

Adoption of Cloud Computing by Enterprises in Morocco: A survey

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Abstract— Cloud computing is a fashionably term, abundantly used nowadays, to describe a range of technologies. Cloud computing is an ICT solution that offers remote access to resources. The ICT is continually developing to create a more competitive advantage for enterprises and this can be reached by way of flexibility, cost optimization, agility, innovation and scalability. Cloud Computing is now a part of the development strategy of the biggest organizations IT. It is an evolution of the IT management which contains enormous advantages in particular in financial term for any company. It is progressively being adopted by a broad range of users starting from commercial entities to customers. It is allowing companies to start from little resources and to improve them only in case of a rise in the service demand. In this paper, we investigate a various aspects of the ICT and we analyze a survey of the ICT and the Cloud Computing use within Moroccan enterprises. The findings offer companies and cloud computing service providers with better understanding of factors influencing cloud computing adoption. Besides, this survey forms specific recommendations to firms to evolve adoption strategies adapted to their particular needs.

Keywords— Cloud Computing, ICT, Enterprise cloud adoption.

1 INTRODUCTION

WITH a view to host their applications, businesses are starting to progressively rely on cloud computing systems.

The adoption of information and communication technology (ICTs) strategies, like electronic services, by companies has enabled them to further both economically and competitively [1]. These simplify the exchange between firms and customers and offer reliability, affordability and ease of control.

Information and communication technology (ICT) is a crucial part of the contemporary world.

Moreover, the use of the new information and communication technologies devices is being widely generalized. Hence, the access to information and the progress of connections has the potential to conduct to a new era in industrialization and marketing [8], [13].

Cloud Computing is an ICT solution, which is a collection of hardware and software provided on the demand on the Internet in real time. Using the power of technology, the client can update, store, create and access to his personal information commonly. The customer is capable of utilizing simply the Cloud applications without going via the installation step using a device connected to Internet [3], [4].

Besides, the Cloud Computing makes it possible to offer solutions to accompany businesses in their ICT strategy and their development.

A customer works in a virtual environment with this technol-

ogy, which allows for all the advantages delivered through present technologies, yet with reduced costs by using a formula known as 'pay-as-you-use' [5]. Nevertheless, while cloud computing acquires all the general advantages related with new ICT, it likewise contains a preminent number of threats (as a result of the offshoring of ICT functions) in comparison with other conventional systems [16].

The lack of empirical studies about cloud computing adoption in Moroccan enterprises has hindered understanding and thus strategy development to improve its adoption. The current gap in the literature has led us to the following research problem: do Moroccan companies adopt Cloud Computing? And what are the actual challenges that impede cloud computing adoption to Moroccan organization?

The purpose of this survey is to determine whether Moroccan companies have implemented ICT strategies and in order to recognize the major challenges impacting the adoption of cloud services. By way of explanation, this paper's pertinence for enterprises and ICT practitioners is double: Initially, it spreads awareness as to the advantages of cloud computing, thus facilitating to expand the tool and contributing to cancel out any risks of resistance. Second, the availability of a measure related to each barrier will allow for the creation of a risk assessment matrix that may help executives and technical experts to understand the main risks associated with cloud computing adoption. For that reason, we carried out this investigation of cloud computing users within Moroccan companies libeled as first-time adopters. This survey is indispensable for understanding the fundamental factors that conceivably affect the success of cloud computing implementation within businesses, in the same way for identifying possible areas for enhancement.

The remainder of the paper is organized as follow: The relevant literature review of Information and communication technologies (ICTs) and the Cloud Computing in the first part of the work. Section 2 exhibits the methodology used in this investigation. The findings of survey are presented in section

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3, whereas section 4 gives discussion of findings. Finally, section 6 concludes the paper with potential future directions.

A. Information Communication Technology (ICT)

Information and communication technology (ICT) has been partly responsible for social and economic enhancement. ICT, or information and communications technology (or technologies), is the infrastructure and components that permit innovative computing.

Information and communication technologies (ICTs) have become a support tool for controlling businesses, becoming a motivation for business processes, exploiting evolving strategies for reaching competitiveness and innovation in business operations, and bringing sustainability to enterprises overtime [6].

ICT combines electronic technologies and techniques exploited to control information and knowledge, as well as information-handling tools used to create, store, process, distribute and exchange information [7]. Thence, it sheds light on the enterprise progress that looks for staying at the forefront of the digital technology that expects actions, conceive adept services and build new relationships with clients.

