiveness of small and medium enterprises (SMEs) and for large companies (Marchi, 2008). In particular these effects are mainly due to the increase speed and the depth of information, that allow managers to conduct the company and to react faster to market changes. This kind of situations are particularly frequent in large enterprises where administrators can leverage the full potential of information technologies. Instead, with reference to small and medium enterprises, the adoption of these technologies could generate organizational problems that may affect adversely the competitiveness of the company. The study of the consequences produced by new information technologies on the administration of the company is relevant because these tools can affect many areas. Indeed, new technologies implementation may have positive or negative effects for the company in three areas:

1. **Organizational,**
2. **Information and directional,**
3. **Operational.**

The first area is the organizational one. At organizational level, the introduction of a new technology can disrupt the routine business, innovating deeply operational and organizational processes. The term *"innovation"* means a radical change of organizational processes and behaviors (even individual) (D'Atri, 2004): typically people are creatures of habit and they have an aversion to change. For that reason

the process of innovation must be planned and managed to avoid problems and negative effects for the company (i.e. the loss of competitiveness).

Also the informative area could be touched by technological innovation. More specifically, according to several authors (Agliati, 1996; Marchi, 2008; Quagli, 2008), technological innovation has upset the "quality" of the available information for companies, transforming them from scarce resource to a kind of resource:

- Available in large quantities
- Available in a short time
- Available at lower costs

What should be noted is that the technologies innovation allow the management to reply more quickly to the changes of the context (Agliati, 1996) changing also the decision methodology.

However, to make the company more competitive the information availability is not enough. It is necessary that the technological solutions are able to assist management procedures in the decision-making process (Quagli, 2007, 2008). Indeed, managers must be able to understand quickly the changes of markets and must seize new opportunities for development in order to ensure the survival of the company. So it is essential that company management could acquire the information quickly.

In this regard, Cantino (2008), focuses on the tools that are used to represent the information to senior management, and specifically describes flexible solutions for:

- Monitor the performance of the enterprise ,
- Determine key performance indicators for the organization,
- Measure the companies performance in comparison to environmental changes.

Using new technology, managers can quickly acquire relevant information, reducing the decision-making process, and speeding up the response time of the company.

Moreover, these technologies can also be useful in financial statement communication. Teodori and Veneziani (2008) analyzed the evolution process of the companies and they highlighted that there are two major changes: the content of the information intended for the financial markets, and the tools used for relations with the recipients.

Finally, the operating environment was certainly the most stressed by technological innovation. Especially in recent years, new software for enterprise resource planning (ERP), customer retention management (CRM), order management, transaction processing, and many others, have simplified the business routine and have reduced the cost, the work time for employees, times for obtaining information (Pilotti, 1996; Bracchi e Motta; 1998).

What should be noted is that the information system is a cross element for the company: a support function from whose effectiveness and efficiency depend the availability of information for management, the reply of the company to the changes, the rapidity of employees to accomplish common goals.

2. The evolution of cloud computing in Italy

In the last years the weak Italian entrepreneurial fabric has faced many challenges due to the financial crisis, leading companies to go through considerable economic, organizational and management difficulties. The turnover of several sectors registered a sharp decline, and businesses were forced to cut their budget significantly. Many of these have begun to seek solutions to reduce costs and, at the same time, to increase the efficiency and effectiveness of the secondary functions. Among these, one of the most important function is Information and Communication Technology (ICT) that has experienced a deep transformation due to the introduction of a new technology: the cloud computing. This tool, which is considered as a kind of outsourcing of ICT function, represents now the strategic key of many big, medium and small business realities.

According to a survey Made by the observatory Cloud & ICT of the Politecnico di Milano (CIT), the growth of cloud was likely to exceed, on the whole, the one of the ICT. Cloud market was estimated to be five hundred million euro, but the most important evidence of the analysis is represented by the business owners and managers' awareness about the benefits tied to the adoption of Cloud solutions. The research has shown that 75% of software developers in our country would work on the Cloud by the end of the year and that, while the spending in information technology has grown in only 13% of the analyzed cases, the one in Cloud is increased in 50% of the companies considered (54% for public Cloud and 50% for Private Cloud).

Already in 2010, during the conference *"Cloud Computing - Successful experiences in Italy"*, promoted and organized by ZeroUnoweb in partnership with ClubTI, 150 between ICT managers, professionals and representatives of the ICT providers, stated the Italian entrepreneurs' strong interest in Cloud. A relevant example was given by the evidence of several companies that had already adopted Cloud solutions, confident that the system *"as a service"* could be help business to reach great benefits.

Already in 2010, a European research Made by the Centre for Economic Business Research (CEBR) and EMC in Italy, France, Germany, Spain and the UK has estimated that, by 2015, the cloud is expected to produce a wealth equal to thirty-five billion euro only Italy and, considering the total that the five economies should achieve continuing to adopt the cloud with the rhythms and the manner provided, the estimated value would amount to about 177.3 billion, distributed as it follows:

- Italy - 35.1 billion euros,
- France - 37.4 billion euros,
- Germany - 49.6 billion euros,
- Spain - 25.2 billion euros,
- United Kingdom – 30 billion euros Euro.

Moreover, in 2011, the CEBR underlined that Cloud computing would give a great contribution to the development of numerous business also belonging to very different sectors from ICT. On the basis of these predictions, the research valued the positive effect at the macro-economic level: about 456.000 jobs and, compared to the rest of Europe, the highest number of start-ups. In addition to this, during the period 2010-2015, Cloud Computing should generate benefits for about 151 billion euros in Europe. They were divides as follow:

-        24 billion in efficiency improvements of existing businesses.

-        43.3 billion in the creation of new companies.

-        28.5 billion of savings in IT costs.

-        55 billion of indirect benefits (increased workers' wage, opportunities for producers of raw materials and semi-finished products, etc.).

A comparison with the previous analysis, shows that the development and a better knowledge of the market enabled us to formulate more accurate estimation, including the indirect benefits too. This expectations could be summarized in the following table:

EMEA: Cumulative Economic Benefits 2010-2015						
	France	Germany	Italy	Spain	UK	EMEA
	€ mil	€ mil	€ mil	€ mil	€ mil	€ mil
Business development opportunities	24,599	32,642	23,995	16,866	29,555	127,657
Business creation	51,377	69,507	43,305	30,939	20,026	215,153
Net total cost savings of which:	26,323	37,740	28,463	22,008	26,206	140,740
-- IT CapEx savings	28,653	36,378	30,461	23,013	36,176	154,682
-- IT OpEx savings (FTEs / productivity)	13,818	18,139	14,533	10,396	16,943	73,829
-- IT OpEx savings (power & cooling)	11,107	14,345	11,821	8,510	10,566	56,349
-- additional cloud services expenditure (PAYG)	- 27,255	- 31,122	- 28,353	- 19,910	- 37,481	- 144,120
Indirect GVA	60,450	81,351	55,007	40,737	42,202	279,747
Total Economic Benefit	162,749	221,239	150,770	110,550	117,989	763,297
Direct and Indirect employment ('000s)	430.6	689.7	398.2	365.0	289.0	2,172.5

Table 1 – Expected economic benefits created by cloud computing adoption

What should be noted is that the benefits created today (2015) by cloud computing are in line with the expectations outlined in the table above.

Furthermore, the research indicated the public sector as the one in which this tool can help more to reach efficiency and money-saving.

In the same period, Symantec Italy has led *"Virtualization and Evolution to the Cloud Survey"* (2011) to analyze the strategies that companies would follow in order to move business-critical applications on virtual environments and Hybrid-Cloud. What should be noted is that Italy had a slim advantage over the rest of the world thanks to a spread of virtualization server found in 84% of the respondents; the 77% of the interviewed companies were considering the possibility of adopting Hybrid or Private cloud solutions. Many companies began to virtualization process staring with applications considered less critical - such as test and development environments - to move after the more complex and delicate ones (such as the e-mail management, e-commerce, customer retention management, enterprise resource planning and so on).

However, during 2011 there was a big step for cloud computing development principally thanks to the launch of *"Fast Start"*: it is a solution developed by "Systeme, Anwendungen, Produkte in der Datenverarbeitung" (known as SAP SE) and Nuovola Italiana (Telecom Italia SpA). Specifically, SAP decided to create a software-as-a-service application using the infrastructure offered by the provider in order to propose a simplified solution of already known management software. The program allows managers to calculate a "turnkey" online estimate that includes software licenses, hardware and services through a configurator provided by the Italian online platform. Then, customers could choose the modules that they need and pay a monthly fee that included the connectivity, its management, the maintenance and the specialist assistance. Nevertheless, what should be emphasized is that, in Italy, big companies are still distrustful about the adoption of this new technology: for this reason, the CEO of SAP stated his Great trust in Telecom skills in order to succeed to win, together, these fears.

The public cloud solutions have not reached an high spread yet, mainly because there are fears (i.e. data security, outsourcing problems, loss of control on data, etc.) that limit the adoption of this tool. Some authors state that, unlike other

European realities, Italian companies request applications with an high level of customization just to more relevant partners (i.e.: Telecom Italia, Aruba, etc.).

On the base of what already said about the opportunities that the crisis has created for cloud development, is possible to state that this technology represent an ideal solutions for Italian companies, and, more generally, for those companies that decided to "rethink their ICT in a more flexible perspective and less legacy".

In the year 2012 cloud computing sales had had a strong surge especially thanks to the extension of services to all the people (and not just businesses). A lot of people were interested to try these new solutions and the technological concept became from a complicated mechanism known only to ICT professionals, to a simple and more accessible idea assumed to the less experienced in the field.

Matt Eastwood, at the IDC Cloud Symposium in Milan (2012), stated that *"cloud computing is finally considered, also in Italy, as a useful tool to win a major challenge to which ICT has since always respond ie to be able to reduce costs by improving on the one hand the speed of response to changes in the business and on the other the management of the governance-risk-compliance."* In this regard, the research conducted during 2011-2012 by IDC, showed that in subsequent twenty-four months the share of IT budget dedicated to Cloud would rise from 35% to 47% with a predominance of investments in private Cloud that the medium and large enterprises considered as the starting point to reach the stage more advanced and generally desired by the SMEs, represented by the SaaS world.

According to the researchers (Mainetti, 2013; Piva, 2013), the for a good implementation of cloud computing in businesses there are three steps to follow:

1. **Converged Systems**. In this step it is necessary to consolidate the hardware and the software integrating with virtualization and software. In other words it is describing the introduction of a IaaS system.
2. **Integrated Systems**, takes place at the level PaaS, integrating in converged systems middleware, databases, and architectural design.
3. **Cloud Systems,** with orchestration of "integrated systems" and "Cloud services public" you create the most popular services Public SaaS.

In Italy the main obstacle to the development of this new technology is the slow progress of infrastructure investment (Mainetti, 2013; Piva, 2013). This condition is really a strong limit because the Italian industry, characterized by many medium-sized companies with strong budget problems and with limited internal skills that do not allow the implementation and management of ICT solutions more requests, represents the ideal setting for Cloud computing.

The *"Observatory on Cloud & ICT as a Service"* of the School of Management of Politecnico di Milano, in 2012 conducted a survey on a sample of 130 large companies and 660 small and medium-sized enterprises (SMEs). The research showed that the investments in Private Cloud represented for 54% of cases while those in public Cloud 46%, for a total of 203 million, which 195 spent by large companies (120 in Infrastructure-as-a-service, 65 in Software-as-a -service, 10 in Platform-as-a-service) and 8 by SMEs. An important response is that about 95% of total expenses for Cloud solution was attributable to companies with over 250 employees. In addition, these companies were already working on Cloud services (56% used at least one of them, 11% were doing pilot projects) another 25% were interested, and 8% claimed to not be. The numbers drop drastically for companies under 250 employees: 22% had started projects Cloud, 8% wanted to introduce them, 60% stated that it had no interest and 10% did not know what the Cloud Computing. For more clarity, the results of this analysis were summarized in the following image.
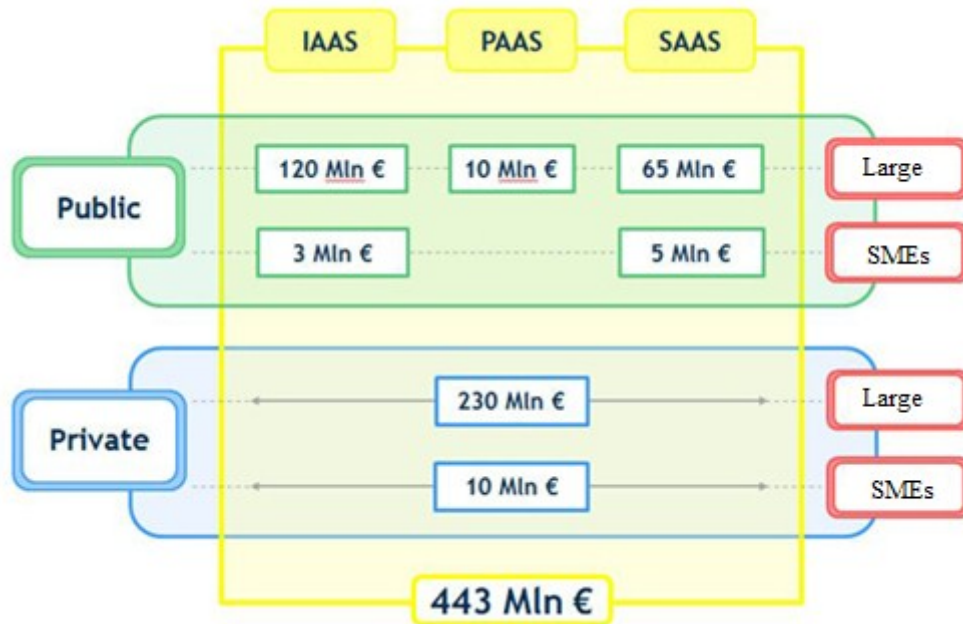
Image 1 – Cloud computing adoption in Italy in 2012 - source: Politecnico di Milano

Moreover, the same survey highlighted that only 22% of the considered SMEs adopted the cloud computing while among the large firms, 56% has successfully implemented this new technology. The data were summarized in the image number 2 which provides a graphical representation of the phenomenon of differentiating on the basis of the type of company and the level of implementation achieved. The analysis referred to by the following representation is based on a sample of 131 large organizations and 660 SMEs.
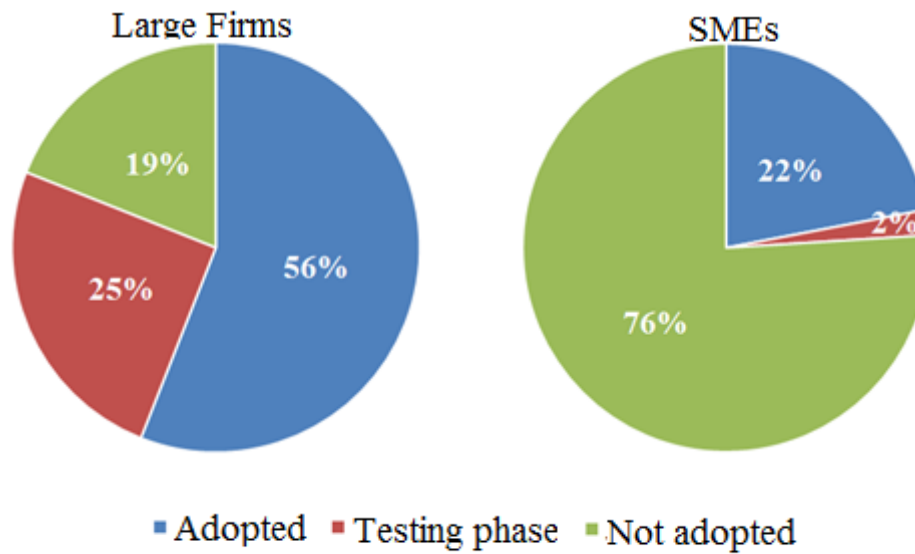
Image 2 – Cloud adoption for large firms and SMEs during 2012

From the graphic is possible to observe the critical situation of cloud computing adoption during 2012. That happen because there are two great problems in the Italian ICT market. Briefly, is possible to state that on one side of the market we find the large providers that did not adapt their business models to those typical of SMEs (deferred revenue and lower amount associated with small customers) (Piva, 2013; Mattietti, 2013) and on the other, the aforementioned infrastructural delay and the poor quality of broadband connectivity in many areas. The report concludes hoping for greater collaboration between the private and the public with the hope that projects such as the Digital Agenda, actually succeed in transforming the Cloud Computing in a "structural trend" not leaving this innovation really in the clouds, away from the fertile fabric Italian company which could be exploited all its great potential.

In the same year (2012), Alessandro Piva, research head of the *"Observatory on cloud computing"*, following the results obtained from the previous surveys, founded that in Italy there was a propensity towards the cloud but this was strongly opposed by a series of delays:

"... comparing the Italian ICT expenses to the GDP what we can state is that we are (just) below the EU average, but with a great lag with the biggest EU countries. Our users are not connected to a percentage not even among the top 50, in an area where the Nordic states have the record... and our connection speed is lower than the Korean, or than the other European country. "

The author has repeatedly highlighted (2012, 2013, 2014) that cloud computing represents an opportunity for our country. The chain of Cloud Computing is crowded of new actors, creating direct benefits (to user and enterprises) and indirect benefits (increased GDP, more jobs). There are no more interacts only with a system integrator and a Consultat but also together with other subjects such as component developers, brokers and telco. The next image shows the growth of the different actors operating in the cloud.
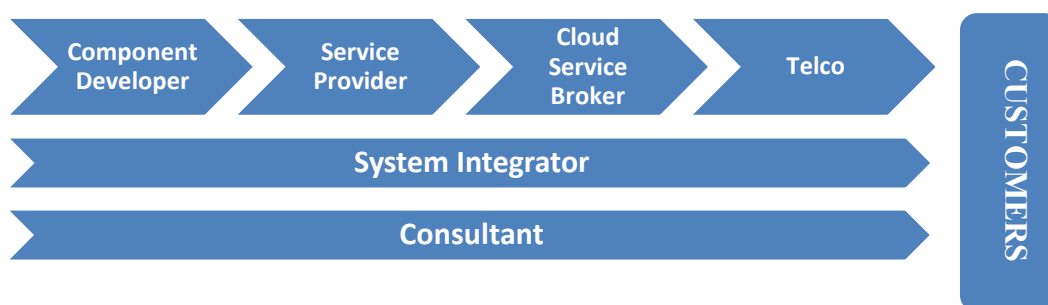

Image 3 – Cloud computing market in Italy, year 2012 - source: Politecnico di Milano

Despite the tangibility of direct and indirect benefits, in 2012, still reigned skepticism towards this technology. For this reason, ComScore and Microsoft conducted a research about the reasons that led the Italian companies to choose (or not choose) cloud computing. From the survey it was clear that a part of Italian SMEs chose the migration as a strategy to reach better security and savings while many others have shown strong reluctance caused by fear of excessive costs and low level of protection. Companies that have accepted the Cloud with great

enthusiasm have calculated an average reduction of time spent managing security, equal to 18 hours per week. According to the managers interviewed, the security, in the Cloud, would be better protected because of the reduced time required for updating and the existence of the security function of the cloud provider. However, among the detractors, 40% of respondents said they did not use the Cloud services because intimidated by any security while 38% revealed that it would be more confident if there were industry standards, so that the customer can understand what of these the provider has decided to join. The remaining 22% of companies that had not opted for migration yet, justifies this choice with the fear of incurring investment or maintenance costs are too high. The research then showed some hesitation and a strong confusion between small and medium-sized Italian companies. Among the main reasons are definitely the low maturity of the market and the aforementioned backwardness and the lack of information on the risks and benefits actually obtained by the implementation. In light of this, Microsoft decided to change course aiming to "work capillary informative and precise aims to remove doubts and false illusions about the Cloud" (Microsoft, 2012).

