Determinants of the Decision to Transform Towards Cloud: an Exploratory Analysis of 225 CISCO Case Studies

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Abstract
This article aims to identify the determinant contingency factors in the decision to transform to cloud computing. An exploratory study of 225 cases of companies of different sizes and shapes, spread over all continents, was conducted, taking into account the factors of culture, size and structure. The factors of industry, strategy and technology were also considered, as well as managerial cognition. Indeed, the companies studied were chosen in seventeen distinct sectors of economic activities. The contributions of this research are manifold. From the managerial point of view, the 225 case studies that were analyzed led to the identification of factors which may facilitate or hinder the decision to convert to the cloud. From the academic point of view, this work has allowed to enrich the research knowledge with the various contingency factors of cloud computing transformation. From a methodological perspective, this research has overcome an important challenge, the exploratory study of a large number of companies that have adopted cloud computing, in a wide range of industries, and spread over all continents.

1. Introduction

To survive the multidimensional changes in markets related to frequent evolution of national and international regulations, consumers’ behavior, information and communications technologies (ICT) and the globalization phenomenon, companies have constantly to reinvent themselves. They seek to transform their information systems in order to integrate quickly the technological and sociological mutations such as cloud computing, big data or mobility [23]. These frequent changes and their induced reconfigurations are accelerating. In this new era of Internet of Everything (IoE), managers are increasingly aware of the necessity for transformation and rapid innovation.

In this context of disruptive innovations, such organizational transformations involve deep changes of business processes. It is therefore essential for these companies to find transformation models enabling them to lower costs and drive transitions, without hindering their development and degrading their quality of service, the customer satisfaction, or the level of security [41].

This paper proposes to identify the determinants of the decision of transformation towards cloud computing. It analyses the development, the adoption and the impacts of cloud computing in 225 CISCO case studies from seventeen different sectors such as administration, health, banking, finance, industry, media, telecommunications, technology or transports.

The remainder of this paper is structured as follows: The second part is a literature review, centered on the adoption of cloud computing. The third part describes the methodology used in this exploratory study and the research field. The fourth part presents the results from the analysis of the 225 case studies. The fifth part discusses the results, emphasizing the limits and perspectives for future research.

2. Towards a definition of cloud computing
Cloud computing is broadly defined as a set of virtualized computing reconfigurable and adjustable resources, depending on users’ needs through service level agreements. It is not a new technology but a set of technologies associated in a toolbox designed to manage firms in a different way. It leads to a new business model based on a utilitarian approach of information and communication technology (ICT) [47].

Although cloud computing is massively used since ten years by individuals with webmail, YouTube, Flickr or Facebook, it has developed much more recently in companies [28]. Cloud computing is the combination of many models. IaaS (Infrastructure as a Service) is the ability to provide more processing power, storage space, network infrastructure and other IT resources, enabling customers to deploy and run applications of their choice. There is no need to manage the underlying cloud infrastructure. One of the main benefits of IaaS is the flexibility that this type of management involves for the managers. Indeed, IaaS frees the company of the need to own, manage, maintain and control its own servers, which reduces costs. SaaS (Software as a Service) offers to consume software as a hosted service priced according to the time of use. SaaS therefore refers to a software model not sold as a licensed product that the customer installs on its servers, but as a service accessible remotely via the Internet [2]. PaaS (Platform as a Service) intermediate layer between IaaS and SaaS provides a computing platform to enable a company to develop its own solutions and custom applications, for example an operating system, a digital work environment, development tools, a database architecture or a programming language [20]. Cloud computing has progressively encompassed XaaS (Everything as a Service).

The theory of adoption consists of the characterization of factors that positively or negatively influence the decision to choose a new method or a new management approach [29]. The adoption of information systems is generally influenced by the profile of decision-makers, system characteristics, specifics of the organization, environmental context [42] strategic vision, modes of interaction with other organizations and capacity of integration [31].