Successful ICT deployment needs innovative control to constantly view evolvments and implement suitable technological solutions to increase organizational competitiveness.

ICTs progressively change completely delivery to a global value system, where access to information and ubiquity is accomplished, while exchange between principals and users offers significant opportunities.

The Cloud Computing takes a relevant position among these innovative technologies and it will be treated in the bellowing part.

B. Cloud Computing

The concept behind cloud computing is that information technology (IT) services such as software, hardware and other technology applications are rented out to clients and payment is made for the amount of time the service is exploited or stored. Conforming to the National Institute of Standards and Technology (NIST), 'Cloud computing is 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'[9].

NIST also put forward five essential characteristics, three service models and four deployment models.

Cloud computing is particularly characterized; therefore it is distinct from the traditional form of computing. According to the NIST definition, five broad characteristics of cloud computing were identified: Broad network access, on-demand self-service, resource pooling, measured service and rapid elasticity.

Broad network access is where computing resources in the cloud are made available on diverse devices via the Internet. On demand self-service is the capability to have computing resources in the cloud at every time and being able to self-provision determined by one's needs at a point in time [15]. Resource pooling permits the service furnisher to combine

computing resources with multiple users.

The measured service characteristic means the amount of pooled computing resources utilized are maintained and reported back to the user, through establishing the rate of consumption and its associated cost. Enterprises thus only pay for resources that really consumed [5], [14]. Finally, rapid elasticity of cloud computing means users can systematically monitor the amount of computing resources available to them depending on their requirements and for only the period of a specific task or period. There is no doubt that companies can reap great benefits from cloud computing [13].

Noticeably, one of the considerable opportunities of cloud computing is in its potential to aid companies in developing countries to earn full advantages of information technology without the essentially massive upfront investment that threatened past efforts. Cloud computing might have a similar impact on computing as the impact of mobile phones in communication. So this allows the government and local companies to benefit extremely from the efficient use of information technology.

The Cloud Computing is based on three service models [2]: platform as a service (PAAS), infrastructure as a service (IAAS) and software as a service (SAAS)).

Platform as a Service delivery model of cloud computing concentrates on the development and testing of applications without having to worry about the underlying infrastructure [11], i.e. developers don't have to be concerned about provisioning the servers, storage and backup associated with developing and installing of an application. Examples of PaaS include Google App Engine and VMware's Spring source.

In IaaS, the service furnisher provides the required hardware resources (CPU capacity, memory volume, servers, data storage, management control and communications programs) needed to run a consumer's applications. The user signs up for the necessary hardware resources and pays for the consumed resource over a certain period of time. Examples of IaaS include Amazon Elastic Compute Cloud (EC2), Simple Storage Service (S3) and Simple DB.

Finally, in SaaS, the application is rented in the request by a service provider, accessible via Internet [10] or via the network of an organization, or via both at the same time. Examples of SaaS are Dropbox, Twitter, Microsoft Office 365, Web emails, Customer Relationship Management (CRM) application, and Google Apps. Most of these personal applications are, nonetheless, free online services

The deployment models that determine the type of access to the Cloud Computing are [12]: public cloud, private cloud, community cloud and hybrid cloud.

In public cloud, computing resources are made available to the general public over the Internet. It is conceived to be exploited by any user in order to offer a similar range of capacities and services. Examples of public cloud are Google Apps, Salesforces, Amazon Web Services, etc.

In private cloud, the infrastructure is designed, built and managed by the organization intending to use that service.

Community cloud is formed by governmental organizations, educational institutions, the healthcare industry and similar industries that operate under common intentions, interests or

aims and rely very much on shared data.

Hybrid cloud is the composition of two or more of the previous deployment models (private, community or public) which are bundled together but with each operating independently of the other.

The Cloud Computing is a very promising technology enabling customers to reduce operating costs, and many others, while increasing efficiency. However, with the many benefits, come some drawbacks as well.

2 RESEARCH METHODOLOGY

This research paper showcases the main findings of a small component within a considerable area of research study; a number of findings have been interpreted with a central focus on cloud computing being adopted with Moroccan enterprises. It explores to highlight shortfalls and multiple aspects preventing and affecting on the adoption of this technology alongside information and survey. The methodology was utilized whilst relating to the greater area of study which highlighted principle aspects influencing cloud computing adoption. This research study was confirmatory in nature investigating to establish the primary barriers and challenges aspects that impact on Moroccan enterprises in adopting cloud computing. The efficiency of a survey method has been largely recognized in the literature [17].