In 2013, during the third edition of the annual survey conducted by the Politecnico di Milano on a sample of 201 large companies and 507 SMEs has been detected an increase Italian investments in Cloud Computing 11% (reaching a market value equal to 493 million euro). So, there was a more than proportional growth of the entire ICT market as proof of what is said in several studies and benefits transferred from the instrument to businesses (Lawler et al., 2012; Brender e Markov, 2013; Gupta et al., 2013; Mahmood et al., 2014; Oliveira et al., 2014; Son et al, 2014). In support of this claim should be emphasized that large companies (> 250 employees) increased the ICT spending by 13% and that the cloud markets increased by +54% for the public cloud and +50% for the Private cloud. Also the SMEs market was increased significantly. Indeed, there was an increase of the average expenditure in ICT by 16% compared to +40% of the Cloud market. These results are a turning point for the Italian market but are very far from the other markets. Indeed, the survey highlighted the existence of a deep

"digital divide" that unfortunately continues to grow increasing the distance of our businesses to those operating in most advanced economies or even worse than those who are working their way starting both from emerging countries of the BRICS (Brazil, Russia, India, China and South Africa) and from other areas (such as Indonesia, Argentina, Turkey and Mexico). These markets exceed three times the Italian market with a cloud-growth-rate stabilized at 25-30%.

In our country, the low propensity to technological investment led to the creation of a scenario characterized by 3 main factors:

- Reduction of the ICT investments in small businesses.
- The Continuative search of technological solutions to reduce ICT costs.
- Ageing of the infrastructure and application in SMEs.

However, the forecast about cloud implementation in businesses are encouraging and shows a further increase awareness and planning of this tool into Italian company, with a + 11% (always compared to 2012) of firms (they also reported the existence of a multi-year plan focused on migration).

According to Stefano Mainetti, Scientific Director of the Cloud computing Observatory, the 2013 could be considered the year of realization of the Cloud with a general increase in investment. The companies interviewed stated the migration for several reasons. The great part of them gave particular emphasis to optimization of processes and services (56%), innovation (27%) and the old structure renovation (17%). Instead, SMEs favored the greater effectiveness of the processes (23%), the increased productivity and availability of information (23%) and the efficiency (42%) and reduction of ICT spending (12%). Also, the investment in the Cloud computing are no longer considered as experiment therefore limited to a brief window of time, and a good part of the initiatives, quantified by research with a 23%, are included in projects aimed at 'introduction of new services and solutions that will used in the long term perspective for organizational change. As usually happen when a market is "mature", there is a reduction of the gap between the proposals of the sellers and the real needs of

customers and this allows companies to reduce the risk of vendor lock-in (that represented, in the early stages, of the main reasons that discourage the implementation of an innovative technology).

The proof of market maturity cloud be find in a survey conducted by "Enter the Cloud", a blog created to share information, experiences and news on cloud computing, cloud hosting, virtualization and ICT. The survey was conducted on a sample of two thousand cloud professional final users. As results the study demonstrated that the 29% of the respondent would take cloud-based strategies by the end of 2014. More precisely 22% was already using a this kind of technology while 7% were ready to migrate. Moreover the 28% of respondents were instead engaged in the implementation of cloud computing while the remaining 43% had not yet thought of or otherwise designed a plan that included the transition to this new technology. The image 4 summarizes what is described:
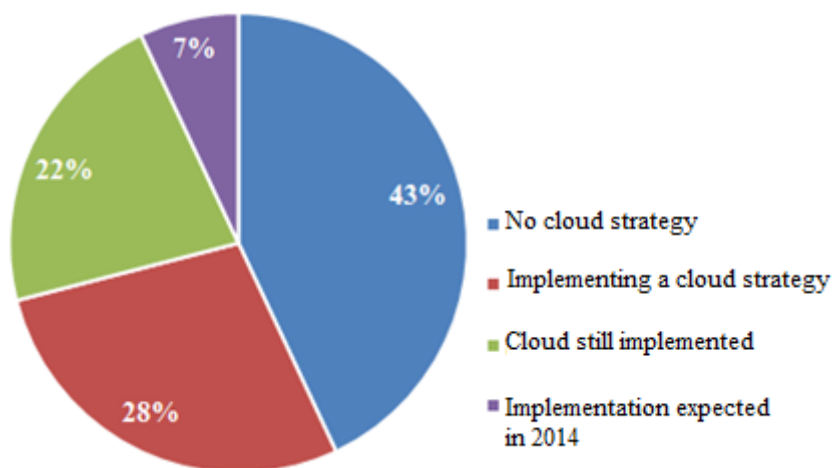

Image 4 – Cloud computing in Italian companies, year 2013

As the next image shows, is also possible to observe the composition of the answers on the base of the different kind of subject interviewed:
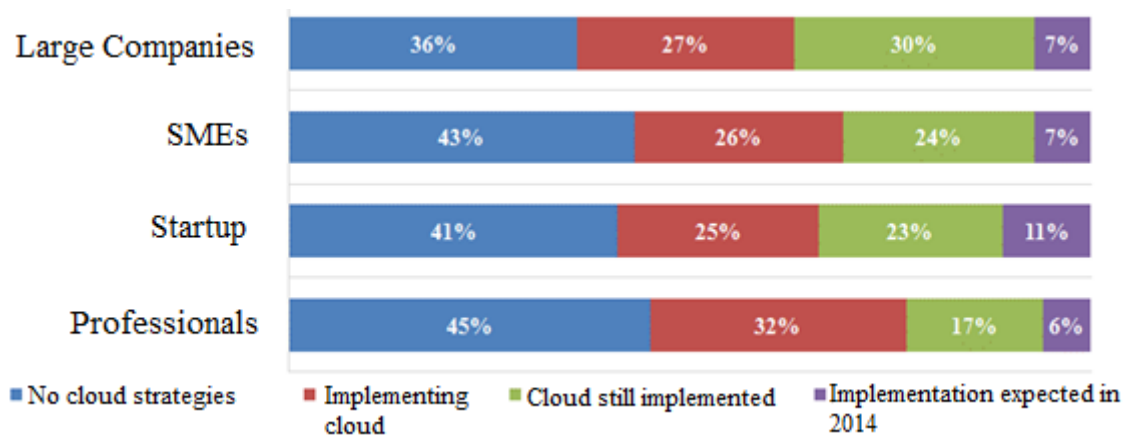
Image 5 – Cloud implementation level, year 2014

Moreover, the research highlighted the main factors that hinder the spread of the cloud. About the 10% of respondents had no particular concerns and Security (49%) and privacy (44%) were once again the two main barriers that have kept away many potential customers that they could move further activities on the cloud. However the 40% of respondents considered the difficulties of Italian ADSL infrastructure as the main factor of the failure of adoption. Instead the 18% complained about excessive reduction of data and infrastructure control while 29% admitted to have a background in the field very rough.

As regard the difference between the different delivery models, the Private Cloud despite being made from more expensive and complex issues related to the software and the network is the most widespread form while only 16% of users were oriented to Public Cloud and 21% to Hybrid Cloud. The propensity to investment is a further element analyzed in the survey. About the 64% of respondents between current users and people who are investing their time in implementing a strategy involving migration, has allocated less than 5% of the budget ICT business to the cloud. For other results are those given below:

- € <5% of the budget for the 64% of cases (+ 10% compared to 2012).

- 5% <€ <20% to 23% of cases (-4% compared to 2012).

- 20% <€ <35% to 8% of the cases (-27% compared to 2012).

- 35% <€ <50% to 3% of cases (+ 200% compared to 2012).

- €> 50% to 2% of the cases (-67% compared to 2012).

Another important result of the research concerns the spread between the different kinds of cloud and the different deployment models. The survey showed that 43% of respondents chose SaaS, IaaS and those 35%, only 22% had opted for that PaaS. The different motivation for the final user could be summarized in the following graph.
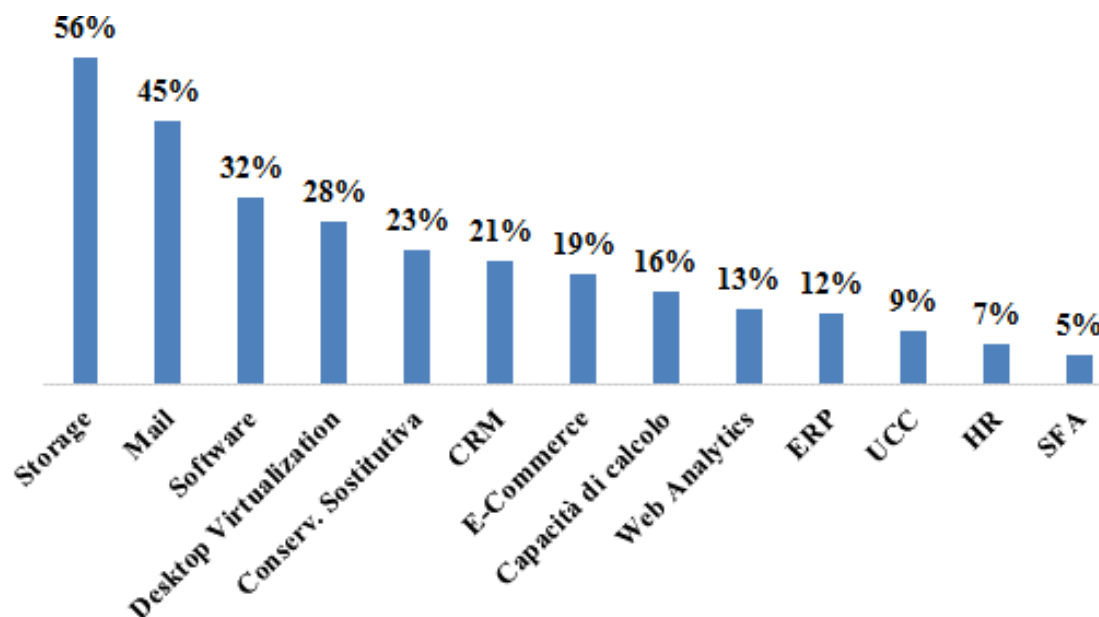
Image 6 – Cloud computing demand analysis, year 2013

Italian companies in the provider evaluation give relevance to the country in which the servers are located. The right choice of Cloud provider (with data centers located on the Italian territory) was significant for 66% of the experts surveyed and for the 16% represented a determining factor. Most of this is due to the legal problems because if the servers are located in Italy, many problems will be handled in accordance with the national legislation (which is very restrictive). Many companies, in order to feel more secure, prefers providers with systems located in our country (this give them the illusion of a higher level of control). The last element analyzed and that probably is a useful tool to get an overview of the market side provider is brand awareness, brand recall more precisely. Aruba

holds the first place (44%) followed by Telecom (23%), Seeweb (6%), Register (3%), Italy Cloud (3%), Hosting Solutions (2%), Tiscali (2%), Vodafone (2%) and Cloudup (1%).
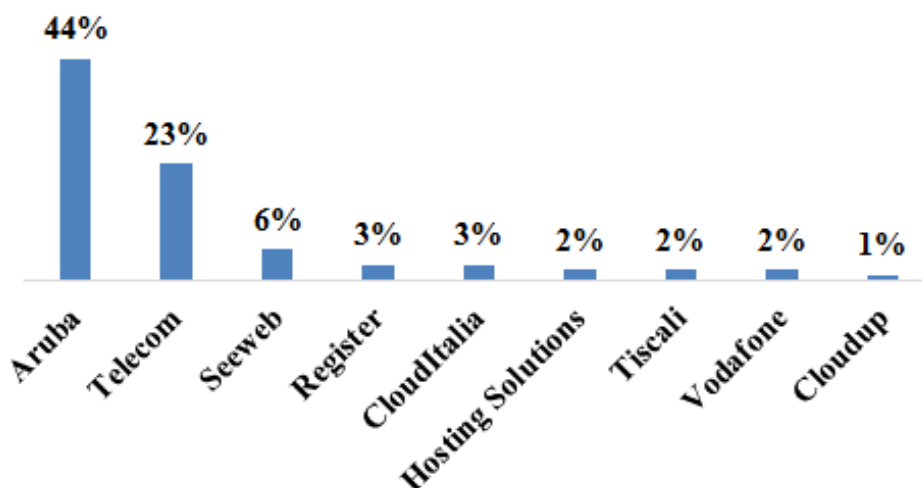

Image 7 – Market share of Italian Provides, year 2013

The year 2014 is considered as the "year of the action". The ICT Observatory of the Politecnico of Milan has also produced for this year a research on a sample of 581 between large companies and SMEs. The data show a growth of Cloud 40% against 12% the previous year, in particular the market for public cloud rose from 229 to 320 million euros and the planned investments were increased by 28% . This technology could be considered, with the Mobile, Social and Big Data *"one of the factors that can actually create an organizational revolution, changing the way we disseminate information, make decisions and collaborate within and outside the organization, giving new impetus and productivity to Italian companies"*(Mainetti, 2014). Taking into account that the direct and the indirect the total market value reached 1.18 billion euro. The observatory has estimated that, for 2014, will be invested for its implementation 860 million euros, and it will increase of 28% in the next year. Despite the prevalence of internalizing activities core business for 2014 was recorded some increase in the percentage of this type of migration related activities. The increasing success of this tool is

definitely related to its versatility and to the high number of solution proposed by providers. About this, the most popular application proposed on cloud market are: Social & Web Analytics (32%), Human Resources (26%), E-mail & Office Automation (23%), Enterprise Social Collaboration / Intranet (15%), Data Management (13%), e-commerce (15%), Vertical solutions for business (11%) and Customer Retention Management & Sales (8%).

The following images show the trend of Cloud computing total expense, with a detail on the Public, and the growth rate in the years 2011-2014.
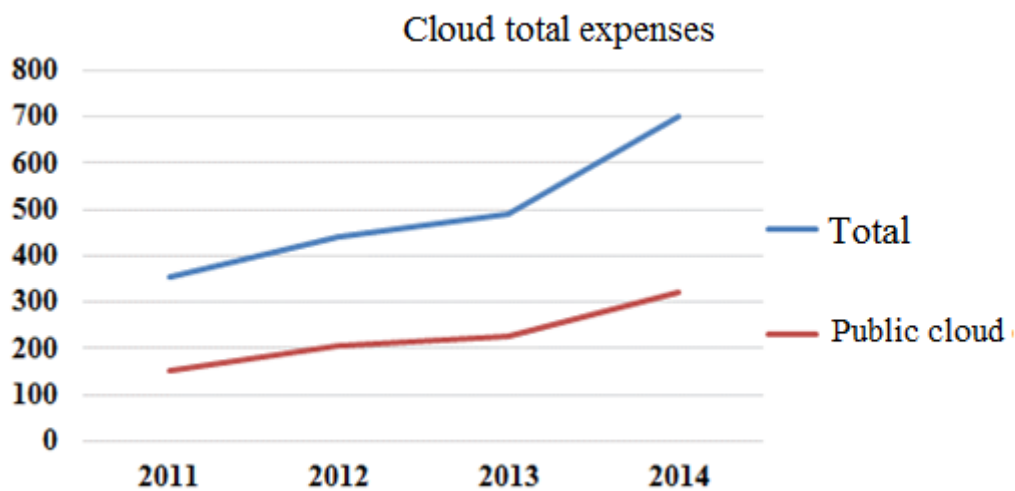
Image 8 – Cloud expenses in Italy

Cloud Growth rate

45%
40%
35%
30%
25%
20%
15%
10%
5%
0%

2012   2013   2014
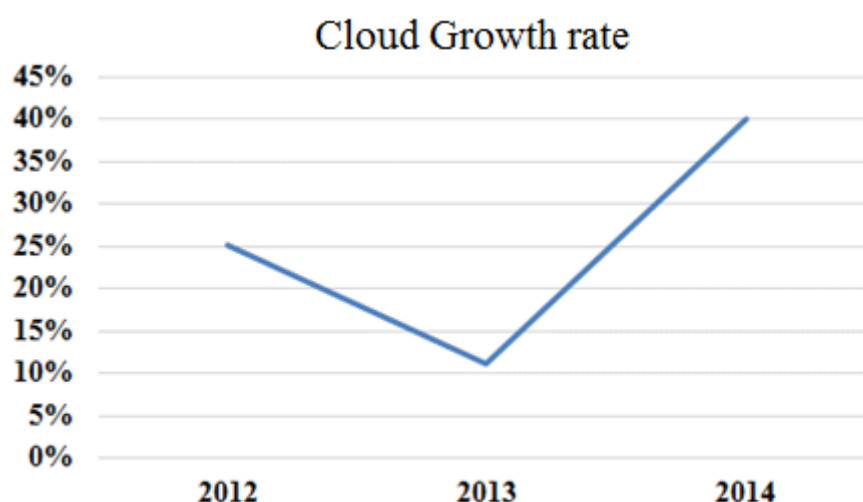
Image 9 – Growth rate of cloud computing expenses

In conclusion, what is worth to note is that there is a significant market growth for Cloud computing in Italy despite the digital divide and the strong reticence average entrepreneur to outsourcing. The following images show the evolution of the market from 2011 to 2014. It is important to highlight that the financial crisis has not produced the same devastating effects of other sectors on the ICT sector. The Cloud actually managed to ride this opportunity offering itself as a cheap alternative and safe implementation and / or management of internalized costs.

3. The factors behind the choice of Cloud

In this paragraph we will discuss the main benefit arising the adoption of cloud computing by the SMEs.
Recently, a survey conducted by "Enterthecloud" highlighted that the main drivers that push Italian SMEs to move their activities on the cloud. More specifically:

- 27% considered the possibility of being able to access documents and applications remotely and without space and time limits.
- 22% considered it as essential factor for money savings and for reducing the costs of infrastructure.
- 20% expressed some attention to the reduction of operating costs.
- 21% explained that the flexibility and scalability were also fundamental factors that can push a company to migration.
- Only 10% of users believe that Cloud Computing could be safer than on-premise solutions.