Cloud computing can be considered as a very efficient and sophisticated form of outsourcing of ICT. It has therefore only very little impact on the end user’s behavior as he will continue to use the same applications and the same data but through a different distribution channel, much more reliable, ergonomic, secured and up to date [1]. The adoption of cloud computing, which relies on extremely complex circumstances [9], is facilitated at the individual level, although it still remains very limited in organizations, mainly due to the perception of a loss of control of information systems caused by the cloud, to a supposed lack of security and to an incompatible or deterrent legislation regarding this ICT distribution model [18].

If cloud computing is adopted by a very large number of individuals and some small and medium firms wishing to benefit from greater IT resources and more secured systems at a lower cost, larger groups and governmental organizations seem not to be ready to convert to it and do not see the same benefits [26]. The main argument leading SMEs to opt for the cloud is the payment proportionate to the volume of technology consumed, allowing small organizations to access the same applications that a large one, at an appropriate cost for their size and budget [2].

Other reasons for cloud adoption by smaller companies are ease and comfort of use, as well as increased security and confidentiality [22], on demand invoicing, adjustment of resources based on real-time needs, adaptability and compatibility of technologies and accessibility of data and tools regardless of the location or device [25]. However, the cost of the adoption itself is often a major obstacle that deters decision makers, despite the potential future savings that this adoption could eventually generate [28].

"Due to the current fashion, the term cloud computing is often used for advertising purposes in order to revamp existing offerings with a new wrap" [5]. This practice has discredited cloud computing, considered by some managers as fashion name used for a set of old concepts, which had a very negative impact on its adoption. The many benefits of cloud computing, defended by consulting firms and the most influential providers such as Amazon, Google, Microsoft, IBM, CISCO, Orange Business Services, Econocom, Symantec or McAfee, have largely been challenged by
literature [43]. This discredit formulated by some researchers and experts, as well as warnings from some privacy defense organizations, affect cloud adoption by individuals and companies. However, some positive aspects are perceived as indisputable by a majority of users: the illusion of infinite capacity of computing resources, the absence of commitment, payment based on consumption and access via any terminal [11].

The disruptive power of cloud computing and its ability to bring out new business models is a key motivation in the adoption of this technology by large groups [13]. Cloud computing has the power to reorganize the business environment, to establish new economic paradigms and to redefine organizational cultures to help them create new dynamics and new markets [6]. This desire to innovate and to acquire new sustainable competitive advantages is the main motivation of multinational firms who are pushed to take risks by smaller start-ups and competitors with bolder strategies. In high-tech companies, the factors that most influence the adoption of cloud computing are: the size of the company, the support of the corporate management, competitive pressure and the behavior of business partners [30]. The qualitative and quantitative requirements in terms of information processing are also important incentives to adopt cloud computing, which has proven particularly efficient in controlling complex logistics chains [9].

Some authors point out that a company can reach the necessary maturity to convert to the cloud by optimizing its risk management, its pricing policy and its ICT deployment strategy [24]. Cultural and societal readiness of the organization, control of complex dynamics generated by the cloud, trust in the relations between the different actors and close involvement of managers in the transformation process are other factors in the success of the adoption of cloud computing [17].

3. Methodology

3.1. A positivist epistemological position with an exploratory approach

This research aims to have a better understanding of the cloud computing phenomenon, its origins and current situation. It aims to identify contingencies factors determining the decision of transformation towards cloud. An exploratory and qualitative approach is used based on the case study method [46]. The transformation phenomenon is studied through the rigorous and systematic observation of 225 cases in 17 different sectors who have adopted cloud computing. This field study allowed to formulate generalizable recommendations. These recommendations were then discussed and contextualized. It is therefore a matter of generating theories from the data analyzed [21].

The starting point is the practices identified in the companies studied. These practices were compared and their performances measured. New situations and practices led to formulate new theories that correspond to the cases studied [46]. The aim is to precisely define factors that could facilitate or hinder the transformation towards cloud computing of the 225 observed firms, and to analyze the influence of the industry and company size. This analysis might be used to make recommendations to managers. Many authors have highlighted the richness and relevance of this type of qualitative approach and its descriptive and explanatory capacities [34].