TABLE 1
SOCIO-DEMOGRAPHIC PROFILE OF PARTICIPANT ORGANISATION

Organisation size	Percentage
Less than 100 Employees	40%
100-501	30 %
501-1000	6.67 %
Over 1000 Employees	21.33 %

This investigation was established online via Google Forms. For the intention of this study, we disseminate a questionnaire among a sample of individuals working within Morocco. A survey was carried out on 30 companies. The questionnaire was divided into three main sections. The first of these contained the personal information of respondents, who were classified as either CEOs or ICT people. The second relates to the access to Internet, which were considered as the essential motivation for ICT adoption in businesses. The last section focuses on the use of Internet services of the Cloud Computing. Moreover, about twenty questions were elaborated, from which the mandatory and the optional answers, with open questions as well. To analysis these data, we employed Qlik-view which is a software allows users to operate and manage a huge data sets using its in-memory technology on a desktop software platform [18].

Majority of firms interviewed are in the IT sector. For the purpose of analysis, Table 1 exhibits a socio-demographic profile of the enterprises in the investigation.

3 RESULTS

In this section, we showcase the main findings of our analysis. The IT tool develops and conducts to a several changes. While most investigations focused mostly on the use of digital tools, this survey assesses the influence of the ICTs on the enterprises business. Implementing cloud computing within an overall IT strategy can offer a real competing benefit, enhance firm efficiency and manage the cost of IT resources for businesses [19]. With respect to the literature, our results align with the theoretical prospects of many studies.

This survey reveals that 100% of the participants companies have a web page that permits an easy information transaction and furthers an instant communication at any moment and anyplace.

As stated in figure 2, 26% of the interviewees noticed that the web page delivers links to the social media pages in multiple platforms (Facebook, Viadeo, Twitter, etc.).24% mentioned having a web page that contains personalized content for regular or habitual visitors. 19% confirmed that it delivers client assistance through telephone or « chat » as well as the possibility to file complaints online and give a review (via email, a web form, etc.), 12% of them reported that it providers online ordering or booking.