What should be noted is that the great part of the sample consider cloud computing as a tool useful to improve the company efficiency.

Contrariwise, another Research conducted by Zerouno and Club-Ti on a sample of 68 Italian companies showed how CEOs of the Italian SMEs evaluate the factors considered behind the adoption of SaaS. The results were processed according to five perspectives:

- Operational procedures,

- People,

- Supplier,

- Technology,

- Economics.

The first perspective is the operational procedures. The SaaS model is generally adopted to optimize processes supported by the application, and companies have claimed to prefer the flexibility of use of cloud solutions and the customization typical of those implemented internally.

In the perspective of people (staff) is not necessary a high commitment from the top management because this indicates a strong culture of innovation models of ICT sourcing. Whatever could be necessary to ensure an efficient and effective collaboration with suppliers. Also, about the staff skills, cloud adoption led in some cases to a conversion process with technical chosen to focus more on the

aspects related to the processes as purely technical ones will require less intervention from the inside. However, the survey found a high degree of acceptance and a poor resistance to change by final users.

The third perspective is the one for the supplier. Is possible to distinguish the role of service provider (which deals with the integration of systems) from that of the supplier of the application in the strict sense. The choice of the first type depends primarily on the ratio of trust and then by the proven skills of the management. The application supplier is generally selected on the basis of the Brand.

Considering the technology perspective, the main factors considered by the CEOs are the simplicity and the rapidity. The systems require a very short time to be ready to use, but often the process of integration with enterprise systems pre-existing significant difficulties. Other elements that have a particular relevance for users are the flexibility, scalability and the ease of use.

The last point of view is represented by the costs. Usually, they are the determining factor in the cloud choice because the migration allow companies to reach a certain level optimization for hardware, software and infrastructure. Indeed, according to a survey conducted by IBM, companies that use the Cloud Computing actually achieve higher profits and are more competitive in relationships with customers.

What should be noted is that there are five levers that can accelerate or reduce the growth of Cloud in companies (Gartner, 2012). According to Gartner, these are: technology promises, the possibility of hybrid configuration, request of technical support, the intrinsic potential of cloud technology, the role of the actors.

The first phenomenon to consider is that the technology promises numerous benefits including the ability to be able to focus their resources on core business, outsourcing the management of activities with a lower value added. This aspect must be accompanied by a careful analysis some issues such as security, transparency reduction, network performance and provider lock-in which must be implemented for all those activities of integration and / or upgrades. These issues create a complex environment that needs very thorough analysis: wrong choices could create problems that can reduce or cut out generated the benefits. The

second lever identified is the possibility of a hybrid configuration. This choice allows CIOs to start a gradual migration managing to overcome the reluctance of many typical companies. What should be noted is that in a complex environment such as the Public Cloud, is important to define with the customer the guidelines of the integration mechanisms. The third focus concerns the spread of Cloud technology and the consequent increase in requests for technical and commercial support. This has encouraged the growth of the Cloud Broker, that has an intermediation role in cloud computing world. Nevertheless they must be prepared mechanisms to create a fruitful relationship between the two parties and ensure greater efficiency of business processes. The fourth element is the intrinsic potential of this technology. Companies do not have to develop a concept of the Cloud to represent him only as the novelty of the year, a trendy choice. What is really important is to look beyond the simple migration and try to take full advantage and the opportunities that the cloud can offer. The fifth and final aspect to consider is the role of the actors. Companies that wish to continue to achieve their data center can not disregard the models implemented by the cloud and then have to design the infrastructure with high levels of flexibility in order to facilitate and make less expensive and complex any future additions and / or migration .

4. The Cloud for Public Administration

One of the main actors that can use cloud computing and get a lot of benefits from its use is, definitely, the Public Administration.

The first Administration that starts to implement cloud computing were the US Government.

Indeed, they have one of the biggest private cloud infrastructure because it was clear that this technology is the key to reach more rapidity and costs effectiveness

in the public sector. An American analyst, Shawn P. McCarthy (2013), distinguishes three types of services provided by government Private Cloud:

- Type 1: they are very similar to the methods used by the companies on the market.
- Type 2: with the exception of hosting, the rest is managed by external providers.
- Type 3: management and hosting are outsourced to external parties.

The researcher explains that the American government could safely speak of *"a private Cloud offsite"* featuring hardware resources dedicated to 100% even placed elsewhere. A clear example is the case of an expensive geological software that would be used by few offices. Using the cloud the larger institutions, positioned at a higher level, buy the software and offer it to the different agencies / offices located in different parts of the territory.
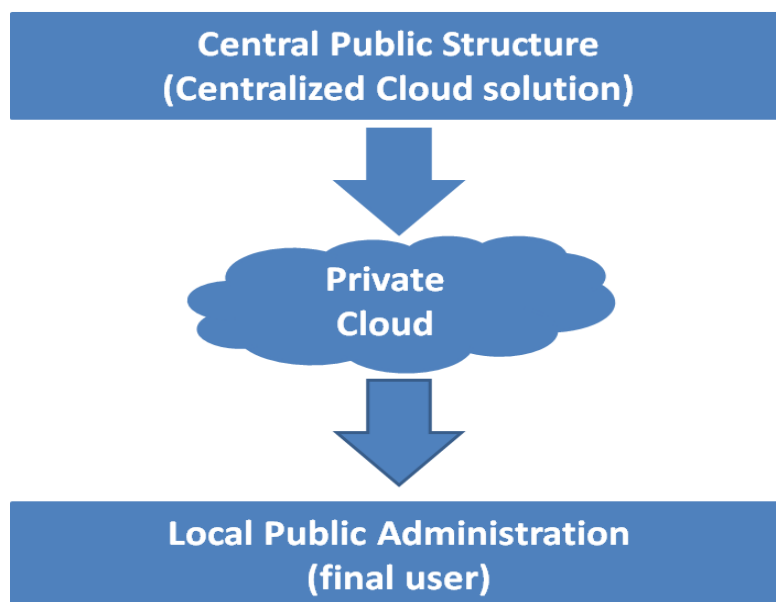
Image 10 – Cloud computing for Public Administration

The image n. 10 provides one of the possible representations of the logic with which the Cloud would be applied within the public facility.

In Italy the Public Administration have over 1,000 data centers located throughout the national territory (27 thousand servers) employing over seven thousand dedicated operators.

To these must be added the approximately three thousand data center used by the regions, local authorities and health sector and with an additional staff of about thirteen thousand people. From the economic point of view the estimated total expenditure is more than three billion euro a year. Also we should add the cost of the internal human resources (about one billion euro) and energy expenditure that should absorb about 300 million euros. The implementation of a Cloud system would help public sector to reduce this expenditure and for this reason in 2012, the Italian Government published the Digital Agenda 1.0.

The Digital Agenda is a policy document with whom a public body define its strategic commitment to the promotion of the digital economy in their own territory. The European Union has defined the Digital Agenda for Europe (DAE) in order to help citizens and businesses in Europe to get the most from digital technologies and it is for this that constitutes the first of the seven pilot program Europe 2020. The aims are to ensure inclusive growth, smart and sustainable Member States by achieving the following objectives / priorities:

- Create a new and stable regulatory framework regarding broadband.
- New infrastructure for public services through digital loans Connecting Europe.
- Start a grand coalition for digital skills and jobs.
- Propose a strategy for the digital security of the EU.
- Update the EU regulatory framework on copyright.
- Accelerate the Cloud Computing through the purchasing power of the public sector.
- Launch of a new electronic industrial strategy.

The idea is that the achievement of these goals would solve the problems of digital market fragmentation, the interoperability lack (poor synergy between devices, applications, databases, networks and services), the investment in

infrastructure lack, and the insufficient commitment in research and in 'innovation, lack of digital literacy and computer skills, the increase of cybercrime and the decline in confidence in networks.

The Italian Digital Agenda (ADI) was instead established March 1, 2012, and its activity is focused on the following topics: digital identity, digital administration, education, digital health, digital divide, digital justice, electronic payments and invoicing. In order to ensure the achievement of the objectives set by the "European Strategy EU2020", was created a real control room, divided into six working groups that treat the main target of the Digital Agenda. The teams are divided by themes and are: Infrastructure and Security, E-commerce, E-Gov / Open Data, digital Computerization and digital skills, Research & Innovation and Smart Communities. The activity of periodic update of the strategy is entrusted to the Agency for Italy that operates a digital monitoring and control for the introduction of innovations that emerge at regional and local levels.

The Digital Agenda gives a special space to the cloud computing. The regions may play the role of *"Cloud service broker"* then, following the cloud logic, could deliver services to more territories and more BP levels (local, regional and national). The poor quality of Italian internet infrastructure creates a deep digital divide that is holding back the spread of digital services and this is not acceptable for areas such as health that need a high level of performance, security and reliability.

For these reasons, during the *"Cloud Computing Workshop"*, organized by Unindustria after the diffusion of ADI, Renzo Turatto, Head of Innovation and Technology Department of the Ministry of Public Administration, explained why the Cloud could be a revolution for the Italian Public Administration. Italian national economy is very fragmented and very small units with unbundled suffering from obvious problems of technological upgrading. The cloud could help overcome these limitations providing three types of benefits:

1) Less consumption of ICT resources (shared) with reduced costs,
2) Standardization and process engineering (towards a better quality of data resulting in better interaction with citizens),

3) Access to technology and best innovative capacity.

About the less consumption of ICT resources, Turatto provides a simple example which helps to understand how it could achieve significant savings. Many small business are forced to adopt infrastructure and equipment that will be used a just for few times each month, and with the Cloud, a central body could provide to the individual the operating units. *"[...]this will be shared between different "government users" that in this way will be able to optimize the sizing of equipment and investments. The PA spends an average of two billion euro a year just for the hardware purchase and if it is possible to achieve a reduction in costs as little as 10%, we would be talking of over 200 million Euros."*(Turatto, 2014).

For the second point what should be noted is that the Italian public administration has never been given special importance to the standardization / process engineering in a more industrial but with the Cloud, the need to interface with a platform characterized by precise rules of operation, should be a great first step towards this goal. This would allow to keep a certain traceability and ensure greater availability of information and documents for operators and public officials that this could ensure a better service to the citizen. Not always the inefficiency can be attributed to the inefficiency of the operators because very often really are not able to find what is required. The Cloud, among the many opportunities, could create a kind of centralized database also able to reduce this type of problem.

The third benefit refers to a critical problem: the low propensity to innovation of public administration and the low competence of the smaller realities. The cloud, should ensure reduction of the barriers and could serve as a starter for a process of technological upgrading.

According to Microsoft (2011), Cloud Computing will allow the government to access information services in a dynamic, flexible and self-service. The dynamics is due to the possibility of access and release at any time, in a simple and fast; elasticity refers expandability and the instantaneous release of resources only when needed; the self-service highlights the lack of expensive external

interventions. Administrations smaller then be able to obtain immediate benefits because they would be empowered to deliver new services without bothering to expand its internal resources and all distinguished by a remarkable speed.

5. Risks in ICT and cloud computing

The aim of this paragraph is to highlight the main risks of ICT for Italian company and, more specifically the risks arising cloud computing adoption.

A short premise is due. Successful companies must be able to identify new value sources for stakeholders to survive to the rapid changes of context. For this reason, process of defining business strategies and risk management take a strong importance and they need flexibility and dynamism. Over time there were developed approaches to risk management known as *"traditional"* that provide the management of risks as "watertight compartments". This kind of approach are focused only on particular types of risk (i.e.: financial risks, risk for corporate assets) and only on the reduction of losses associated with risky event. This logic does not allow to anticipate and prevent the emerging (new) risks but is limited to a *"damage limitation"*.

In order to provide a complete perspective on corporate risk management - as well as a model of risk prevention – the Committee of Sponsoring Organizations of the Treadway Commission (COSO) created the model Enterprise Risk Management (ERM) (2004). Agreeing to COSO (2004), the aim of ERM is to bring consistency in the companies risk management; indeed, despite the strong attention of supervisory bodies and the knowledge diffusion on this subject, the maturity of the companies in terms of risk management is still low.

According to COSO (2012) there are many areas where companies have a deficit of attention on the risks and between these there is definitely the ICT governance. With the introduction of cloud computing the ICT governance becomes more difficult and risky and for this reason in 2012 was published the document

"COSO Enterprise Risk Management for Cloud Computing". As with any new technology, cloud computing entails commensurate risks. The intent of COSO ERM for cloud computing is to leverage the principles of COSO*'s Enterprise Risk Management* in order to provide guidelines that will identify succinctly the risks and impact cloud computing will have on an organization. The more educated executives become about the risks and benefits of cloud computing, the more effectively they will be able to prepare their organizations for the future. The guidance presented here will enable executives to identify, monitor, and mitigate or accept the risks that come with using cloud computing.

According to Warren Chan, co-author of the paper and principal at Crowe Horwath LLP[1]:

"The advent of cloud computing is causing executives to revisit how they would like their enterprises to be supported by technology,[…] Applying COSO's ERM framework to the business processes being supported by cloud solutions will provide management with a complete view of the associated risks, benefits and risk response options."

So, the potential benefits cloud computing can bring an organization are numerous, but they are just part of this unfolding story, because there are also many risks.

The document highlighted a set of 5 opportunities and 10 risks arising cloud computing adoption.

With particular reference to the opportunities, the COSO, mention:

- Cost savings: cloud customers pay only for the resources that they really use rather than purchasing equipment *that may not be fully utilized at all times.* Also companies do not need to invest money in servers, CPU, and other ICT tools.
- Speed of deployment: the cloud-providers can provide to the companied need more quickly than the traditional ICT function.
- Scalability and better alignment of technologies resources: companies can change the demand of servers and storage simply asking to providers.

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[1] public accounting and consulting firm.

- Decreased effort in managing technology: cloud computing allows companies to focus more time on the core business.
- Environmental benefits: if a great number of companies use cloud computing the carbon emission and the power consumption will be low.

Despite this advantage there is also a set of risks:
- **Disruptive force:** By lowering the barriers of entry for new competitors, cloud computing could threaten or disrupt some business models, even rendering them obsolete in the future
- **Residing in the same risk ecosystem as the CSP and other tenants of the cloud:** The actions of the CSP and fellow cloud tenants can impact the organization in various ways. For example, is possible to consider the following:
    o Third party cloud service provider and their customer organizations are distinct enterprises;
    o Cloud service providers and their customer organizations are likely to have separate risk management programs to address the perceived risks.
- **Lack of transparency** – A CSP is unlikely to divulge detailed information about its processes, operations, controls, and methodologies.
- **Reliability and performance issues:** System failure is a relevant risk event that can occur in any computing environment but poses unique challenges with cloud computing.
- **Vendor lock-in and lack of application portability or interoperability:** Many Cloud Service provider could offer application software development tools with their cloud solutions.
- **Security and compliance concerns:** the data are located on hardware that is physically outside of the direct control of the company.
- **High-value cyber-attack targets:** the consolidation of multiple organizations operating on a CSP's infrastructure presents a more

attractive target than a single organization, thus increasing the likelihood of attacks.(higher risks)

- **Risk of data leakage:** A multi-tenant cloud environment presents a risk of data leakage that does not exist when the servers are dedicated exclusively to a single company.
- **IT organizational changes:** sometimes, with an high degree of cloud computing usage, companies needs fewer internal ICT personnel in many areas like infrastructure management, technology deployment, application development, and maintenance.
- **Cloud service provider viability:** many cloud service providers are relatively young companies (or the cloud computing business line is a new one for a well-established company) and for this reason the longevity and profitability of cloud services are unknown.

What should be noted is that in addition to these risks, there are certain characteristics of cloud computing that may create problems for security. Some management teams may be willing to accept the risks of running their entire enterprise in a public cloud with a low capital investment. For example, the start-ups prefer to focus their investment in the core business rather than in the ICT infrastructure. This kind of companies can deploy their business models supported by cloud solutions *"more quickly and more economically in comparison to the previous generation of technology options."*

All the risks previously highlighted should be given careful consideration because theirs manifestation would present many negative consequences. Also many of them can not be mitigated by contractual clauses with the service provider, so, as solutions, companies may be obliged to rely on third parties (i.e. for security).

According to COSO, the risks increases more and more with the increase of the loss of control. The following image explains the trend of the risks for different levels of outsourcing:
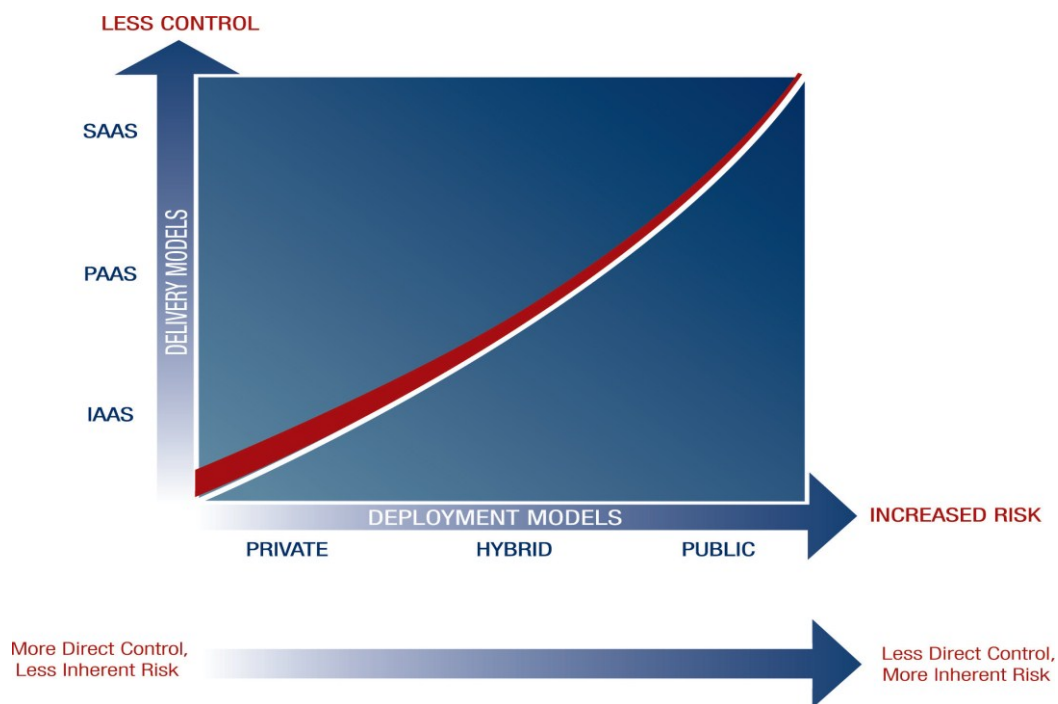
Image 11 – relation between risks and delivery models.