3.2. Theoretical foundation: Contingency theory

Contingency theory was built around the idea that there is not a "unique best way" to decide, organize or run a business. The operational management is contingent, that is to say, subject to internal and external environmental and situational constraints. Many authors argued that it remains a dominant theoretical approach to organizational design, and perhaps the most widely used in studying organizations [39]. For Galbraith [16] organizational design problem is the search for consistency between several areas including strategy, organizational modes, and individuals.

Since the 1960s, several contingent approaches were developed. These approaches consider that, contingency factors, or environment aspects, impact organizational structure, operational management and decision-making. Klaas [27] stresses that the fundamental proposition of the contingency theory is that the survival and viability of an organization depends on the achievement and the maintaining of consistency between an organization and its environment. Organizational effectiveness is achieved through harmonization between organizational characteristics and contingent variables [33].

This theory is also one of the most used theories in information systems research. Moreover, in 1965, Woodward, one of the pioneers of the contingency theory, demonstrated that technologies must be taken into consideration in determining organizational characteristics such as control, centralization of authority, and formalization of rules and of procedures [45]. Cloud computing is not an exception to that rule. Actually, the implementation of cloud computing as well as the transition mode adopted to achieve it, is particularly subject to organization’s internal and
external contingencies. It is indeed a mode of consumption of information systems that must fit with the strategy and the structure of the organization.

Several types of contingency factors have been proposed in the literature including the strategy [35], technology [45], culture [8], managerial cognition [14], size [4] and structure. Nevertheless, the decision of transformation towards cloud generates a change in the organizational structure, by providing it with a new configuration of its information systems. It is, therefore, interesting to study the contingency factors of this transformation decision.

3.3. Selection of the research field

To identify contingency factors determining the transformation decision towards cloud, it was necessary to find a relevant research field allowing to study a representative sample of companies having adopted cloud computing.

Moreover, in order to build a generalizable model, taking into account the contingencies factors already confirmed by the research literature, these companies must be very diverse. To consider industry, strategy, technology, and managerial cognition factors, the selected firms must cover a great number of businesses in different economic sectors. In addition, they must be from several countries and continents to take into account the culture factor. Finally, they must be of different sizes to consider size and structure factors.

To find, and then study, all this diversity of firms that have adopted the cloud, we explored a variety of options. Each of them is either impossible to achieve, or too expensive, or needing the cooperation of dozens of researchers in several countries over a very long period. To face this challenge, we have decided to look onto cloud computing major global actors. These few actors are very large multinational groups, whose clients perfectly meet our research needs.

The actor who best matched our requirement is CISCO. In fact, the American company CISCO Systems Inc. is the worldwide leader in networks. It supplies cloud-computing providers with solutions that they can distribute to their own clients. CISCO is unquestionably the most performant company in cloud computing technologies field, with the most developed and audacious cloud strategy (cf. figure 2). Moreover, with HP and Microsoft, it offers one of the most elaborated and complete cloud solutions portfolios on the market. While Cisco is one of the major suppliers of IaaS, it is well positioned on the models of cloud computing as well. It does not only offer cloud-computing tools, but also custom-tailored strategy advice associated with deployment models. In addition to being a cloud provider, it is an intermediary bringing together cloud adopters with the most appropriate cloud providers.

It has entirely focused its strategy on cloud computing for the next 10 years, in order to support organizations in interconnecting individuals, business, services, data, processes and platforms by reducing the costs of managing information systems.

![Figure 2: Market shares evolution in the three main categories of cloud computing [35bis]](image)

3.4. Data collection, processing and analysis

We conducted an exploratory study of 225 CISCO clients mentioned on its internet website. The majority of these customers’ projects have been achieved during the past two years.

From the client companies’ perspective, cloud providers or specialists, called "pure players", such as CISCO, are the most legitimate providers and therefore are preferred. Their market shares confirm this trend. Nevertheless, there are other types of providers like SaaS solutions editors, integrators, services and computer engineering companies, management information systems consulting firms or outsourcers. There are also cloud-computing providers who base a part or all of their offers on those "pure players".

Once the list of companies to be studied was established, data was collected in three phases.