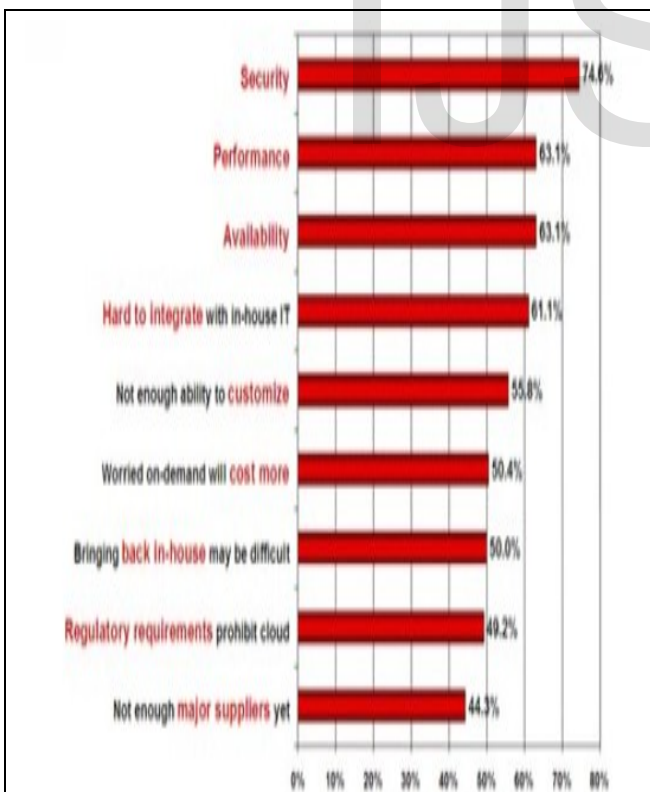
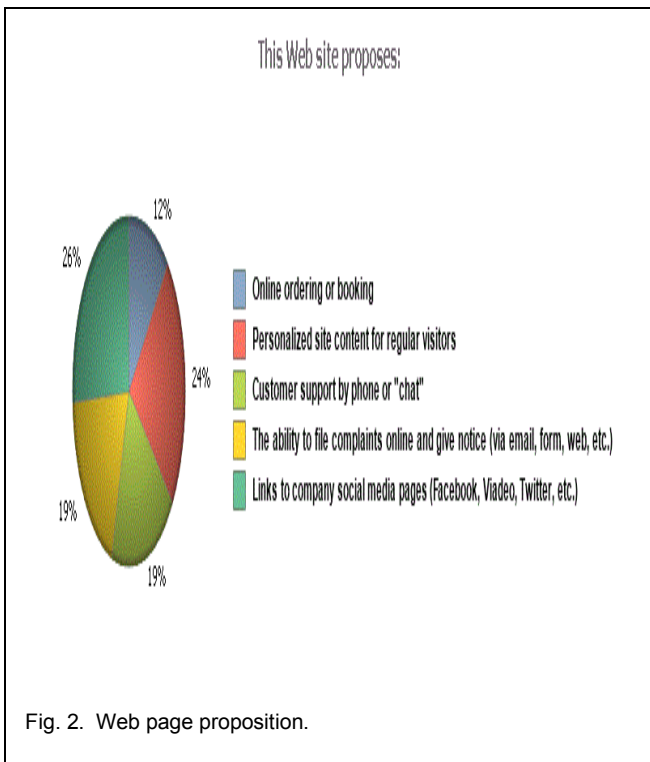
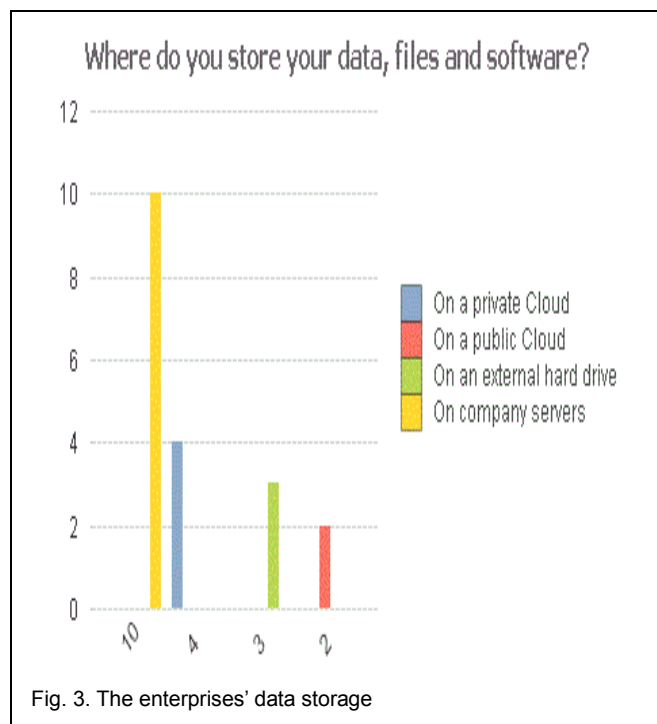


Fig. 1. Results of IDC ranking security challenges [14]

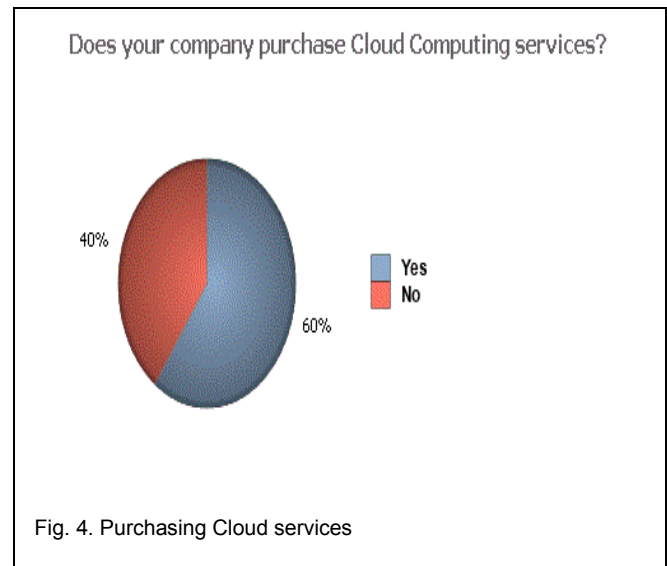


On the side of data, files and software storage, 20% of the responding companies report that they are stored on an external hard drive, 66% of interviewees report that they are stored on the company servers, 27% on a private Cloud, and 13% on a public Cloud, as depicted in the Figure 3.