Referring to the following chapter for a more detailed discussion about risks of cloud computing, what should be noted is that the management choice about the level of outsourcing could reduce the direct control on data and, as a direct consequence, could create a higher level of risk.

However, according to COSO the adoption and acceptance of cloud computing is congruent with *"the popularity and acceptance of other trends of the past decade (e.g., social networking sites and virtual retailing), for which the people and facilities cannot be seen but are greatly trusted to facilitate communications, store information, and transact business."* Indeed the application of cloud computing could create problems especially if the migration is not followed by a right due diligence, and control steps. Also, if correctly used (with the necessary precautions) this tool could yield a multitude of benefits.

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Chapter 2

Perceived riskiness of cloud computing: an investigation of the Italian setting

Abstract

Over the last years cloud computing has been regarded has potentially able to improve efficiency in organizations. This paper aims to identify possible areas to improve control after the implementation of cloud computing to render it effective. To this aim we carried out a semi-structured survey among cloud computing first time adopters to understand what are the risks perceived ex-ante and their supposed impact. The survey relies upon a final sample of 100 individuals in 50 enterprises located in Italy. We choose the Italian setting because it is characterized by an increasing number of programs emphasizing the importance of cloud computing and supporting its wide dissemination. The findings allowed us to identify the expected benefits and the perceived risks related to the introduction of the new tool, thus revealing possible areas for improvement during the implementation phase.

1. Introduction

The persisting crisis of the Italian manufacturing industry reflects the difficulty of domestic enterprises to adapt to external changes that have affected the international economic environment over the last twenty years (Bank of Italy, 2013). In particular, the country was unprepared to the globalization and technological changes that increased competitive pressures on a global scale

(Bank of Italy, 2009). More specifically, the main reasons behind the difficulties experienced by Italian entities can be ascribed to the backwardness of innovation for Information and Communication Technology (ICT) (Bugamelli and Pagano, 2004; Bank of Italy, 2009; Marchi and Mancini, 2009).

Indeed, the dissemination of information systems is usually regarded as a crucial element to guarantee fast data processing and circulation of information that favour the creation and maintenance of competitive advantage (see, among others, Black and Lynch, 2001 and 2004; Bresnahan, Brynjolfsson and Hitt, 2002; Triplett and Bosworth, 2004; Quagli et al., 2007; Marchi and Mancini, 2009). However, a report published by ISTAT (2011) reveals that Italian firms, if compared with European competitors, show a strong technological gap, partially filled during the past decade with the diffusion of "basic" technology (computers, email, internet). In this scenario there were numerous initiatives promoted by national entities such as the *ASTRID Foundation* (Foundation for Analysis, Studies and Research on Reform of Democratic Institutions and on innovation in public administration) and *i-Think* (an independent body that deals, among other things, with the analysis of public policies and the interaction between science and technology), who joined the government in drafting the Digital Agenda (a document for the modernization of ICT systems in the public administration) and to promote new information technologies such as cloud computing.

In general, cloud computing can be described as a package of services offered by a company (provider) to potential users (cloud user) who may decide to outsource the ICT function, as a whole or in part, to gain benefits in terms of costs and flexibility. The services range from the basic computer functions (network management, physical memories, etc.) to more complex functions (the processing of sensitive data, application services). In other words, the user operates in a virtual environment, realizing the benefits ordinarily offered by current technologies, but with lower costs (using a formula known as pay-as-you -use (Ibrahim et al., 2011). It is necessary to point out that cloud computing keeps the general benefits associated with new ICT introduction but also incorporates a

greater number of specific risks (arising by the outsourcing of all ICT function) in comparison to other conventional systems (Fan and Chen, 2012).

What should be noted is that the existing studies carried out in the ICT field have broadly identified the strengths associated with the use of cloud computing (Buyya et al., 2008 and 2009; Sultan, 2010 and 2011; Marston et al., 2011; et Kaiserswerth al., 2012; Lee and Mautz, 2012), but dedicated just a few space to the problems relating to implementation and risks across the enterprise. For this reason, the idea of this study is to address these under-investigated issues by specifically focusing on the the expected benefits and the perception of risks associated with the use of cloud computing, with the purpose to identify possible areas to improve control after the implementation of cloud computing to render it effective.

To this aim, a first necessary step is to map the possible risks related to cloud computing, and to measure the degree of expected risks, their probability, and their practical impact on businesses practices and procedures. Hence, we carried out an exploratory study, relying upon a semi-structured survey among cloud computing users of Italian SMEs identified as first-time adopters. The survey was carried out on a sample of 250 individuals (in the management accounting and IT divisions) who work in 125 Italian small and medium enterprises, belonging to different sectors. We removed from the sample the incomplete forms getting to a final data set made up of 130 questionnaires and covering 65 enterprises.

The survey allowed the creation of a map of the perceived risks and their potential impact. This is crucial to understand what are the main factors that potentially influence the success of the introduction of cloud computing in organizations and to identify possible areas for improvement in order to make the changes effective.

Therefore, this paper has a twofold relevance. First, it enlarges the awareness of the real system of the risks of the Cloud Computing making it easier to spread the tool and helping to counteract any resistance barriers. Second, the availability of a measure associated with each risk can potentially improve the internal control systems of companies in terms of effectiveness and efficiency.

The remainder of the paper is organized as follows. Section 2 clarifies the main characteristics of cloud computing technologies. Section 3 examines the main issues raised in the existing literature on the benefits and the risks relating to cloud computing adoption. Section 4 focuses on the research design. Section 5 presents the findings of the analysis, and section 6 provides some concluding remarks.

2. Cloud computing: deployment models and characteristics

Literature offers a considerable variety of definitions for cloud computing (Buyya et al., 2008; Broberg et al., 2008; Armbroust et al., 2010; Mulholland et al., 2010), most of which derived from the one provided by the U.S. National Institute of Information Technology (NIST) that in the document *"NIST Definition of Cloud Computing"* (2009, then revised in 2010 and 2011) defines cloud computing as: *"a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models" (*Mell, Grance, 2011). This report identifies the attributes and characteristics of cloud computing, emphasizing the ability of this tool to ensure accessibility to the data independently from different places and users (*on-demand self-service*), at the same time (*ubiquitous network access*), reducing the need of resources (financial and human) through sharing with other companies (*resource pooling*), ensuring high versatility (*rapid elasticity*) and a reliable measurement of the cost of the service (*measured service*).

Furthermore, also in the European context attention has been paid to the issues relating to cloud computing. In particular, the Commission of the European Communities "Information Society & Media" issued its own report on cloud computing *Unleashing the Potential of Cloud Computing in Europe* (2010, then

revised in 2012), where it defines cloud computing as: *"an elastic execution environment of resources involving multiple stakeholders and providing a metered service at multiple granularities for a specified level of quality (of the service)"*. What should be noted is that both NIST and the Commission of the European Communities celebrate and promote cloud computing as a great innovation for its efficiency, flexibility and adaptability to businesses (NIST 2009, 2010, 2011; Commission of the European Communities "Information Society & Media"2012).

Both reports describe three different service model that can be employed to implement cloud computing: *Infrastructure as a Service* (IaaS), *Platform as a Service* (PaaS), *Software as a Service* (SaaS) (Mell and Grance, 2009 and 2011).

For a purpose of clarity, one can consider this three different architectures as the levels of a pyramid represented in the following image (Figure 1). The differences between the various levels depend on the degree of outsourcing. Thus, s moving from the basis to the top there is a growing level of efficiency (in terms of cost-efficiency) but also a lower control on data.
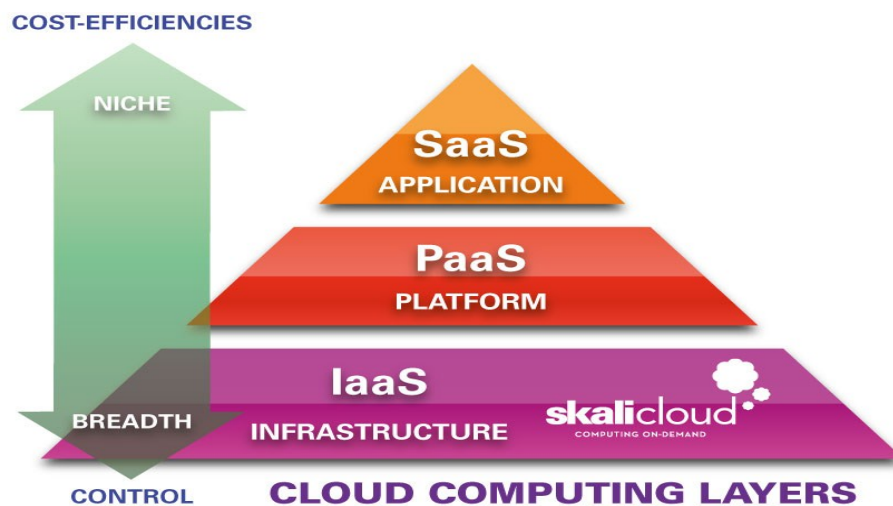

Image 11 - Cloud Pyramid
Source: Microsoft.com

At the lowest level there is the IaaS that represents a solution which allows the cloud user to deliver process, storage, network and other basic elements absolutely independent from application services of any kind. Built on this base

level there is PaaS. This kind of architecture provides, in addition to the services offered by IaaS, basic application services such as operating systems, middleware, languages, database technologies and the runtime environment necessary to run an application and read the data, that are the only element which remains under the responsibility of the user. On the top of the pyramid there is SaaS that expands the functionality of PaaS also offering the delivery of application services of any kind, accessible from anywhere and from any device. The application is not owned by the customer/user, but is obtained by paying a royalty. This last solution offers the chance to outsource a number of applications and functions such as Human Resources Management, Customer Retention Management, Enterprise Resources Program (ERP) but, on the other hand, it reduces the possibilities of customization if compared to the other cloud solutions.

In summary, it is worth highlighting that the IaaS architecture is characterized by a higher level of control because most functions are already internal: the customer preserves the responsibility of the security for the software and for the data that are stored in the cloud. On the other hand, the SaaS solution is characterized by the total outsourcing of IT functions and the Cloud Service Provider (CSP) is the only responsible for the security of data and applications. The following picture (Figure 2) summarizes the main differences described above.
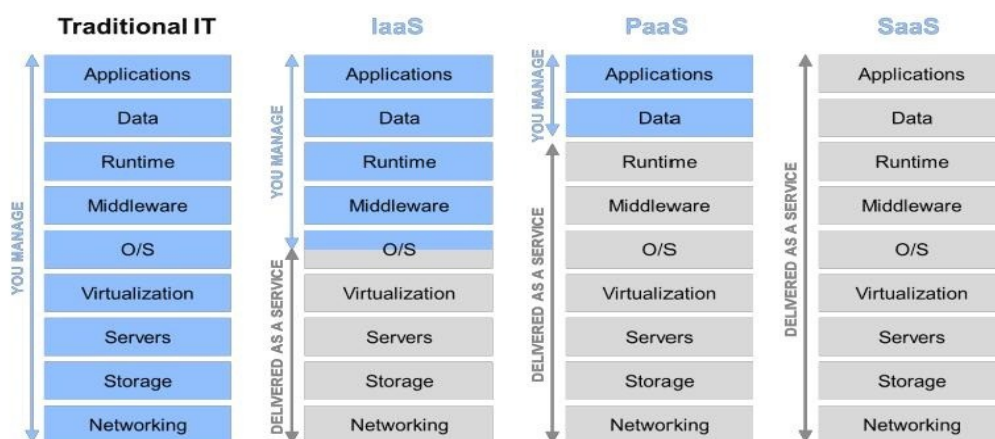

Image 12 – Different level of outsourcing obtained using different cloud solution
SOURCE: Microsoft.com

Referring to Microsoft and IBM Reports (2011, 2012) for a better explanation of all the micro-function the previous image explains the loss of control passing by a Traditional ICT solution (typically managed only by users) to a SaaS solution (completely outsourced). For example passing from traditional ICT to IAAS lead in the cloud server virtualization, servers and storage, meanwhile Operative Systems and application are still managed by cloud users. Besides, if the ICT function usually involves the centralization of all the micro-processes in the company (generating substantial costs) a SAAS solution allows total outsourcing of ICT function and generates, for the business user, the inability to carry out controls or customize applications.

In addition to the architectures of cloud computing, another essential element to take into account is related to the four deployment models of this tool that have been identified by NIST as private cloud, public cloud, community cloud and hybrid cloud. Users of different organizations mainly relate the existing differences between these models to the accessibility to cloud infrastructures. In private cloud only one customer uses the infrastructure and, intuitively, the advantage of this solution can be ascribed to the higher level of security that is ensured for the organization. However, the implementation of private cloud requires more capital expenditure and an efficient ICT team (Carrol et al., 2011). On the other hand, public cloud requires less expenditure than the other solutions but implies higher riskiness for organizations in terms of security, transparency and compliance. Community cloud represents a deployment model in which many organizations that share mission, security, compliance etc. use the same infrastructure, thus benefiting from costs reduction (Carrol et al., 2011; Brender et al., 2013). At last, the hybrid cloud is a combination of different models that share standard data and applications, still remaining detached (Brender et al., 2013).

On the basis of the characteristics addressed above one could argue that cloud computing solutions can vary a lot across enterprises and sectors, given the intrinsic nature of the tool that can be tailored in view of the needs of the users.

However, it is possible to identify general benefits and risks related to the tool, despite its customization, that will be the subjects of the next section.

3. Benefits risks and vulnerability of cloud computing

In the literature on ICT several authors (eg, Bakos and Treacy 1986; Anderson and Tushman, 1990; Hyvönen et al., 2007; Cantino, 2008; Paoloni, 2008; Marchi and Mancini, 2009; Tan et al., 2009) treated the impact of new technologies on business practices, emphasizing how innovation could help to streamline processes, to increase the speed of the data processing and to enhance reliability (Chapman and Kihn, 2009; Tan et al., 2009). Instead, extant studies on cloud computing focus mainly on the issues relating to the enhancement of the main advantages associated with this technology - with reference to to the strategic dimension and to the questions of the information, as well as on the ability to connect multiple activities and make data available to more individuals in real time (Vouk, 2008; Buyya et al., 2008 and 2009; Marston, 2011; Mangiuc, 2012). Indeed, despite the growing interests for cloud-related issues, at present the literature appears to be rather limited. A huge number of studies, in addition to the reference for the same definition of cloud computing Buyya (2008) Brodeberg (2008), Pyke (2010) and Ambroust (2010), has devoted attention to the differences between this tool and other ICT systems. Moreover, the majority of these researches has adopted a descriptive approach (Mangiuc, 2011), mainly discussing the advantages and opportunities (and risks) associated with the implementation of the tool (Buyya, 2008, 2009; Vouk 2004; Marston 2011).

On these grounds, a bearing in mind that for the purposes of this study a fuull comprehension of the benefits and risks associated to cloud computing is of a primary importance, the following paragraphs offer a brief review the literature on these issues.

Commonly, the benefits associated with cloud computing characteristics are purely economic, due to the reduction in the investments for hardware, the agility of deployment of new applications, the ability to achieve economies of scale. Yet, elements such as the reduced the need for ICT support, the increased accessibility and cost allocation data processing, and the ability to redraw at any time the cloud service required paper to be quite crucial (Ionescu et al., 2011; Lee and Mautz, 2011 ; Lawler et al., 2012).

Marston et al. (2011) addressed the issue relating to cloud computing implementation by conducting a SWOT Analysis. They identified as a major strength the lower costs of implementation (for example, investment in infrastructures and electrical charges) and management (maintenance), and the ability for businesses to customize the level of the service redesigning and modifying it, without incurring additional costs, every time that it become necessary. In essence, the use of a cloud computing platform provides the ability to transform the huge amount of fixed costs into variable costs semi-specifically attributable to the fees payable to the provider, bringing the service to a model of the kind pay- as-you-use (Ibrahim et al., 2011). For this reason, the idea that cloud computing, if carefully adopted, represents a tool that can generate higher benefits for businesses is becoming increasingly affirmed (Lawler et al., 2012).

The following table summarizes the main benefits identified by the literature on cloud computing.

Table 2 - Benefits of cloud computing adoption

Reduced Cost	Cloud customers pay only the resources that they really use.	Ionescu et al. 2011; Almulla et al. 2012; Lee, Mautz 2012; Lawler et al. 2012;
Increased storage	Thanks to the external storage organizations can store more data than on private computer systems.	Lawler et al. 2012; Lee, Mautz, 2012.
Highly Automated	Organizations do not need IT employers to keep software up to date.	Buyya et al. 2008; Almulla et al. 2010; Dahbur et al.2011; Lawler et al. 2012

Flexibility	Cloud computing offers much more flexibility than past computing methods. It can also offer possibility of scale economy.	Buyya et al. 2008; Dahbur et al. 2011; Lawler et al., 2012
More Mobility	Employees can access information from wherever they are.	Buyya et al. 2008; Lawler et al. 2012
Allow IT Shift focus	No longer having to worry about constant server updates and other computing issues, government organizations will be free to concentrate on innovation.	Almulla et al. 2010; Lawler et al .2012

On the other hand this tool is called to have many weakness that need to be faced before its adoption. Literature focuses also on these critical issues related to the implementation of cloud computing. The introduction of this tool in the business context, in fact, requires to redesign and adapt the internal control system because of the existence of "dangerous aspects" especially related to the loss of control of the data entered into the cloud. In a recent document, the NIST argues that cloud computing, as any emerging technology, is not usable by any company because it contains a lot of open issues (NIST, 2012). In addition, according to many authors (see for example, Badger et al., 2012; Doherty et al., 2012) there are five open issues that could represent problems, risks or disadvantages to cloud computing adoption. The following table summarizes the critical aspects related to cloud computing adoption.

Table 3 - Open issues about cloud computing

Computing performance	Using different application in the cloud mean require different level of performance. This problem is not exclusively a cloud problem, but is important to notice here.	Marston et. Al. 2011; Chow et. Al 2009; Fanning, Centers 2012;
Cloud Reliability	For cloud computing reliability came from the match of various factors from the hardware and software offered by provider to subscriber's personnel. A Cloud solution result from many factors with different degree of reliability depending to the environment too.	Almulla et al 2010; Marston et. Al. 2011; Grobauer et al 2011; Fan, Chen 2012;

Economic Goals	Cloud computing gives the opportunity to outsource the IT function and this offer many economic possibility, but also many economic risks.	Ambrust et. al.2008; Buyya et al 2008; Ionescu et al 2011; Marston et. Al. 2011;
Compliance	The provider is in a best position to enforce the compliance rules.	Weinhardt et. Al. 2009; Chow et al. 2011; Edwards; Tiwari, Mishra 2012;
Information Security	Moving data into cloud could create many problems about data security and privacy.	Almulla et al 2008; Ambrust et. Al. 2008; Chow et. Al. 2009; Mangiuc 2010; Tiwari, Mishra 2012; Marston et. Al. 2011; Bojanc et al; Grobauer et al 2011; Fan, Chen 2012.