The table 1 shows this classification:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Americas</th>
<th>APJC</th>
<th>EMEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supplier</td>
<td>Adopter</td>
<td>Supplier</td>
</tr>
<tr>
<td>Education</td>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Energy</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Media</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Finance</td>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>
Tableau 1: Ventilation of companies by region and activity sector

| Administration | 2 | 8 | 0 | 0 | 0 | 4 |
| Health         | 1 | 6 | 0 | 0 | 0 | 4 |
| Law            | 0 | 0 | 0 | 1 | 0 | 0 |
| Industry       | 0 | 6 | 0 | 1 | 0 | 7 |
| Organizations  | 0 | 1 | 0 | 0 | 0 | 0 |
| Services       | 0 | 3 | 0 | 0 | 0 | 1 |
| Retail         | 0 | 3 | 0 | 0 | 0 | 0 |
| Internet       | 25| 8 | 22| 4 | 9 | 12|
| Technology     | 5 | 9 | 0 | 0 | 1 | 2 |
| Technology     | 12| 4 | 2 | 1 | 6 | 2 |
| Transport      | 0 | 2 | 0 | 0 | 1 | 0 |
| Telecom        | 0 | 0 | 0 | 0 | 1 | 0 |
| Wholesale      | 0 | 1 | 0 | 0 | 0 | 0 |
| 225 | 45 | 73 | 25 | 12 | 19 | 51 |

In the first phase, the documents provided by CISCO for each of these companies were explored in depth. One of the co-authors facilitated the exploratory approach, Director of the cloud computing division of CISCO Europe. Documents describing cloud projects of these clients have allowed identifying their needs, motivations, challenges, solutions supplied by CISCO and results. The second phase consisted in a systematic exploration of the companies’ websites, and institutional communication about cloud projects. In the third phase, a review of the professional press, specialized in the field of cloud, enriched our data corpus with the information mentioned on cloud projects of these companies.

In addition to primary data of the first phase, the last two phases have increased significantly the amount of secondary data. Triangulation of these data increased the reliability of data collected through institutional sources, and allowed to have a more accurate and nuanced analyses.

After identifying themes [40] to be studied, namely, factors enrolled in the transformation to cloud decision-making, three processes were used for data analysis. These processes are comparing, categorizing and linking [37]. The initial comparison phase consists of choosing data to be studied among all the collected data. Categorization helped identifying common elements and differences between all studied cases. The linking consists in searching connections between categories, in order to proceed with the verification, interpretation and the inference of results, and therefore identify the determinants of the decision of transformation towards cloud computing.

4. Results analysis

4.1. The determinants of the transformation decision

The analysis of case studies helped to understand why a manager wants to adopt cloud computing in their organization. More precisely, what are the contingency parameters that affect or control the decision of transformation towards the cloud? The case studies show that the cloud has many impacts on all sectors studied. These impacts are, in one way or another, more or less important depending on several contingency factors, including the industry, the conducted project, the opportunity, the target, or the functionalities.

For areas such as public administration, health or education, cloud is a paradigm shift. For instance, in the administration, the cloud can improve citizen interaction with government services. In addition, it contributes to improving the transparency of the administration by increasing its visibility and facilitating the supervision of its activities. The cloud enables better management of public funds, not only by reducing infrastructure costs, but also by lowering the uncertainties in managing budgets and therefore the opportunities of corruption.

Considering the health sector, cloud allows a better focus of investments on core competencies, while reducing investments in IT services and information systems. It improves remote access to patient records and delivers health services and quality products for geographically remote patients from major medical centers.

Regarding education, the impact is also important. Increased competition, particularly between higher education institutions, pushed them to transform their business models radically, by providing better training levels, with lower costs. The cloud has played a major role in achieving this transformation. More and more institutions are currently sending out on the cloud as important environments as virtual education or VLE (Virtual Learning Environment), the "e-learning", the LMS (Learning Management Systems), or students' information management systems. In this sense, cloud computing can offer a lower-cost environment of collaboration between teachers and researchers, teachers and students, students and school services, and between students themselves.
Cases studies show that the benefits are operational. In fact, cloud provided an opportunity for organizations that have adopted it to transform a large part of their capital investment expenditures (CAPEX) into operational expenditure (OPEX). Actually, cloud has enabled these organizations to carry out projects that were not possible few years ago. Dreams thus can finally turn into reality for these companies, especially SMEs, who suddenly are able to access to agility, functionalities and unexpected ways. Their managers have to worry about investing in infrastructure and information systems, but only to invest in operational and strategic projects within their heart of business.