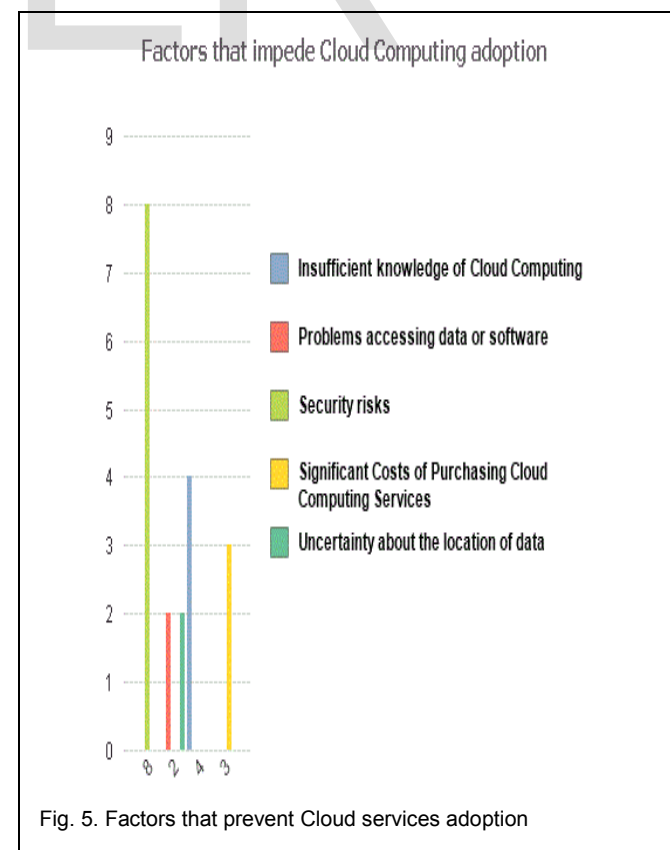
Such as certain technical innovations, the cloud's value proposition is that it makes IT faster, easier, and cheaper. However IT leaders must meticulously assess potential cloud services before they make the leap.



As indicated in the figure 4, the Cloud services are bought by 60% of enterprises while 40% do not.



Various factors, sometimes accumulated, can prevent or limit the use of Cloud Computing. This fifth graph below indicates that most of the interviewees consider security one of the factors that hinders the Cloud Computing adoption, others think it is due to the limited awareness about what cloud computing can do and how it works, and others mention the high costs of the purchased services and the uncertainty of the data location likewise the problems of the access to data and software.



Referring to Figure 6, most businesses buy the customer relationship management services, besides the database hosting, the e-mail, the office software, the file storage and the computing power.

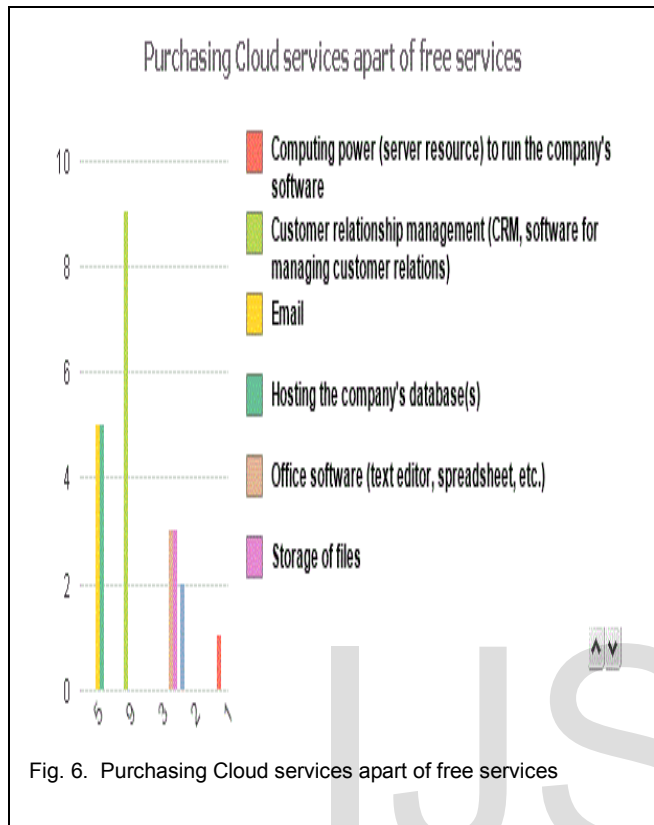


Fig. 6. Purchasing Cloud services apart of free services

4 DISCUSSION

This section will discuss the findings of this survey which are outcomes of the analysis carried out as indicated in the results section above and they constitute the reason for the contributions of this paper. These findings indicate that the ICT usage by the Moroccan firms is important by possessing a webpage so that transmit business credibility, present the solutions, and facilitate exchange. The interviewees companies were productively utilizing the Web to exhibit traditional public relations materials and hook up with publics.