Leaving aside these problems, there are numerous risks related to the adoption of this instrument, described accurately and thoroughly by the NIST (2012) and the European Commission (2012). The aim of these reports is to provide the necessary information to understand how and when cloud computing can be considered an appropriate instrument to the decision-makers (Commission of the European Communities, 2012; NIST Special Publication 800-146, 2012).

A possible classification of these risks is the one proposed by Dahbur and Tarakji (2011). They considered all the possible risks related to cloud computing and suggested a breakdown into four groups: organizational, technical, legal and other general risks. The organizational risks regard the impact of cloud computing on the company organizational structure. Technical risks include all the possible technical problems caused by the cloud service provider. Legal risks are related to the problems arising from the storage of data in different countries with different laws and regulations than those of the client company. Finally, the category other general risks includes problems such as data protection and privacy in specific public cloud. Table 4 provides a possible classification of the risks of cloud computing adoption.

Table 4 - A possible classification of risks

	Loss of business reputations
Organizational	Provider failure, termination or acquisition
	IT organizational changes
	Resource sharing isolation problems
	Malicious (insiders or outsiders) attacks on the cloud provider
	System integrity
Technical	Data leakage
	Natural disaster recovery
	Shared technology vulnerabilities
	Cloud cross compatibility
	Risks resulting from possible changes of jurisdiction
Legal	Liability or obligation of the CSP in case of loss of data
	Responsibility of CSP in case of business interruption
Other general risks	Social engineering

	Data privacy and protection
	Physical security
	Loss or stolen backups
	Loss or compromise of security logs

This classification shows the existence of 18 different risks associated with the implementation of cloud computing. All the above-listed risks could represent an important barrier to cloud computing adoption and it is important for the final user to find a right trade-off between these risks and the benefits that they can gain upon the adoption of this tool. Despite this, in the literature there are few empirical studies on this topic (eg, Lawler et al., 2012; Brender & Markov, 2013). However, in a context in which this instrument is the main way to reduce the cost of ICT and to enhance efficiency, it seems necessary to elaborate further on the various employment methods of the tool, its perceived riskiness by the final users and, not least, the impact that such risks may exert on the company. The identified risks classification was the one taken as a reference for the analysis carried out in this work.

4. Research design

As already stated, and bearing in mind the issues raised in the previous section, the idea of this study is to focus on the expected benefits and the perception of risks associated with the use of cloud computing, with the purpose to identify possible areas to improve control after the implementation of cloud computing to

render it effective. On this ground, this study aims to answer the following questions: *what are the expected benefits and perceived risks on the use of cloud computing by Italian SMEs, identified as first-time adopters?*

Hence, we disseminated a questionnaire among a sample of people working in companies where the implementation of the tool was approved but not yet formally occurred. The usefulness of survey methods is widely recognized in literature (Corbetta, 2003; Noor et. Al., 2007; Al-Tamimi and Al-Mazrooei; 2007; Ariffin and Archer, 2009), because it allows observation standardization and the collection of a variety of comparable data and information. Moreover, in recent years, a number of institutions (Bank of Italy, 2011, 2012, CONSOB, 2012) and several authors (Al-Tamimi and Al-Mazrooei; 2007; Ariffin and Archer, 2009) have used this method to collect data and carry out research on risks, their perception and their verification.

survey among cloud computing users (first time adopters), and focusing on their ex-ante perceived riskiness of the new tool, when its adoption is decided and the change is going to happen. The survey was carried out on a sample of 250 individuals (in the management accounting and IT divisions) who work in 125 Italian small and medium enterprises, belonging to different sectors, in which cloud computing was implemented. A group of 130 unselected cloud users completed the survey that was carried out for the first period of the implementation of this new tool. It was published online in November and it accept the respondent's answer for 30 days. After the first 15 days we have about a 33 percent response rate, and after 30 days the response rate grow up to 52 percent. The questionnaire was disseminated in November 2013. It was released online to mitigate the problems of the distance from the respondent and to reduce the lag time that we could have with other dispensed mode. The respondents were asked to answer to 39 questions about the probability and about the impact of the cloud risks verification. The questionnaire (attached to the paper in the Appendix 1) was divided in 5 sections to consider the different kind of risk. The first section focuses the personal information of the respondent; it also asks about the main motivation to cloud computing adoption in theirs organization. The other

four section are focused about the different category of risks identified in literature and summarized above in table 3 (organizational, technical, legal and other general risks).

To measure the risk perception we employ a likert scale. We choose to use an even number scale to avoid the risk of central bias. The six possible answer goes from 1 (minimum risks) to 6 (maximum risk). Respondents were asked to explain their perception about the probability of risks verification and about the impact of these risks on their organizations.What should be noted is that the analysis focused on people who never used cloud computing, in order to assess the expected benefits and perceived risks before their effective manifestation, so as to obtain a thorough idea of the main reasons behind cloud computing implementation, and of the threats of the process.

In this regard a clarification is due. Indeed we employed a notion of perception intended that refers to any subject and involves the imagination of phenomena and events that could happen (Renn and Benighaus, 2013). Such a notion encompasses the issues relating to probability. Therefore, in this study "to perceive" a risk implies a full knowledge of the risky event, even if it has not manifested yet. In fact, the notion of perception is closely related to the personal experiences of people (subjective) that determine the human and cultural formation. Many sociological authors manifested criticisms about the investigation of risks perception by specific groups because the evaluation can be affected by subjectivity (Slovic et al., 1980; Brehmer, 1987; Slovic, 1987; Renn, 1990; Rohrmann, 1995; Slovic, 2000; Streffer, 2003). Nevertheless, the study of perception found ample favor in the scientific community, as it allows to highlight some of the factors underlying human behavior (eg, Renn, 1990; Slovic, 1992; Streffer, 2003).

On this basis, an event is considered risky if the people who must take a choice perceive it as such. In this regard, recent literature shows that the corporate risks, defined as the potential occurrence of an adverse event to the established goals, is strongly related to the human predictive capacity (Potito, 2014). Therefore, it is

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not possible to speak about risks by neglecting individual "decision-making skills".

As already stated, this paper measures the perception of technological risk defined as the process of formulating an opinion on the reliability, the probability of the occurrence of adverse events and the acceptability of them (Slovic et al., 1982; Brehmer, 1987; Slovic 1987; Renn, 1990, 2004, 2013; Rohrmann, 1995 and 1999; Slovic, 2000). It is worth pointing out that this process is often affected by social and cultural factors, which constitute a limitation for the research, especially if the sample includes subjects with very different technical knowledge. In order to limit the influence of personal and cultural experiences in their responses, for each company we invited to respond to the questionnaire two different subjects: an administrator and the person who manages ICT. Moreover, what should be noted is that the expectations of the benefits and the perception of risks depend on the considered time horizon and on the reason of the investment.

The sample was reliable as Cronbach's Alpha was 0.978. Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.95. A principal component analysis of the aggregated data for the sample was conducted and a varimax rotation was performed. Inspection of the data indicated that outliers strongly influenced correlation coefficients. We decided, therefore, to compute rank correlations among the eight rating scales and to carry out a principal component analysis on these rank correlations. Based on the scree-test plot we decided that three components, accounting for 0.968 of the variance, are necessary to explain the correlations among the eight rating scales.

After the dissemination phase, respondents' answers were drawn in order to obtain a modal value to create a likelihood matrix.

5. Findings

In this section we present the main findings of our analysis. First, it is important to summarize what were the main reasons that prompted the adoption of cloud computing in the SMEs. Interviewers had to choose just one of the main benefits put into light by literature (see the previous table 1). The following table summarizes the respondent view about the expected benefits related to cloud computing implementation.

Table 5 – Expected benefits

Benefit expected	Number of respondent	%
Cost reduction	40	30,77%
IT employees reduction	30	23,08%
Increased flexibility	29	22,31%
Increased mobility and information access	20	15,38%
Less IT focus	11	8,46%
TOTAL	**130**	**100%**

What should be noted is that the main benefits expected from cloud computing adoption are related to *cost reduction* and *IT employees reduction*. These items had a preference rate of 30,77% and of 23,08%, respectively. The results are aligned with Lawler's (2012) expectations of a significant reduction of fixed costs after cloud computing adoption. Moreover, the greater operational flexibility seems to be the key advantage for the 22.31% of respondents. This is indubitable because the instrument allows the simplification of ICT processes, ensuring benefits for SMEs that decide to adopt it. The benefits of *increased mobility and information access* and *less IT focus* received a lower response rate, 15.38% and 8.46%, respectively,. The lower weight recognized for these benefits is consistent with expectations inferred from theoretical studies examined in the previous section (Al-Tamimi, Al-Mazrooei, 2007; Ariffin, Archer, 2009). That said, with reference to the perceived risks, the findings are more heterogeneous. For a

purpose of clarity, in the following table we show the average value of the perceived risks and their supposed impact.

First, it is important to discuss the risks perception of the two different group of people interviewed (CEO and ICT people). What should be noted is that both groups responded similarly to questions related to probability and impact. This eliminates the idea of subjectivity of the risk assessment discussed in literature (eg, Renn, 1990; Slovic, 1992; Streffer, 2003), so it is possible to state that risks perception about cloud computing does not depend on human experience (such as position or academic formation). We used the following boxplots to put into light the low dispersion of the data: both the median value are about 65% for the probability and impact.

Image 12 – Box plot, probability perceived by the different category of subject

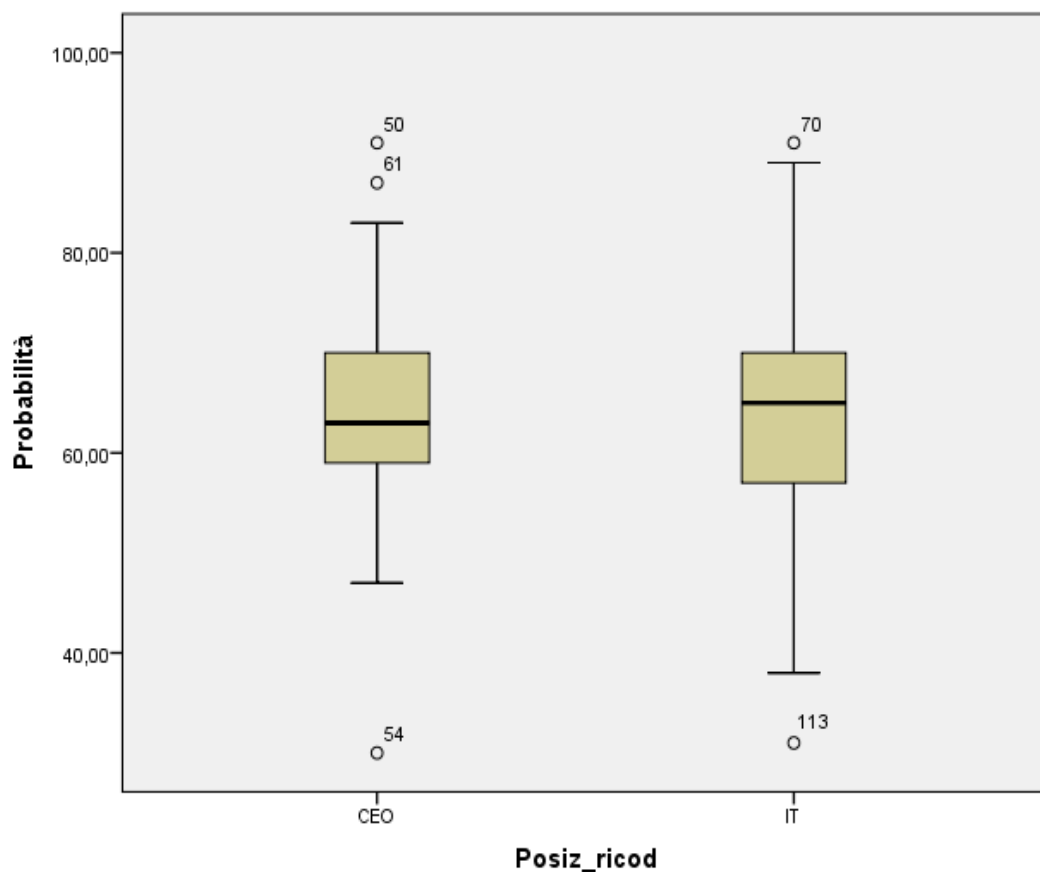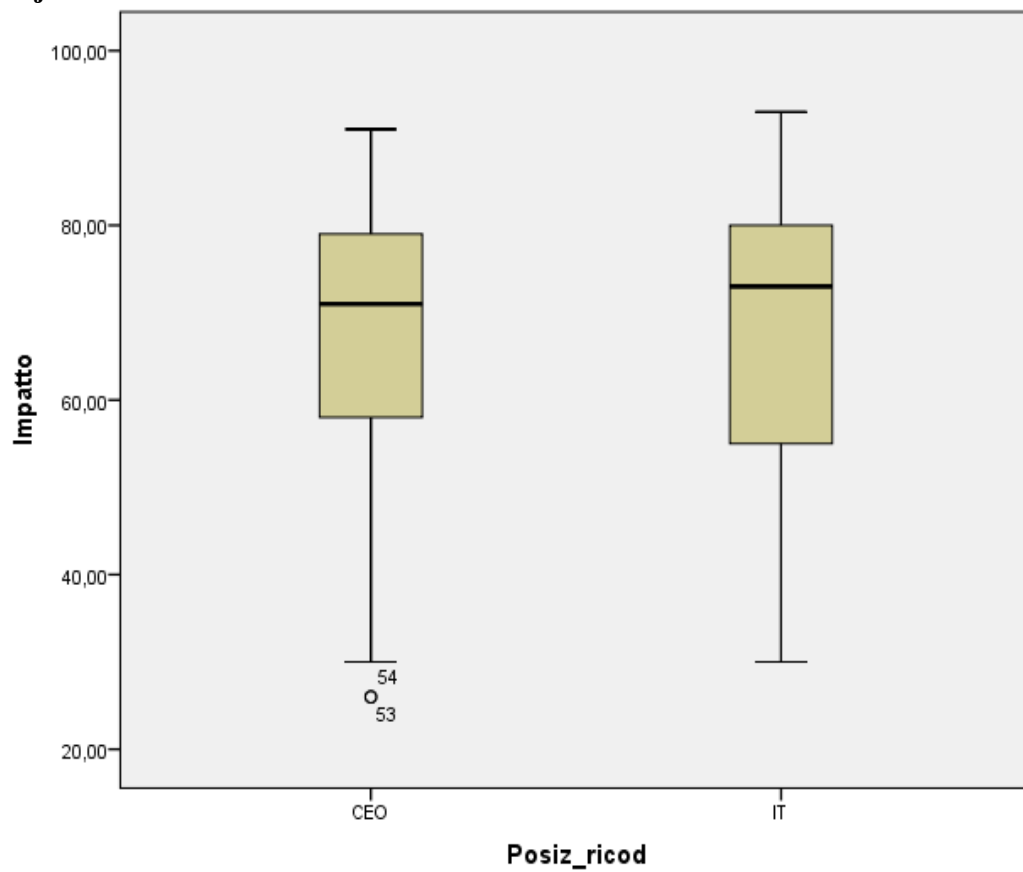**Image 13 – Box plot, probability perceived by the different category of subject**

A statistical analysis was carried out to further interpret the responses and is summarized in the following table. Taking into account the high level of standardization for the responses, we analyzed their modal values To increase the readability of the data presented, we used a color scale (green lowest, red highest).

Table 6 - Risk verification

	Classification	RISKS	MODAL VALUE OF PROBABILITY	MODAL VALUE OF IMPACT	RISK WEIGHT
1	Organizational	Loss Of business reputation	4	5	20
2	Organizational	Provider failure	3	5	15
3	Organizational	IT organizational changes	5	6	30
4	Tecnical	Resource sharing isolation problems	4	5	20
5	Tecnical	Malicious (insiders or outsiders) attacks on the cloud provider	4	4	16
6	Tecnical	System integrity	3	4	12
7	Tecnical	Data leakage	3	4	12
8	Tecnical	Natural disaster recovery	4	4	16
9	Tecnical	Shared technology vulnerabilities	4	6	24
10	Tecnical	Cloud cross comparability	4	4	16
11	Legal	Risks resulting from possible changes of jurisdiction	5	5	25
12	Legal	Liability or obligation of the CSP in case of loss of data	4	5	20
13	Legal	Responsibility of CSP in case of business interruption	4	5	20

| 14	Other general	Social engineering	5	5	25
15	Other general	Data privacy and protection	4	5	20
16	Other general	Physical security	4	4	16
17	Other general	Loss or stolen backups	4	6	24
18	Other general	Loss or compromise of security logs	4	5	20

We obtained a risk weight multiplying the modal value of probability and impact. What should be noted is that the risks with higher score were the following ones: ICT organizational changes, social engineering, and those arising from a change in jurisdiction. However, for all the categories there is a perception of high probability as always higher than (or at most equal) to the half of the values taken into account in our measurement scale. That said, is possible to state that final users consider cloud computing as a tool that could expose the company to risks with very high probability. This idea is also confirmed by average values that do not differ significantly from the modal, and the variance, which stood always around 1.

As far as the impact of the occurrence of each risk is regarded, table 5 shows the degree of destructive impact that the implementation of this technology could have according to the users. The events that could most affect the proper functioning of the company, or that would create more damage, are the following ones: ICT organizational changes, the vulnerability suffered by sharing technologies and the risk of loss or theft of backup. In this regard it should be emphasized that all the categories show a modal value always greater than 4, and this indicates that the instrument is perceived by new users as unsafe or in some cases dangerous for the company.

However, it is also worth noting that on the one hand modal has very high values, the lowest average of the modal value, and a very high variance allow us to affirm

that part of the population is in sharp disagreement with the majority and does not believe that the occurrence of risky events can generate problems with excessively destructive impacts. Furthermore, using the average value for each risk class and placing probability on the X axis and impact on the Y axis, it is possible to create a map of the perceived risks (as a likelihood matrix). This tool can help to understand what are the main factors that are potentially limiting the introduction of this tool.