The analysis of case studies shows that the transformation towards cloud model is not quite the same. Indeed, the company will no longer wait for the needs to be expressed, but rather considers the potential benefits and makes the transformation to the cloud based on those profits and buy the concerned cloud services. The benefits are somehow very closely linked to the needs, and will eliminate several steps of the classical model by moving directly to the purchase decision.

Nevertheless, the transformation towards cloud decision is hindered by several constraints. The most restrictive one is data privacy. In fact, secured exchanges and access to the cloud, as well as issues related to networks, are still the most important question marks for cloud business clients. Moreover, it is not obvious for a company to entrust their data to a third party that will store them elsewhere on a cloud, especially when it comes to data that constitutes competitive advantages, such as data related to customers. Even with the most detailed privacy terms, companies are not willing to let go those data upon which rely their own survival. In addition, companies are afraid their cloud providers will not restore their data. The provider choice is hardly reversible. As a matter of fact, cloud is very different from the traditional outsourcing. The drafting of delivery contracts thus requires a high degree of legal expertise, which is not accessible to all companies.

The case studies allowed identifying several other barriers to cloud transformation decision. These barriers are considered by the literature as well as by companies as drawbacks or side effects of cloud computing and the associated changes in business model. The most common fears are related to the confidentiality of some information, lack of perceived exchange safety, and securing data detained by cloud providers.

At the end of case studies’ exploration, contingency factors, considered as determinant to cloud transformation decision making, were identified and distributed into two classes. The first class is that of the factors fostering the decision of transformation towards cloud. Parameters of this class were distributed into three categories: user experience, economy and structure. The second class lists the factors hindering the cloud transformation decision. The parameters of this class were distinguished into three categories: "Insurance", "Criticality" and "Resistance to change".

![Figure 4: Contingency factors: Determinants of the decision to transform towards the cloud](image)

### 4.2. Factors that favor the transformation to cloud

The first fostering factor is "user experience". The employees of the enterprise using cloud are primarily consumer and they behave as such even in their professional lives. This factor can have a double impact. On one hand, they are in empathy with the company’s customers. They understand their requirements and wish to accompany their consumption practices. On the other hand, they are themselves consumers, with habits and specific requirements, who wish to enjoy in their company the same technologies as those they use and appreciate home. As employees, they want to have access to data, content and applications they need from anywhere, from any device and at any time, as they do at home when they use public cloud solutions, such as Picasa, Gmail, Dropbox or iTunes. Cloud solutions for the public have been adopted by many companies for corporate use. Indeed, both Gmail and Dorpbox, for instance, have corporate offerings and are aggressively pursuing Corporate contracts. Nevertheless, the implementation of specific solutions is usually needed.
"User experience" is also available in (1) simultaneity of access to cloud services for multiple users, (2) tailored solutions instantly accessible, (3) instant collaboration technologies such as Cisco WebEx and Jabber, or (4) universal mobility and multi-terminal with real-time synchronization.