This study exhibits that the plurality of Moroccan enterprises stores their data on local servers. Nevertheless, there are some enterprises that store its data on private cloud. But on the other side, with the view to contribute maintain the huge quantity of data being created regularly within their markets; most of firms recently notify they've set aside funds for additional storage space. That comprises public and private clouds, which commonly provider agility and cost savings over onsite data centers.

This survey declares most of interviewees admit that security is their first menace that prevents the cloud computing implementation for their organizations. Security has been mentioned in several investigations and studies on cloud computing adoption as one of the key issues that impede end-users away from adopting any form of the cloud [20], [21], [22], [23], [24]. Key references such as cloud security alliance [25] high-

light different security issues related to cloud computing. In a survey directed by a research firm IDC, security is one of the biggest concerns, as shown in figure 1 [26]. In developing countries, internet broadband, economic development, and security privacy and trust are the emerging issues related to the use of cloud computing [33].

Firms must take note of such threats in consuming cloud services. Especially threats relevant to privacy and security issues should be judiciously focus on.

Concerning data location, users do not always know the place of their data. Generally, this does not matter. For instance, Facebook members are in most cases not worried about the location of their photos and emails uploaded to Facebook. Nonetheless, when a business has some confidential data that is saved on a storage device in the Cloud, they may want to know the place of it. They may also wish to determine a chosen location [27]. Moroccan enterprises are anxious about the location of data [30]. Therefore, cloud vendors may help rise consumer confidence by ameliorating transparency in terms of location of data, as well as assisting companies with legal compliance as they move to the cloud.

Moreover, the most of companies surveyed do not have sufficient knowledge about cloud-based solutions and services. This lack of knowledge will restrict the dissemination. As a result, a lot of unexpected problems are likely to come up at the time of the adoption phase. Also, this reveals that the greater part of organizations managers do not have knowledge of cloud computing. Therefore, we observe that the technology is still new to the country. For this reason, there need to be more advertisement from service vendors in order to allow businesses to be aware of this new technology.

Furthermore, the high cost of purchasing Cloud Computing services is also a militating factor, which is reported by Moroccan companies. This problem limiting the ready adoption of cloud services is cited by various studies [28], [29].

In this survey, the utilization of the paid cloud is more widespread in Moroccan firms. As well as, the companies must have a thorough understanding of the scope of services being purchased. The most frequently acquired services are customer relationship management, email, hosting the company's database and file storage. But other cloud services of advanced level are used much less: the purchase of accounting software, office software and the use of computing power.

4 CONCLUSION

Cloud computing is a new emerging computing paradigm of ICT resources handling and providing in the internet by businesses. Hence, the evolution of cloud computing such as a new IT strategy will see to the compact of more firms in Morocco with this technology. This will influence the progress of the business sector as a strategy for economic development. As a result, the effect of adopting cloud computing on economic development could be evaluated and understood via its usage by these firms.

This paper is an extension of work originally reported in Proceedings of the 4th International Conference on Optimization and Applications [28].

This research paper was an opportune possibility to analyze Cloud Computing services adoption in Moroccan companies and to explore different digital communication tools and functionalities used by the respondents. As well as, this survey is carried for understanding the fundamental factors that conceivably impact on the success of cloud computing implementation within enterprises, likewise for identifying possible areas for improvement. The investigation exposes that they are aware of the digitalization benefits. However, some Moroccan companies often do not have sufficient human resources and skills to adopt new technologies. In addition, today's companies are offshoring these services to Cloud suppliers, nevertheless there are some challenges that limit cloud computing adoption as security risks, lack sufficient knowledge about cloud services and location data.

In face of the numerous benefits of utilizing a cloudbased service, its adoption is slow because there is often the lack of consideration of the approach to adoption. Cloud computing solutions can be approached either publicly, privately or as a hybrid. Accordingly, It is necessary to know what approach to cloud computing firms are taking to realize their objectives. Participants were interested in a private cloud approach and attributed this to the sensitive nature of their work and security concerns in other environments. They felt private cloud offers a more robust platform.

So, if the issues identified in this research are tackled, there is a prospect of cloud computing services being the next big thing in ICT for firms in Morocco. This will boost the business confidence in cloud services usage. Thus, it's necessary for cloud services providers to guarantee a good level of safety from all different risks coming from outside, in that event, there should be a solid and mutual agreement between the cloud vendors and their customers. Moreover, the adoption of cloud services can be enhanced by the establishment of more focused research in the area of cloud computing.

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