GRAFIC 1 – Map of risks arising cloud computing
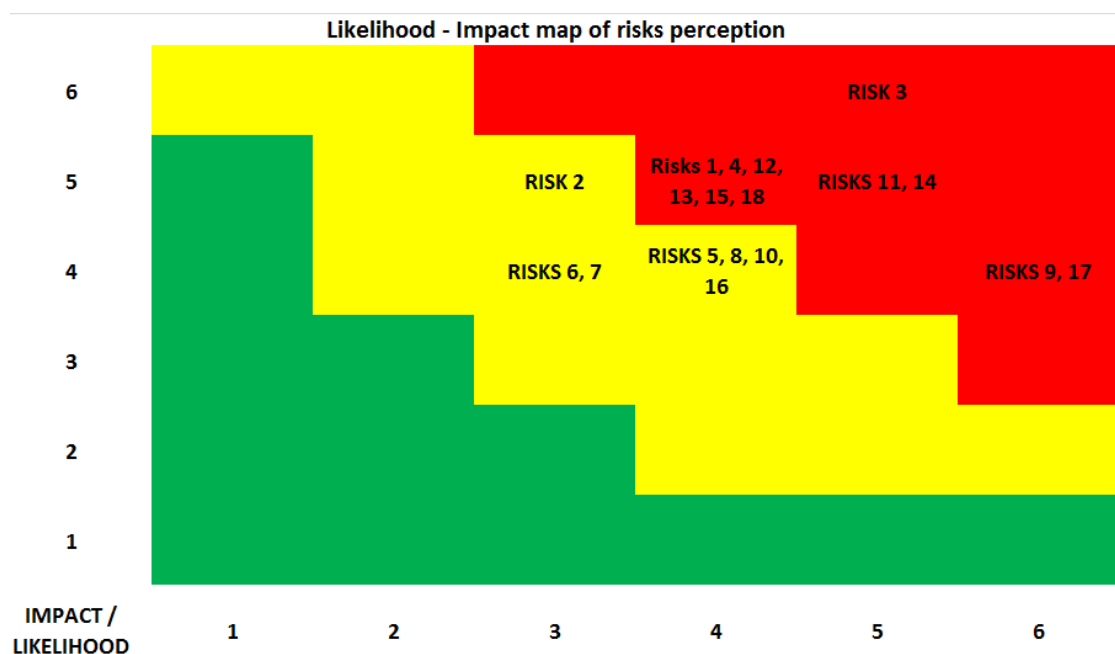
What should be noted is that the respondents have a high perception of all risks (that are all concentrated in the upper-right area), or at most equal to half of the values used in our measurement scale. All the categories of risks appear grouped together on the top-right side of the map, in an area with good probability and high impact on the businesses. The graphical analysis further confirms that the main risks perceived are "organizational changes of IT," "sharing technologies vulnerability ", "loss or stolen backup" and "loss or stolen security logs".

As already seen, in the literature, several authors discussed the risks of deploying a technology, such as cloud computing, without an empirical investigation. The results obtained show that these risks are strongly perceived by cloud end-users. This can lead a series of questions such as *"why companies should introduce a tool considered very risky?"*. Interpreting the results, one possible answer is that the expected benefits from the introduction of the instrument more than offset the risks that are associated.

6. Conclusions

This paper addresses the embryonic debate on the possible connections between risk control and cloud computing, to identify possible areas to improve control after the implementation of cloud computing to render it effective. In this paper we presented the cloud computing underlining the benefits and the risks that this tool could give to organizations that start to use it. We carried out a semi-structured survey among cloud computing first time adopters to understand what are the risks perceived and their supposed impact, before the first use. The findings reveal that the main benefits expected by cloud computing users are the cost reduction and the increased flexibility (recalled by the 60% of the total respondent). That said, the results on the perceived risks show that the most dangerous risks for the respondent are "IT organizational changes", "resource sharing isolation problems", "provider failure" and "loss of reputation". The main risky areas for cloud implementation appear the organizational and the technical. Moreover, in light of these results, the main problem is that there is a strong perception of all the risks because they all are higher than 50%. So this could be a problem because all this risks are an obstacle to a efficacious implementation of this tool.

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Chapter 3: Cloud computing adoption in the Italian SMEs: a multiple case study

Abstract

This paper aims to identify the benefits provided by cloud computing to Italian SMEs. To this aim we carried out a multiple case study among four cloud computing first time adopters to understand what were the main reason of the migration and the process of change of the ICT function. Our results show that the system infrastructure in the cases studied would have cost about 30% less over 5 years, and using cloud computing could have potentially eliminated 23% of the support calls. These findings seem significant enough to call for a migration of the system to the cloud but there are also many internal risks keep away the companies from this tool. Whilst the benefits of using the cloud are attractive, in this chapter it is highlight that it is important, for the companies decision-makers, to consider the organizational implications of the changes brought about with cloud computing to avoid the organization-wide performance.

1. Introduction

The advent of computer technology has significantly changed business processes. Since the '90s, in fact, there has been an increasing use, by companies, to tools such as printers, personal computers, etc. These technologies have renovated, automated and accelerated many business processes contributing to greater effectiveness and efficiency and making it indispensable. Basically these instruments generated a double benefit: on the one hand allowed the drastic

reduction in variable costs (material stationery, storage space data, data processing faster) while the other operated the increase in data processing capabilities. These two attributes are certainly the main causes of the race, from business, to the most expensive new computer systems. The companies were seeking greater competitive advantage through new technologies constantly updating their equipment.

This paradigm has gone on until 2007 year in which the financial crisis has greatly reduced the financial capacity of businesses leaving unchanged the scenario of hyper-competition typical of the new millennium. In this situation, the market pressure, cost optimization and increased productivity appear to be the guidelines that should be considered by companies no longer to achieve their goals but also to ensure its survival. It seems necessary to adopt a framework of Information and Communication Technology (ICT) can reduce administrative costs (fixed and variable), to ensure increased productivity and while maintaining a flexible structure to enable a rapid response to all the needs of the market. With this in mind the requirements on which you must focus the ICT are: speed, flexibility, scalability, security, cost efficiency, transparency. These requirements appear to be met by the adoption of a new technology: cloud computing.

Cloud computing is a distributed computing paradigm that enables access to virtualized resources including computers, networks, storage, development platforms or applications (Mell & Grance, 2009). These resources can be unilaterally requested, provisioned and configured by the user with a minimal interaction with the cloud provider. Furthermore, resources can be rapidly scaled up and down to meet the user's needs, thus creating the illusion of infinite resources available at any time (Martinez et al., 2015). Resource utilization can be measured, controlled by customers in a pay-per-use basis (Ibrahim, 2011). With the support of important industry stakeholders like Google, Amazon or Microsoft, cloud computing is being widely adopted in different domains. Cloud services such as Google Mail or Dropbox have become everyday a useful tools for millions of people. Many companies currently use cloud-based applications such as Salesforce and small and big businesses are embracing virtual infrastructures

offered, for instance, by AmazonWeb Services (AWS) or Microsoft Azure (Marston et al., 2011). So the advantages for companies are undubitable (Microsoft, 2011).

Also, many authors of the ICT field have broadly identified the strengths associated with the use of cloud computing (Buyya et al., 2008 and 2009; Sultan, 2010 and 2011; Marston et al., 2011; et Kaiserswerth al., 2012; Lee and Mautz, 2012), investigating also the problems relating to implementation and risks across the enterprise.

What should be noted is that, despite all the advantage for the companies arising this tool, there is not a strong usage of cloud computing in Italy. For this reason, the idea of this study is to address these under-investigated issues by specifically focusing on the decision process, the expected benefits implementation phases of cloud computing in the Italian SMEs. The method has been widely recognized and used by the scientific community for studies of ICT (Gable, 1994). The motivation behind the massive use of this method is certainly conducible to the possibility not to limit the research to a single sector, analyzing the benefits in several areas and bringing out similarities or differences for the end-users. To reach this aim were explored four service companies operating in different sectors. For each company were 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, users are those who are actually affected by the change in the company.

The results shows that one of the main limitations to cloud computing implementation is the *"fear of the unknown"*, typical of changes regarding organizational or ICT functions: for this reason, implementation often occurs step by step. Only after having beaten the initial skepticism, in fact, cloud computing is recognized as a beneficial tool for business and then implemented at all levels.

The remainder of the paper is organized as follows. Section 2 clarifies the main characteristics of cloud computing technologies. Section 3 examines the main issues raised in the existing literature on the benefits relating to cloud computing

adoption. Section 4 focuses on the research design. Section 5 presents the multiple case study on a sample of four Italian SMEs, and section 6 provides some concluding remarks.

2. Cloud computing

The first definition of this instrument could be found in the document "Definition of Cloud Computing" published by the US National Institute of Information Technology (NIST) (2008, then revised in 2010 and 2011) that indicates this technology as *"a network model that allows access to a set of shared information across computing resources (eg, servers, storage, applications, services) that can be rapidly provided by a provider"* (NIST, 2011). This report identifies also the characteristics, the distribution models and the architectures.
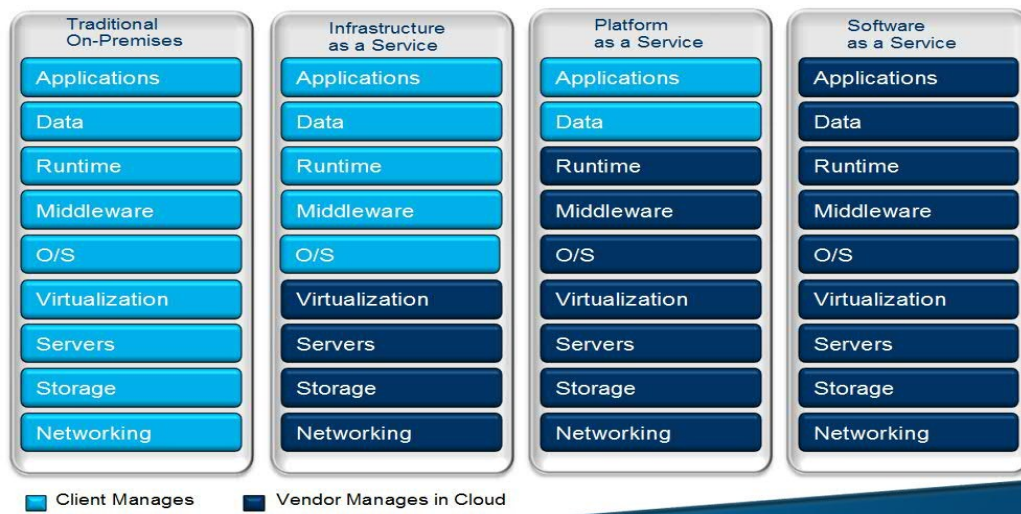
With reference to the characteristics of cloud computing, the document emphasizes technical attributes and its flexibility. The technical features are identified as the ability to access data from different places and for many users (on-demand self-service) at the same time (ubiquitous network access). This tool also allow users to reduce the use of resources (financial and human) through a sharing process with other companies (resource pooling), to measure the cost of the service (Measured service), ensuring high versatility (rapid elasticity).

Below, NIST, identifies three different models of delivery and distribution cloud computing, these models are known as: Infrastructure as a Service (IaaS), Platform as a Service (PaaS*), Software as a Service* (SaaS). The differences between this deployment models are represented by the different degree of outsourcing required by the client and asked to the Cloud Service Provider (CSP), by the level of control and personalization maintained on the data.

The first model is the Infrastructure as a Service (IaaS) that allows users to outsource only basic services. This solution provides users with a hardware "remote" including servers, storage, memory and virtual environments. The second solution, known as Platform as a Service is an extension of IaaS and allows the user to obtain a complete development platform on which to build

applications or services to be distributed later in the network. The user maintains control on the data (which does not end up in the cloud) and continues with the use of their applications but outsources operating systems, middleware, programming languages). Finally, the last cloud solution is represented by SaaS. This model expands the functionality provided by the PaaS allowing the outsourcing of data and application services of all kinds. In this case, the CSP shall manage all the ICT functions of the customer while also providing software and virtual working environments by paying royalty. What should be noted is that the latter solution offers the possibility to outsource a number of applications and functions such as human resources management, customer retention management, enterprise resources program by reducing the degree of customization than previous solutions. For more clarity the characteristics of the different architectures have been synthesized in the image below.

Image 14 – Comparison between traditional IT and different cloud solutions

Traditional On-Premises	Infrastructure as a Service	Platform as a Service	Software as a Service
Applications	Applications	Applications	Applications
Data	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
O/S	O/S	O/S	O/S
Virtualization	Virtualization	Virtualization	Virtualization
Servers	Servers	Servers	Servers
Storage	Storage	Storage	Storage
Networking	Networking	Networking	Networking

Client Manages   Vendor Manages in Cloud

Source: www.microsoft.it

The blue areas indicate the activities controlled by the customers while those in dark blue are the responsibility of the provider. Moving from a traditional IT to a SAAS solution increase the degree of outsourcing and therefore the economic benefit for the company, but it also reduces the control on the data, applications

and the customization possibilities. The choice depends, therefore, by the requirements of businesses and it is attributable to a trade-off between money-saving, security, flexibility and customization.

As a direct consequence the IaaS is characterized by a higher level of internal control as most of the functions are still internalized, while with a SaaS solution to lose control denotes the transfer of responsibility to the provider. However, From an economic point of view the IAAS presents higher costs than a SAAS system (because the company bears the internal costs in addition to the rent paid to the provider) and it is reasonable to assume that the choice depends on the customers necessity.

It seems necessary to point out that, recently, were be implemented two new distribution models known as Data Service (DaaS) and Hardware as service (HaaS). These kind of architectures were never formalized by NIST but are discussed in the documents of numerous service providers (Microsoft, 2011; IBM, 2011; Aruba, 2012). The DaaS service make available to users a virtual space for the date storage that become available at any time and for any application as if they were resident on a local disk. Examples of this kind of technology could be Dropbox, MEGA, OneDrive or Google Drive. Contrariwise HaaS systems allow users to send their data to a server which will process them and make them available as output. An example of this kind of technology is the private hosting: the service provider provides the user with a set of resources that thanks to a service, the users can configure completely from the operating system overhead. These models could be viewed as an extension of PaaS.

Moreover, the NIST identifies the different types of architectures. According to the aforementioned report (2009), is possible to discern four different cloud computing architecture: Public cloud, Private cloud, Community cloud, Hybrid cloud. This distinction depends from the level of control on the hardware of the provider. More specifically, a cloud is defined "public" when the resources are shared, assigned and reassigned dynamically by providers basing on the actual needs of users. On the same infrastructure jointly operate two or more users and traffic management is performed by the provider. The private cloud is defined if

all how many resources are used to meet the demands of a single customer. In this case the infrastructure dedicated to the need for a single organization and systems are located on the premises of the customer who will have the responsibility to ensure the management. These types of systems are very similar to the data center from which differ due to technological solutions that allow to obtain greater optimization of fuel consumption and potential. Finally, the infrastructure can be Community, where it may be shared by many organizations that share certain interests (Mission, security requirements, policy etc.), Or hybrid, where present simultaneously characteristics of two or more distribution models. All features hitherto analyzed help to make cloud computing an attractive and commercially viable, especially for SMEs. However, there are a number of hidden costs and potential risks (such as data security, privacy, compliance, and vendor lock-in clauses) that could reduce the benefits produced by the instrument to clear them (Ibrahim, 2011). Therefore, when you decide to implement the tool in the company, it seems necessary to carefully weigh the benefits and risks in order to identify the optimal solution. It should be emphasized that the proper understanding and perception of these elements directly influences the choice of services for this seems necessary to explore these issues from two points of view. In fact, if the buyer requires a better knowledge of the service to find the ideal level for the satisfaction of his needs, the other the CSP requires a better knowledge of the market to be able to undertake different service strategies based on business needs its customers.

3. Litherature review

Summarizing Cloud Computing can be defined as *"a set of technologies that enable, store, store and process data through the use of hardware and / or software distributed and made available virtually on internet"* (Candiotto, 2013).

These services are provided by qualified suppliers to the users through a set of technologies and information resources available on-line (Limone, 2013).

The literature on cloud computing was increased considerably during the last few years and the topic was discussed in many sides. According to Yang and Tate (2009) the studies on this topic can be divided into four areas: technology (regarding performance, network and data management), business economics (cost-benefit analysis, market analysis, risks, legal issues), applications (studies of purely engineering) and general studies (not empirical studies regarding the introduction and implementation). What should be noted is that the literature on the topic is recent since the first studies on cloud computing dates back to 2008 (Yang and Tate, 2012) and in the early years the number of publications were really limited. In fact, only few years later (2010) the discussion on cloud computing has attracted the interest of many authors (Weinhardt et al, 2009). Despite this expansion what is really clear is that the literature on cloud computing may still be limited.

The first studies on the topic were strictly theoretical. Many authors provided their own definition of cloud computing and highlighted the enormous benefits that this tool could provide business which decreed the adoption (Boss et al., 2007; Weiss, 2007; Buyya, 2008; Vouk, 2008; Plummer et al. 2009; Weinhardt et al, 2009; Vaquero et al, 2009; Armbroust, et al., 2010; Mulholland et al., 2010). These authors share and support the idea of the NIST previously provided. The following table shows the first definitions of cloud computing provided by the literature in order to allow a comparison.

Table 6 – A comparison between different definitions of cloud computing

Definitions	Authors
Cloud is a pool of virtualized computer resources.	Boss G, Malladi P, Quan S, Legregni L, Hall H 2007
Cloud Computing is not a fundamentally new paradigm. It draws on existing technologies and approaches, such as Utility Computing, Software-as-a-Service, distributed com- putting, and centralized	Weiss, 2007

data centers. What is new is that Cloud Computing combines and integrates these approaches.	
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, 2008
Cloud computing embraces cyber-infrastructure, and builds on virtualization, distributed computing, grid computing, utility computing, networking, and Web and software services.	Vouk 2008
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, Scott; [GARTNER] 2009
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
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.	NIST (Mell e Grance), 2009
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, Konwinski, 2010

What should be noted is that the definitions provided by the authors are very similar to the one proposed by NIST (Mell and Grance, 2009) and that, for all the authors, the main differences with the other existing technologies are merely linked to the attributes of virtualization and customization and the ability to get the service "on-demand".