The second fostering factor is "economy". It is first expressed by agility allowed by the cloud and that businesses need to create, deploy, and offer new services and to adapt to changes in the environment and markets. Agility is essential to ensure the sustainability of the company, to improve productivity and to stimulate innovation. It also reduces the "time to market" of new commercial offers. "Economy" is also the refocusing of companies on their high value added activities. Cloud computing facilitates access to outsourced support functions such as information systems that are not strategic in many sectors, and therefore supports the focus on what generates high added value. Risk reduction is also improved by cloud computing. Companies are looking to reduce risks associated with the management of information systems by focusing on Service Level Agreements (SLA) offered by cloud providers. Cloud computing is accelerating the transformation of capital expenditure (Capex) into operating expenses (Opex), which is a requirement of all stakeholders: external, such as shareholders or the board of directors, and internal, such as business departments. Cloud computing reduces the cost of upgrading equipment and IT infrastructures that have a shorter life cycle. Indeed, technology obsolescence is increasing rapidly because of the acceleration of innovation, increased computer power and exponentially larger amount of data to be processed. Cloud computing allows companies to not worry about this obsolescence that would require regular updating of their equipment to have always access to the most modern IT services. Some companies have a business with a strong seasonality, such as toy stores that make most of their business at Christmas, and who therefore need to adapt the size of their platforms. If they had a constant computing power, they would manage a large excess of capacity for most of the year, which could be considered as significant unused capital. However, thanks to cloud computing, companies with seasonal activity can adjust in real time their digital resources according to their needs. The funding capacity is also among the "economy" factors fostering cloud computing. SMEs/SMIs cannot have the same level of IT services and management of information systems as large groups, not only because of induced costs, but also their lack of expertise and in-house competencies.

For example, a CRM solution requires almost the same level of investment for an SME as for a multinational company and is therefore much less accessible and return on investment is much longer. Thanks to cloud computing, SMEs can access this type of solution at an appropriate cost for their needs and their uses. Cloud computing has a considerable influence on the ability of a company to adopt a global approach, a key driver to its economic growth. The model of pay per use, or "pay as you go", allows companies using cloud to pay only the services used and the resources consumed. This significantly reduces the necessary investment. For the cases studied, this reduction may be up to 80%. The rate depends on the size of the company and its industry, as well as the nature of the cloud transformation project conducted.

The third fostering factor is "structure". Data are particularly strategic for all business types and in all sectors. Therefore, it is a very involving choice for an organization to decide to entrust the management of its brain and knowledge to another organization. Furthermore, these data are more and more numerous and diversified. Data might be organized, stored and analyzed through knowledge management tools accessible via the cloud.

With recent automations and the development of orchestration layers, the way users consume IT infrastructures through cloud resembles more and more to a utility consumption, such as energy or water. IT service consumption is measured, and the company pays exactly for what it uses. It can easily move from one service to another, activate and disable a service, or switch providers according to their needs. The elasticity of the cloud allows to offer on-demand services. The scalability is guaranteed during the peaks of use, and then the capacity is instantly reduced when the activity lowers.

The ease of implementation is an obvious advantage associated to cloud computing structure. Indeed, it is much easier to buy a cloud service than develop, integrate and manage information systems. Moreover, companies using cloud no longer have to worry about regulations that are becoming more demanding. They account for a significant share of the IT infrastructure cost. For example in a bank, the legal deadlines for data retention and the constraints of security and accessibility of these data are the main concerns of information systems managers. The weight of compliance is transferred from the company to its cloud provider who must meet these requirements and ensure compliance with the specific regulations of his country and its industry.

4.3. The factors that hinder the transformation to cloud
Although many factors are fostering, there still are significant factors hindering the transformation towards the cloud. The first of them is "insurance". In fact, the main concerns expressed by managers are related to privacy, security, contractual commitments, independence, and legal expertise. Reliability is also a key issue because managers fear a service interruption by their cloud providers, although these providers usually guarantee high levels of availability, much higher than levels achieved by the company itself. This fear is amplified by the connection interruptions due to incidents on the Internet service provider's network (xDSL or fiber optics) which handles all the cloud traffic. The location of cloud and related services is also problematic because it can be in a country other than that of the client's company and therefore be subject to different legislation, particularly in terms of security, privacy, and confidentiality.

The second factor hindering is "criticality" of application components. Indeed, some applications are critical, or even vital for business. No risk of temporary unavailability, security or privacy could be tolerated. This is the case in the banking and the telecommunication sectors, and even more when health is involved.

The third factor that hinders the transformation is resistance to change. This is a well-known phenomenon by managers and researchers. Regardless to what to change, it is very difficult to control, although methods began to appear since the late 90’s. A transformation towards the cloud might be a major paradigm shift, implying that resistance to change is likely to be very strong for most stakeholders.

5. Discussion and perspectives

5.1. A gradual transformation in several stages

Although clients are increasingly considering to implement cloud computing solutions, few of them have a real cloud strategy or perceive the breadth and diversity of offers they have access to in the market. Buying a cloud solution is usually made ad hoc, for a specific need and for a limited time, or to experiment cloud services on less critical business elements, such as email or voice over IP. For medium to large companies, where cost reduction is not significant enough to offset the risk and the lack of control of public cloud services, the trend is to start with a private cloud as a test [15].

Investments then remain the responsibility of information systems management, and are still recognized as Capex. Moving towards a private cloud solution or a shared public cloud solution means taking a leap in terms of adaptability and flexibility, and an evolution towards Opex and therefore a considerable change in business models and processes. Historically, due to the structural transformation it generates, the cloud is the responsibility of information systems management. Currently, the influence of business departments is increasingly important. This requires closer cooperation between information systems management, often reluctant, and business directions, very demanding. As a result, companies are forced to transform their decision making processes and to rebalance power relationships [10].

The transformation to the cloud requires going through several different levels of maturity that will enable the gradual incorporation of all contingency factors and the consideration of all the factors that favor and inhibit this transition [41]. These intermediate steps are phases in the sourcing process of cloud computing provider that enable the company to take the time to reconfigure itself, to ensure change management, to adapt decision flows and to explore the world of cloud, understanding its diversity and potential.

In order for business customers to choose their cloud providers, they must take into account a very large number of elements, such as the brand, the reputation, the impact, the support, the size of the company, the flexibility of the solutions, the scope of the offers (from IaaS to SaaS), the interoperability with other vendors to avoid dependency, the Service Level Agreement, the costs and the reliability [38]. All these parameters are particularly difficult to assess and to prioritize, which complicates the decision process and delays the choice. It is necessary to go through a complete and accurate simulation of the value created by the cloud before developing a strategy of transformation and selecting the suppliers most coherent with the set objectives [12].

However, if customers are still struggling to identify the extent of the cloud market, it is also because suppliers who claim to be the cloud market players are still very heterogeneous: many of them have not yet determined their own strategies to address this market. The cloud computing industry is still not consolidated because it is too young, too diverse, and too technologically unstable [36] [44]. Many IT providers consider that they must position themselves in this market only not to disappear in the next five years. They usually just rebrand existing products and services which confuses customers unable to discern the benefits of cloud solutions over traditional solutions [32].

If we take the example of telecommunication operators, they usually have invested heavily in data centers whose maintenance and updating are so
expensive that it requires to amortize them over several years. These operators are service providers in an extremely competitive sector. They are constantly and very frequently led to renew their offers, to differentiate them in their markets, to follow or anticipate societal and technological developments and to respond to new opportunities. However, the size and complexity of these companies make them slower to react and to adopt cloud computing despite their need to increase their income and their profitability while reducing costs.

5.2. A transformation compromised by the very nature of cloud

Another key challenge for cloud computing projects is that of migration. Indeed, attracted by the benefits that cloud computing can bring, companies are increasingly tempted to migrate their old infrastructure to the cloud. However, the cloud market is evolving very quickly and it is impossible to predict which deals will take precedence over the others. These offers are diversifying and multiplying, increasing confusion and reducing the transparency necessary to an informed solution choice. Associated technologies also have undergone significant changes. Despite the fact that managers of some companies are determined to migrate to the cloud, they are unable to decide what to migrate, how to do it, where to start or what to focus on [41] [38]. Indeed, they are confronted with a market that is not stabilized, with a typology of cloud that constantly becomes more complex with several levels of public clouds, private clouds, internal clouds, external clouds, community clouds or hybrid clouds.

Managers therefore try to choose a target cloud configuration towards which to evolve among moving targets, becoming more and more numerous and complex, which are not all equivalent, some of these targets not even being really cloud, but old offers renamed for commercial purposes. Furthermore, not all the companies are in a configuration that is immediately transformable to the cloud. This type of project requires consolidated processes and accurately defined information flows before being implemented. A thorough analysis of information systems and a diagnostic of user skills and practices are also essential to ensure effective processing [44].