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 demonstrate empirically the benefits, limitations, problems and risks arising from the adoption of cloud computing in enterprises. Already in 2009 Rosenthal et al., provided a practical approach for cloud computing implementation analyzing empirically the benefits generated by this technology for the *"biomedical informatics (BMI) community"*. What is worth noting is that in the same period Velte et al. (2009), provided a detailed guide to the migration to the cloud systems for SMEs and for large companies using the case study method. The study highlighted the motivations of the cloud computing adoption, the difficulties of implementation, and risks related. A similar study was conducted in 2010 by Khajeh-Hosseini and Sommerville. The authors analyzed the risks and rewards of migration in a cloud-based-system interviewing the end-users of a company operating in the energy sector. The results showed that cloud computing is a tool potentially able to reduce the operating costs of the companies. More specifically there was a reduction of 37% of ICT costs and a reduction of the 21% of maintenance actions. However, the study also highlighted the significant drawbacks such as loss of customer confidence, loss of control of data, the resistance of the employees in changing their routines and transfer costs. Even Sultan in 2011 provides a study based on the application of cloud computing in businesses. More specifically, the author identifies the organizational and economic benefits generated by the introduction of this tool in an English medium enterprise operating in the computer industry. The author points out that after cloud computing introduction the costs of the ICT function were reduced of approximately 80% (is important to highlight that the employees were reallocated and the previous ICT structure sold). This study underlines that this instrument is not suitable for all SMEs because the convenience of its usage depends by the size of the ICT structure, the costs of the structure already incurred (and that can not be eliminated), the security costs and the degree of risk that the company management is willing to accept. On the basis of these studies other authors have verified the benefits and risks arising from the adoption of cloud computing in

SMEs (Lawler et al., 2012; Brender and Markov, 2013; Gupta et al., 2013; Mahmood et al., 2014 ; Oliveira et al., 2014; Son et al, 2014), emerging markets (Kshetri, 2010; Subramanian, 2014), banks (Brender and Markov, 2013; Choudhary and Vithayathil, 2013), public sector (Kundra, 2011; Singh and Veralakshmi, 2012; Mu and Stern, 2015), in the healthcare sector (Kshetri, 2010; Rosenthal, et al., 2010; Lian et al., 2014; Sultan 2014), and other relevant sectors (Hsu et al., 2013; Chong et al., 2014; Son et al., 2014).

What should be noted is that in all the cited cases cloud computing is regarded as an important solution to corporate networks problems. Anyway, this tool has also a dark side. Indeed while providing a number of benefits not achievable with other technologies, it also creates a number of risks "typical" of the outsourcing of ICT function. Therefore it is necessary to find a proper way of implementation over the right trade-off between risks and benefits to determine when the cloud may be an optimal solution to the resolution of the needs of the enterprise (Ashford, 2009; Sultan, 2011).

In order to have a complete overall of the literature behooved to remember other important contributions about advantages and disadvantages (Etro, 2011; Marston et al., 2011; Fanning, Centers, 2012; Ionescu et al., 2012; Lee, Mautz, 2012; Lin and Chen , 2012), control problems (Almulla, Yeun, 2010; Carroll et al., 2011; Grobauer et al., 2011; Paquette et al., 2011; Mackay et al., 2012; and Ullah Khan, 2014) and risks related to the adoption of the instrument (Almulla, Yeun, 2010; Ramgovind et al., 2010; Carroll et al., 2011; Dahbur, 2011; Wang et al., 2011; Enslin, 2012; Fan, Chen, 2012; Doherty et al., 2012; Mangiuc, 2012; Manap et al., 2013). Leaving aside the issues of control and risks related to the adoption of the instrument, as they are beyond the scope of this work, it still needs more depth about what motivates companies to migrate to cloud technology. Specifically, is important to define advantages as the benefits that a company expects to achieve, as a results of a particular decision.

The literature on this subject identifies five major benefits, such as reduced costs, increased storage, high automation, flexibility, greater mobility and less focus on ICT function. The most immediate for users, as well as further discussed, is

certainly the cost reduction. Customers pay for a cloud service completely customizable and modeled on the company real needs. So is not necessary to support large investments in infrastructure yet. Related to this there is another advantage resulting from the adoption of this tool: the increase of storage. This means that the company can benefit from external memories always available to store their data. Another benefit reachable implementing cloud computing is the high automation. Companies that adopt this tool do not require employees to data centers for the data and backups control because these tasks are delegated to the provider. This allows companies to reach more flexibility. The cloud is customizable depending on the changing needs of the enterprise customer. The possibility of changing at every moment, and to obtain economies of scale are the basis of the competitiveness of the cloud. The accessibility from any place is greater mobility, customers can access at any time and from any location data. This facilitates multinational companies.

What should be noted is that like any new technology, cloud computing has also a dark side. Indeed, together with the benefits identification, the literature identifies a number of disadvantages or problems that may arise following the implementation of the instrument. Specifically, a disadvantage is defined as the charge (not necessarily financial) that the company has to bear to use a certain technology. The disadvantages are discussed in the literature relating to reliability (Almulla et al 2010; Marston et. Al. 2011; Grobauer et al 2011; Fan, Chen 2012;), the economic objectives (Ambrust et. al.2008; Buyya et al 2008; Ionescu et al 2011; Marston et. Al. 2011;), the low level of compliance (Weinhardt et. Al. 2009; Chow et al. 2011; Edwards; Tiwari, Mishra 2012;), the difficulties of adaptation, performance and data security(Almulla et al 2008; Ambrust et. Al. 2008; Chow et. Al. 2009; Mangiuc 2010; Tiwari, Mishra 2012; Marston et. Al. 2011; Bojanc et al; Grobauer et al 2011; Fan, Chen 2012.). Below are briefly expressed the reasons for the misgivings of some authors on the use of such technology.

The first attribute to discuss reliability. Several authors (Almulla et al., 2010; Marston et al., 2011; Grobauer et al., 2011; Fan, Chen, 2012) highlighted

problems related to the capacity of the facilities offered by the provider to provide stable performance over time.

As regards the economic objectives, in literature is clear that, despite cloud computing offers the opportunity to outsource the ICT function getting many advantages, there are numerous risks to be mitigated require incurring additional costs by reducing the convenience of this tool (Buyya et al., 2008; Amrbrust et. al., 2010; Ionescu et al., 2011; Marston et al., 2011; Enslin, 2012). 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 company (or at least it makes the control less effective) (Weinhardt et al., 2009; Chow et al., 2011; Edwards ; Tiwari, Mishra 2012). A further critical issues identified by several authors is the level of performance. The performance of a cloud network does not depend only by the model chosen, but also by the state of the network and the software used. Often the use of applications other than those supplied by the provider may cause compatibility issues and then lower performance. However, this kind of problem is common to many technological solutions (Chow et al., 2009; Marston et al., 2011; Fanning, Centers, 2012). Finally, in the literature, one of the most discussed topic is the data security. Moving data in the cloud could create problems with the respect of the company security and privacy (Chow et al., 2009; Almulla et al., 2010; Amrbrust et al., 2010; Marston et al., 2011; Grobauer et al. , 2011; Fan, Chen, 2012; Mangiuc, 2012; Tiwari, Mishra, 2012).

Despite these disadvantages, several authors stated that cloud computing is a technology potentially able to provide competitive advantage to businesses where properly adopted and implemented (Chow et al., 2009; Almulla et al., 2010; Amrbrust et al., 2010; Marston et al., 2011; Grobauer et al., 2011; Fan, Chen, 2012). In the light of the literature, in a context in which the technology is revealed as the most appropriate instrument to ensure flexibility, efficiency and effectiveness to the ICT function, it appears necessary to examine the reasons that push companies to adopt (or not adopt) cloud computing.

4. Research design

Basing on the literature aforementioned literature, the purpose of this paper is to define which are the main motivation that drive the Italian SMEs cloud computing implementation. In order to achieve this objective we opted for a qualitative analysis in order to explore the nature of the decisions of the actors in different sectors (Lillis and Mundy, 1999, 2005; Creswell, 2009). The case study method has found a wider adoption in ICT field (Benbasat et al., 1987; Lee, 1989; Mumford et al, 1985; Smith, 1990; Lee, 1991; Mumford, 1991) although initially the literature was strictly quantitative (Gable, 1994). This method is generally used to investigate the reasons behind the actions and the decisions of individuals and it has spread increasingly in the last thirty years (Gable, 1994) and has found wide use in the field of studies concerning cloud computing technologies (Yang and Tate, 2012).

That said, the most appropriate tool to answer the research question was the exploratory multiple case study. What should be noted is that many authors have pointed out the effectiveness of the method for observations of this kind. Specifically, according to Yin (1984) case studies are more appropriate when the aim is to examine contemporary events and when it is not necessary to control behavioral variables. The same author points out this method is appropriate if the goal of the research is to explore a new field, and multiple case studies are better when the purpose of the research is to describe, construct theories or test them. Benbasat et al. (1987) defines three kind of the case study. Indeed the author believes that:

    1) with this method, the researchers are able to study information systems on the field, learning the state of the art, and generating theories on the practical aspects;

    2) this method helps the researchers to understand the nature of the complexity of a particular process;

3) a lot of information (generally missed with quantitative analysis) are able to enrich the fields of study existing or create new ones.

The method has been widely recognized and used by the scientific community for studies of ICT (Gable, 1994). The motivation behind the massive use of this method is certainly conducible to the possibility not to limit the research to a single sector, analyzing the benefits in several areas and bringing out similarities or differences for the end-users. To reach this aim were analyzed four service companies operating in different sectors. The table below summaries the business choices, the respective sector, the number of respondents and the number of interviews conducted.

Table 7 – Company investigated

Enterprise Name	Sector	Number of interviews	Number of external interviews	Total number of interviews
Alfa Games Srl	Online Gaming	2	2	4
Beta Casa SPA	Household goods	2	1	3
Gamma Insurance	Insurance	3	1	3
Omega Tech. Srl	Education	2	2	4

For each company were 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, users are those who are actually affected by the change in the company. In some cases it was possible to interview representatives of the provider to which companies 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 the endogenous variables and the exogenous factors, because there were been used inside sources (interviews with

managers and internal documents, usually not accessible to the public) and external sources (reports published by the company , newspaper articles, other publications of the company). However, what should be noted is that the primary sources of information were the interviews with the CEO, considered as the decision maker.

In order to capture more detail and data, but without deviating the topic of this paper, interviews were conducted based on a semi-structured questionnaire consisting in 9 questions (see the appendix 1). The purpose was to obtain information on the preliminary analyzes that have pushed companies to choose a system in the cloud, the motivations, the expected benefits from the implementation, on the degree of outsourcing and security considerations. It is worth to note that the questions were just a sort of guideline, as it provided a number of key issues to be discussed during the interview, rather than representing binding questions to ask to respondents. The interviews were recorded and later transcribed for analysis. Moreover, when the interviews seems to be incomplete, we asked to respondent telephonic integrations. In order to avoid the *individual bias* (ie: the possibility that a single researcher is influenced falsifying the results of the study) the interviews were conducted by a team of researchers composed by 3 members which defined the key themes for the interviews. At least two members of the group have been involved in every interview. During interviews were consulted several internal documents regarding the ICT function and the details that might help to know the relief and the cost of the function, supporting the answers of respondents. Immediately after the interviews, recordings have been heard and transcribed by each researcher. The researchers organized the interviews chronologically, and after they transcripts and discussed them summarizing the data and opinions, around the concepts of expected benefit, the adoption of the motivations and actual benefits from the adoption of cloud computing.

The questionnaire was based on a theoretical framework that sees cloud computing as the tool most appropriate resolution to the resolution of certain issues which enterprises are affected. There are three main drivers that required a

sudden change for businesses they are identified as: costs reduction, market pressure and increase productivity. In modern companies, the satisfaction of the needs *require a series of economic and human efforts by the managers that* constantly look for a right trade-off. The answer to these three problems come from cloud computing that addresses these issues together through a long list of benefits. The next image helps to clarify and to better understand how this tool affects businesses by solving a series of problems.

Image 15 – Drivers of cloud computing implementation
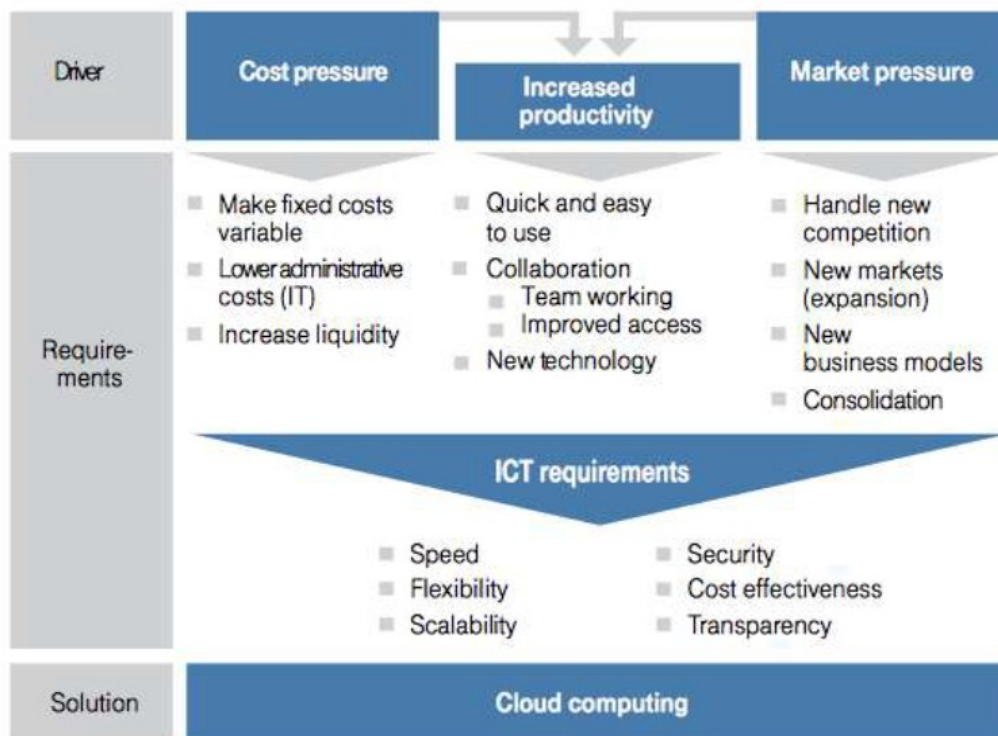
5. Multiple case study

The aim of this paragraph is to provide evidence on the use of cloud computing in Italian Small and medium enterprises. To reach this aim will be treated four cases.

5.1 The Case of Alpha SpA

The Company ALFA SPA operates in the distribution household items. The company was founded in 1968 with the wholesaling business and then expanded downstream of the distribution chain. In Italy, the market of household could be divided into two major segments: on the one hand the stores of the "porcelain" that proposed only prestigious brands, on the other hand the small retailers in which the offer included a very wide range but not deep. The brand grew up, but the turning point was 1994. The management redraws the brand through vertical expansion: from wholesaler chain of franchise stores. This makes ALFA's largest chain of shops for the home and for the wedding list with more than 180 stores in eighteen Italian regions.

The constant evolution of the brand and its development created many organizational complications that has as direct consequence a widespread loss of efficiency. The main problem the ICT function, that was unable to respond quickly to environmental changes maintaining a good cohesion degree between the various business functions. These limits overwhelmingly emerged in 2011 as a result of the financial crisis. In that period the management, to respond to external stress, imposes cost rationalization in the organization placing a series of questions to the IT department. The aim was to combine the communication problems between the different stores (generated by the incompatibility of data, documents and reports) that prevented to obtain a global vision with the need to reduce costs. The best solution seemed to be to unify the software of the stores but this generated, in the short period, additional costs (many licenses were already been paid and the servers were old), limitations and resistance from staff and other implementation issues typical of change (Martinez, 2004 ; Rossignoli, 2004). In addition, the managers, in accordance with the ICT function, looked for a solution that would allow the integration of the digital platform of e-commerce thus

ensuring lower costs, immediate availability of the information and within the limits of possibility, flexibility and scalability. What should be point out is that over the years, Alfa has always implemented the latest technology: it was one of the first companies to introduce ERP system (Based on Microsoft Dynamics) and also systems for data analysis (with Microsoft SQL Server).

"We needed something that would allow management to integrate systems already in use without loss of time to learn to use new programs. 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 these problems was found in the cloud computing.

The management of the company explain that they implemented cloud computing in the company in 2011, when was necessary to replace the e-mail platform. Manager's solution was to switch to a MS Exchange Cloud Based solution. Initially this was the only function for which it was used this technology. The reasons for the mail server outsourcing could be found in the will to do not manage servers internally anymore (on premise) and to break free from the problems of maintenance and disaster recovery, also counting on a significant increase of space for the box / user. The first results were positive and the management starts to think about a total migration in 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 division. The convenience was immediately revealed and for the rationalization of business processes (order management of

the stores, warehouse management of the stores). So, after an extensive discussion between the CEO and the head of the ICT function it was decided to optimize the management processes passing from the old solutions (the physical server) to servers virtualized in the Cloud.

In order to reduce the impact of these decisions the migration was not performed immediately but were provided different steps. First of all managers addressed on the choice of cloud provider. They choose Microsoft Azure that allowed to solve the problems of data storage uniformity and allowed all the shops in the franchise to benefit from a version of Office, allowing you to share the documents on a single platform. After there was another implementation with the creation of 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. This farm was based on IaaS and to deploy was also used a Microsoft SharePoint 2013 server farm in hybrid configuration with Microsoft Office 365. Regarding this the management of the company said:

> *"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 company 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 of the company emphasized that the adoption required a consistent effort for managers. The implementation strategy was designed to avoid or to minimize the impact of changes on the end-user (employees). The idea was that *"Less the end user see the change, unless the company will suffer."* Also for this reason it was decided to adopt a platform with graphical user interfaces similar to the previous ones and that would integrate with the software already in use. The

first implementation was a success. Management has started to bring in the cloud 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 the company at least three main advantages and three disadvantages. First, the less need for machines installed gave rise to a sharp reduction of maintenance costs and energy. Another advantage is the high flexibility that allows users to easily increase or decrease the resources as needed. Finally, the canon of the cloud represents a cost "certain" and tractable as a cost to be fully expensed in the year without the need for capitalization. "This helps to improve certain business ratios of significant importance for society such as ours." On the other hand there are also three disadvantages attributable to the lack of control on the infrastructure, the strong dependence on the internet to use the services, and the higher costs arising the monthly fee. Nevertheless, it is possible to quantify the savings resulting from the use of the cloud in a 30% of the total of the previous costs.

On the issues of security management is not revealed worried.

"I believe that reliability and safety are adequate."

Specifically, according to the directors, what is necessary is to rely on structures (or provider) with proven expertise and authority. Nevertheless, the care and the effectiveness of internal security policies contribute to the robustness of the system.

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

5.2 The case of Beta Insurance

The BETA Insurance Group is the oldest mutual insurance company in Italy. Established in 1821, now has about 660 thousand members and policyholders.

The institute was born at the beginning of the nineteenth century, a period when the fires were a real plague for the economy of the area. In Tyrol, citizens and institutions felt the need to protect themselves with insurance forms, as it already happened in other parts of the Austro-Hungarian Empire and in other European countries. Thus born the idea of a mutual insurance non-profit organization. In 1821 was founded the Tyrolean and vorarlberghese provincial Institute of fire insurance, headquartered in Innsbruck. Its constitution was approved by Francis I of Austria. In 1824, the Institute became an important reality and has 16.000 members-insured. Unlike other insurance companies, compensate in full the damage insured.

Between 1860 and 1890 the institute introduced the mechanism of risk classes, to differentiate premiums depending on the actual fire and this allows the company to grow to the point to begin to extend the range of objects insurable passing also movable as tools, household goods and even animals. The number of members in a few years reached 120,000 and the beginning of the '900 is approved a law, still in force, which requires insurance companies against fire to make a contribution to the bottom of the Fire Department. After World War I, the southern Tyrol becomes part of the Kingdom of Italy under the name of Trentino-South Tyrol and the institute is divided into two branches, the Austrian and Italian. The Italian branch was brought to Trento and had 90,000 members.