Furthermore, there is no known ideal approach to migrate to the cloud. There are as many different approaches as consulting firms that claim to be specialized in cloud computing and each company claims that its approach is the best. Moreover, migration depends on both the infrastructures to migrate, the size of the company's business sector, its strategic goals and its culture. So managers should start by differentiating what can be migrated to the cloud and what cannot.

Before starting the migration, transformation to the cloud project planning is a major challenge. Indeed, the company must take into account the necessary continuity of its services, the technical and functional characteristics of its information systems, integration with the various components of IS, and integration with customers IS, suppliers and partners. It is also important to properly evaluate the budgetary consequences, because although the cloud is very economical to use, its preparation, implementation and adoption can be particularly expensive and requires significant investment over a short period. Despite all the benefits that cloud computing can bring, if the switching costs are too high, it may be that they are not sustainable at the required time or that it is simply not profitable to migrate [12].

The transformation to the cloud involves a full questioning of the company in its structure and in its relations both internally and externally. Managers then have the task of managing hardware and software changes, as well as IT service providers and consultants. This migration also requires taking into account the development of the skills of company employees and a redistribution of roles and responsibilities [28] [15].

Indeed, the power of the IS Direction will be much less once the transformation to cloud is completed, the business departments will be much more independent and have more specific and more integrated tools, the general management will define the strategy of the business without worrying about information systems whose agility will allow them to align almost instantly. Information and decisions flows will be better controlled, more fluid, more transparent, and will generate a rebalancing of influence areas of the different stakeholders. However, while cloud computing can be seen as a considerable disruption to the business, everything seems to indicate that migration to the cloud is a strategic need for flexibility in a particularly volatile and unpredictable environment, a necessity in a more or less short term to ensure the survival of the organization [12], as was the migration to client-server architecture, then to the three-tier architecture and then to the multi-tier architecture and to Internet architectures. Indeed, it seems that we tend gradually and irrevocably to the phenomenon of "everything as a service" (Everything as a Service). In this sense, "information system as a service" facilitates scalability and availability of infrastructure and applications while significantly reducing the constraints and resources mobilized. Not taking advantage of the cloud corresponds to depriving
a company both of a very effective technology, and of ways of accessing new markets.

6. Conclusion

Cloud computing not only improves the way information systems are deployed, managed and used, but also how they will evolve and fit with the organization's strategy. However, despite the apparent benefits that can bring the cloud, either commercial, financial or technical, several challenges have to be taken into account, especially when migrating to the cloud. Several contingency factors positively or negatively influence the decision of the transformation towards cloud. Contributions of this research are threefold, methodological, academic and managerial.

From a managerial point of view, in this research we studied 225 cases. The analyses of these cases allowed us to identifying the factors that foster or hinder the decision of the transformation towards cloud. Although this technology seems to be particularly popular with plenty of advantages favoring a migration, there are significant hindering factors, such as criticality, insurance factors such as privacy or security, as well as resistance to change, that may, partially or completely make these projects fail. However, factors fostering the transformation to cloud, such as user experience, economic or structural factors, might justify the choice. These benefits are conditioned by the sector and the size of the company, and therefore may vary highly depending on specific circumstances, even though some are common to almost all businesses.

From an academic point of view, this study contributes to the research on cloud computing both in the management science field as well as in the computer science field. Indeed, it proposed a framing of the current state of research in this area according to the different aspects studied. Moreover, it helped enriching the research knowledge database with the different contingency factors determining the decision of transformation towards cloud computing.

From a methodological point of view, this research has taken up a challenge that seems insurmountable, namely the study of a large number of companies having adopted cloud computing, from a variety of industries and spread over several countries in several continents.

However, this research has some limitations. As matter of fact, beyond the usual limits related to the choice of the case studies and the methodology used, this work has limitations related to the adopted framing and perspective. In fact, in this paper, we chose to focus on the perspective of cloud client companies. These companies need a methodological assistance in their project of transformation towards cloud. It will be interesting to complete this view with cloud providers' point of view and their opportunistic approach. Furthermore, the combination of these two points of view may then lead to the proposal of a meta-model of transformation towards cloud.

6. References