Behind the crisis of 1929 the Institute became a mutual private as the Provincial Institute fires and administrators were the same members who through their delegates elect the board of directors. During the II World War, the Institute was able to cope with the severe damage of war, without consequence to their assets.

In the 1950 receives permission to operate in the branches accidents, theft, auto and liability insurance in general and counted on 50 agencies scattered throughout the national territory.

In 1999 was founded the Beta Insurance Group and in 2002 published the first Social Report dedicated to its 350,000 members insured and continues the work of enhancement of its commitment to building and spread of mutual values.

The success of the enterprise is directly connected to an advanced infrastructure network. In fact, the management of the company say that they have always adopted expensive ICT solutions but also that they were not necessarily at vanguard. Therefore, the ICT function was seen as something "extra": a lot of tool necessary for the customers' value creation but only sometimes useful for the internal process simplification (management practices, quick search customers, etc.). So all the costs arising from that function were seen as "a necessary effort" to reach the final aims.

However, in 2011 the difficulties of the socio-economic context influenced the growth objectives and theirs achieving methods. The management of the company had to choose between a "pure cost reduction" (based on the cut of expenses) or a strategy to increase the market share. The managers' idea was to redesign the strategy adapting to the environmental changes and looking to move ahead of competitors. Unfortunately, even redesigning the strategy represent often one of the keys to success, in a context characterized by the objective of "efficiency", is also important to limit the costs of carrying out the internal operations and the ICT function. So, in the occasion of the transfer to a new headquarter and with the aim to align their infrastructure services to the objectives of growth and innovation dictated by business lines, BETA has launched a project to outsource the technological infrastructure. The main reason was to find greater agility, cost optimization, service continuity and effectiveness response. Despite the great advantage emerged in the analysis step, the management was skeptical, so the first implementation included just the creation of a secondary backup site aimed to avoid the Disaster Recovery problems. This project outsourced the Data Center and represented an opportunity for a radical technological renewal: the company

has gone from "homemade" solutions to many services provided by a "carrier class" provider and aligned to the newest technology. What should be noted is that the technology upgrade will be guaranteed by the cloud service provider for the entire contractual life (7 years) with the same costs. After the first migration, the managers asked to the same provider for the activation of a new primary site, transferring the secondary transferring in Rome.

"When we implement a new technology we always are cautiously. There is always a strong skepticism 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 company management guaranteed to avoid any problem of disaster recovery but there were still several operational duties inherent in the ICT function (such as the extension of the hours of services availability 24hx7, increasing flexibility in relation to the demands of the business lines, the introduction of a logic of SLA (Service Level Agreements) internal and external, constant innovation and openness to mobile services).

In the same year, basing on the new strategic lines the management started to renovate the ICT function. ICT manager creates a study group in order to compare the different technological possibilities offered by the market with the need to maintain a defined and predictable ICT budget.

"We needed a service that could be 24x7, which would guarantee at the same time operational simplicity and flexibility."

For each technology there were carried out cost-benefit analysis and technological analysis. After few months, a preliminary report identifies the cloud technology as the one ideal to satisfy the technological needs. In fact, using a cloud technology service availability and assistance were guaranteed for all the day (24x7), the system was easy to update (scalability) and to use, and the new working logic

were dedicated autonomy and abatement of logistical constraints. The management, after a discussion with the ICT manager, opts for the implementation. As happens with any new technology, the introduction of cloud computing could have disastrous effects so the administrators organized a plan for a gradual implementation. Thanks to the help of the provider, and after careful thought, the management of BETA has implemented a Cloud Sourcing articulated on the following points:

- Phase of Due Diligence for detailed definition of the scope.
- Option granted to employees can access through thin client to its own virtual terminal.
- Definition of a single fee includes a scope of growth agreed.
- Activation of a service of Cloud Sourcing integrated, delivered by carrier-neutral data center / carrier class located in Italy, for the management of infrastructure environments (systems, equipment, connectivity and security) and application in the field.
- Maintenance technology and operations, through the use of platforms, expertise and operational management procedures, constantly updated with respect to market standards and best practices of reference.
- Management and optimization of software licenses.
- Service Desk for performance monitoring and incident management.
- Management of change requests to the service (change management).
- Government services and verification of service levels (SLA) for the Customer.
- Full integration with service Disaster / Recovery and evolution towards a mode of Business Continuity.
- Consistency and synergy with side project of virtualization jobs.

After an optimization phase (completed in the last quarter of 2014), the passage was total and definitive and has provided a solution to the actual *"business continuity in Cloud sourcing"* (all services always active). The achievement of

this goal is gradually becoming a necessity for the Company, for all the partners, for the customers that usually use web solutions (but also collaborative portals, mobile and social solutions). What should be noted is that in 2012, in the same period of the first great implementation, BETA sold the 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, allow the employees to use their virtual workstation from anywhere using thin clients: the access to the domain of BETA can be done from any thin client and this has allowed employees to eliminate the constraints of physical location and greatly simplify the assistance, as well as to reduce to zero the costs of internal transfers between jobs during reorganizations or individual journeys. Nevertheless, the adoption process has had many difficulties. The implementation required to redesign the ICT function governance, reallocating redundant resources to other functions and keeping only few workers for the internal control. The proposed service Cloud Sourcing integrated (complete with directional connectivity, security, systems, equipment, services and application infrastructure within) allowed BETA to:

- Migrate from inhouse to total outsourcing - without discomfort and with total transparency the approximately 2500 users managed by ICT services.

- Govern and oversee the entire chain of service (directional network, security, systems, basic services and middleware) in a systemic and service orientation to 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 standardization and best practices for adaptation to the existing architecture, with a view to simplification, increased performance and improved security.

- Obtain an average annual savings on IT costs and energy costs related above 20%.

- Guarantee the service availability (up to 24h x 7 and business continuity), greater operational simplicity, speed in obtaining additional resources if required due to the scalability offered Cloud.

BETA has also encountered a substantial cost-saving: the less need for space enabled by the disposal of the previous Data Center allow to recover 600 square meters of physical space, now intended for other uses, while at the same have been reduced consumption of electric energy, of air conditioning system and of the other utility systems. The switch to Cloud computing was made at the end of the useful life of the data center in-house infrastructures, avoiding the large cost for the technological renewal.

In addition, starting from 2015, when the services will be fully operational, it will enable payment methods, type of pay-per-use allowing lower costs of 20% over five years. The cloud also allowed to vary the duties of the staff. The service inside was deleted as no longer necessary (thanks to the standardization of equipment and virtualization that has transferred much of the operations at the server) and the ICT staff has been reallocated to different functions: a part in internal functions , thus ensuring an increase in productivity, another part in the same function but with ICT tasks to support the design and development of the principals of governance, before not adequately covered. In this sense, the firm maximizes the effort cloud deployment obtaining a double benefit: on the one hand enjoys an increase of productivity, it goes to remedy a number of problems in their previous ICT function.

For these reasons, in a short time, the group has started to use more and more cloud computing:

"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 company to risks of choices monolithic "

The issues is certainly related to the 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 organizations (such as IVASS). In this case, what really matter is the choice of provider to ensure the information security also using certifications that attest the quality of control process (eg. ISO).

5.3 Gamma games srl

This section is focused on the case Gamma Games Srl and on the reasons main that pushed the company management in the adoption of cloud computing solutions.

Gamma games srl is a technological start-up founded in Rome, in March 2013, by three Italian undergraduate students.

The aim of the company was to attract a large number of game developers who use to publish their products on the platform Gamma in order to benefit from advertising revenue.

The main activity of the company is based on the co-creation of value with its stakeholders: its structure allows public (users platform) to play games for free and, at the same time, to share the revenues from banner advertising published on the platform with games developers. Thanks to this services, the company offers simple and complete solutions to businesses that want to reach new clients through their advertising, and to game developers that use HTML5.

The large database offers over 15.000 games and involves 250 thousand users from 190 countries, ready to compete online in different games: arcade, sports,

puzzle, action and strategy, etc. The formula (called "win-win") allows the programmer to earn by selling the license of its game or by sharing advertising revenues with Gamma.

The company is positioned in a niche market with an incredible potential: that's why Gamma, in few years, has reached the success and has collaborated with key international partners (such as Microsoft, Nokia, Kaspersky Lab and Goodgame). It seems clear that, to carry out this business, big storage space, continuous software updates and powerful servers able to manage numerous users, are required. This means huge investments (in addition to the ones linked to a well-detailed multi-year investment plan) for a start up that, often, are not compatible with its financial availability.

The foundation of the company was impeded by the limited availability of capital. For these reasons, Gamma's founders have chosen to adopt cloud computing solution from the first day of activities. The first problem they have faced was to define the ideal provider.

"*The choice of the provider was based on the evaluation of three parameters: the uptime in the industry, the size of the provider, the compatibility between the utilities provided with those already known by the employees*."

After careful analysis of the market and of the possibilities offered by the various providers, company's managers have opted for the Microsoft Azure Cloud. The implementation phase has not required considerable efforts: few days (about 3 or 4 in total) have passed between the signing of the service contract and service activation by the provider. In an environment not yet defined, in which people are inclined to learning and routine are not stable, the implementation of an innovative tool is usually simple, as is claimed by authoritative authors (Ionescu et al. 2011; Almulla et al. 2012; Lee, Mautz 2012; Lawler et al. 2012;).

"*Actually this wouldn't have been possible without the use of cloud computing*"

The company's CEO reveals that cloud solution has not been chosen only for the lack of initial capital, but for the possibility of creating economies of scale. This factor proves to be one of the main benefits linked to the adoption of the instrument, as extensively discussed in literature (Ionescu et al. 2011; Almulla et al. 2012; Lee, Mautz 2012; Lawler et al. 2012;).

> "*The need was to ensure scalability and ease of use. The disadvantages are perhaps represented by the necessity of working with something new. [...] We have not migrated, we've used Cloud from the first day. The corporate unit involved was the technical department.* "

In this case, the company had been just founded, so the only disadvantage identified by the founder was not a problem because there were no routine to recreate or activities to be redrawn. This statement shows that the main perceived risk inherent in the instrument, or the organizational change of the ICT function, doesn't have any relevance in the start-ups in which the work environment is not yet defined. Using Cloud Services for Windows Server platform to develop the distribution of videogames, GamePix was able to support the scalability in the world: more than 250 thousand users, following the current trend, are intended to more than double in the coming years. What should be highlighted is that the company has negotiated with the provider a clause that guarantees the continuous updating of the cloud platform. These updates are made according to customers' requests and to the will of the provider.

There's another aspect to highlight: the main benefit of using Cloud solutions is to save financial resources. About this aspect, management has repeatedly affirmed that, especially in a new business, the lack of investment in infrastructure guarantees flexibility and speed to the companies' activities and the opportunity to focus on other business functions. In this way, administrators have the possibility to address corporate resources (financial and human) on the core business of the company, without worrying about some support functions. In addition, the monitoring of costs linked to the Cloud is directly provided by Microsoft Azure

panel of management. What should be emphasized is that the savings in terms of resources, mainly concerns staff costs and server management (it's a provider responsibility).

Respondents underlined that the infrastructure investment that would have incurred to secure the same level of initial service corresponds to about 5 years of subscription to cloud computing.

About the security offered by cloud computing, management has not shown concern. According to the directors, Cloud services are very safe. The provider is entirely responsible for the Protection of server but there is also a disaster recovery system.

"We will continue to use the Azure Cloud and we will make greater use in the future."

5.4 The case Omega tech

Omega Tech is a company, founded in Rome in 2000 and focused on two kind of activities: e- learning and technology services. Since 2004, the company is Partner for the Italian market of the largest training open source online platform, known as Moodle (Modular Object-Oriented Dynamic Learning Environment; environment that allows a modular, dynamic, object-oriented learning). Those enterprises are in partnerships for numerous and complex projects about organization and training for the most important corporate and institutional, Italian and international, realities. Moodle is an e-learning platform, a teaching tool that can be entirely used by the web access: it supports traditional classroom teaching and allows teachers to publish and make available the courses material for the students, to do vehicular communications, to give information about the courses and lessons, to administer students tasks, exercises, tests. Today, Omega Tech is the world's most popular e-learning platform, it is used especially by

academic institutions and schools: over 1150 organizations of various kinds and types, coming from of 81 countries of the world, have installed this tool to manage e-learning activities

This big community, created in the world, represents for the service users a guarantee of constant updating and functional enhancement. Is important to take into account that the platform is distributed with fully accessible source code, according to the Open Source criteria: this means that it can be used without paying any fee. The teacher has the opportunity to create a "virtual" classroom, an environment dedicated to teaching, in which digital resources are used to support the traditional learning process.

Thanks to Moodle is possible to publish teaching materials, develop, plan and manage different types of assessment activities, manage the communications with the users. Omega Tech, in 2005, received the certifications EA 33 and EA 37 for the design and development of products and information technology services applied to multimedia communications, distance learning and traditional learning (in the classroom), with a special certificate issued in "Bureau Veritas".

The fast expansion of the company on the market has led, in a short time, an exponentially grow of its ICT needs: the existing structure was not suitable (or just obsolete) to satisfy the increasing demand. For this reason, in 2011, Moodle's managers began investigating alternative technological solutions that would meet the company needs without overburdening the financial situation. The management was not extraneous to virtualization experiences: for example in 2010 they opted for several solutions similar to cloud computing for the secondary functions (ie: employee e-mail).

The success of this experience persuaded the management to move decisively to cloud computing. The choice of an ideal model has initially worried the 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)."

Therefore, managers opted for the adoption 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 portfolio). This solution allowed a lower use of capital while providing a great security for the most sensitive information (that would have been stored in the private data center). Once defined the kind of service requested and the level of service needed, they moved to the implementation phase.

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

What should be highlighted is that there is a significant difference for the implementation time between the two different services. Indeed, public cloud could be activated by the service provider very quickly, with several benefits in terms of optimization of cost/performance. It gives the possibility to scale vertically with models "pay-as-you-go"; on the other hand the private cloud, based on specific application, the activation time is higher since it requires a set of tests. This step is important in order to ensure the required 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. "

Many benefits had already been listed: flexibility, pay-as-you-go model, possibility to shape infrastructure according to the real needs of the service, horizontal and vertical scalability of the solutions. However, is possible to state that there are many differences between the characteristics of the models. Indeed, the advantages of private cloud are: consolidation of services and the ability to create ad-hoc infrastructure, while the advantages of public cloud are: higher speed of deployment and flexibility that are reflected on customers' proactiveness. All this, with a greater overall availability of infrastructure for the enterprise user. The principal business functions to migrate into the cloud were: ICT, technical support and sales department. During the time, numerous other implementations that led all business functions to the cloud has been performed.

"Actually, the implementations are in constant evolution."

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

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

These objectives have been largely achieved. The elimination of the old server has enabled the reduction of operating capital invested, while the replacement of electrical charges and maintenance with the fees to be paid to the provider has allowed to increase the operating income. So there is an improvement of the ROI.

The saving of the ICT function, without considering the costs of replacing servers, is about 20% annually. The cost-savings would be higher if they used only the public cloud. About the issue of security, administrators are confident.

"Although we were initially skeptical, we have not found jet security issues in our cloud infrastructures."

6. Conclusions

The aim of the research was to shed light on the reasons why Italian SMEs choose to adopt cloud computing. Numerous authors have confronted about the benefits and risks associated to the implementation this kind of solution within enterprises: the results they found were, often, different and contrasting. This study enriches the literature with the results of a series of studies aimed to show how Cloud Computing is able to solve latent problems of enterprises by reducing the costs of management of different functions and allowing a rationalization of resources.

The analyzed enterprises, although operating in different sectors, implemented cloud computing during the same period in order solve similar problems. In three cases out of four, cloud computing gives efficiency and stability to a not well designed ICT structure, while in the other it represents a necessary tool to start the business. The survey shows that one of the main limitations to the use of the instrument is to be found in the "fear of the unknown" - typical of changes regarding organizational or ICT functions: for this reason, implementation often occurs step by step. Only after having beaten the initial skepticism, in fact, cloud computing is recognized as a beneficial tool for business and then implemented at all levels.

The study reflects the limitations typical of the investigations carried out by questionnaire. The large number of interviews not necessarily allows to make

generalizations, subjects questioned may not necessarily have responded with accuracy or otherwise may have made a current situation different from the real.

Concluding Remark

Cloud computing represents a strong innovation for ICT field. This tool has got a great potential and could allow a lot of benefits to companies. However, as any new technologies it has also a panel of risks.

This thesis was divided in three different chapters and had three different aims. The first was to explore the Italian ICT market with a particular attention to cloud computing market. The second aim was to explore the benefits expected and the risks perceived provided by cloud computing adoption. The last motivation was to understand the motivation that push Italian SMEs to adopt this tool.

The first chapter explore the trend of Italian studies in ICT with particular reference to strategic change and the value generated by computer systems within companies. Also it examines the evolution of cloud computing in Italy focusing on the technological infrastructure of Italian SMEs on the evolution of the ICT and cloud market and on the growing attention given to the instrument. The lasts paragraphs provide an overview of the benefits and the risks arising cloud computing adoption for the companies and for the public administration. In conclusion, this chapter highlight the difficult situation of cloud computing in Italy indentifing two main factors: the backwardness of the ICT systems and the low propensity to change.

The second chapter were presented the cloud computing highlighting the benefits and the risks that this tool could give to organizations that start to use it. Using a semi-structured survey among cloud computing first time adopters, we understand what are the risks perceived and their supposed impact, before the first use. The findings reveal that the main benefits expected by cloud computing users are the cost reduction and the increased flexibility (recalled by the 60% of the total respondent). That said, the results on the perceived risks show that the most dangerous risks for the respondent are "IT organizational changes", "resource sharing isolation problems", "provider failure" and "loss of reputation". The main risky areas for cloud implementation appear the organizational and the technical.

Moreover, in light of these results, the main problem is that there is a strong perception of all the risks because they all are concentrated in the area up on the right in the graph.

The aim of the last chapter was to understand the main motivation to the adoption of the Italian SMEs. To reach this aim was used the method of multiple case study. The company analyzed implemented cloud computing during the same period in order solve similar problems. Also, in three cases out of four, cloud computing gives efficiency and stability to a not well designed ICT structure, while in the other one it was necessary to start the business. The survey shows that one of the main limitations to the introduction of this tool is the *"fear of the unknown"* - typical of changes regarding organizational or ICT functions. For this reason, implementation often occurs by different steps. Only after having beaten the initial skepticism, cloud computing is recognized as a beneficial tool for business and then implemented at all levels.

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