Opportunities of Adopting Cloud Computing in Palestinian Industries

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Abstract—**Cloud computing is a term that refers to resources and computer systems available on demand through the network, which can provide a number of computer integrated services without being restricted by local resources.This research attempts to determine the opportunities and strategies of cloud computing adoption in Palestine. A focus group has been conducted in order to accomplish the research objectives. Data were collected from 12 Palestinian firms. Accepted methodology was used to explore the current stage of cloud computing adoption in Palestinian firms and to identify the most important barriers hindering the adoption. The main obstacles that were identified as performing a significance role in Palestinian firms' adoption of cloud computing services include: lack of top management awareness, insufficient financial resources and budgets, shortage of cloud computing experts and professionals, inadequate network bandwidth, weakness of IT companies capabilities, sensitivity of data, legal and regulatory issues, and compatibility with the existing IT systems. In actuality, these results should present a basis for the Palestinian IT managers in terms of formulating a concrete plans for cloud computing adoption.**

Keywords cloud computing; cloud computingadoption;deployment models; development models;Palestinian Industries

1. INTRODUCTION

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. servers, networks, storage, services, and applications) that can be rapidly provisioned and released with minimal management effort or service provider interaction[1]. In addition, cloud computing is a technology of computing in which internet and central remote servers are provided "as a service" to users[2].According to [3, 4], cloud computing is the term given to the use of multiple server computers via a digital network as if they were one computer. The "Cloud" itself is a virtualization of resources which the end user has on-demand access to it. These resources can be provided with minimal management or service provider interaction[5]. They also argue that cloud computing offers the end user resources without the requirement of having knowledge of the systems that deliver it. Moreover, cloud computing can provide the user and business with a far greater range of services and applicationsincluding[1, 6]:

- Access to a huge range of applications without having to download or install anything

- Users can avoid expenditure on hardware and software; only using what they need

- Makes the hardware and software easily maintainable.

- Applications can be accessed from any computer, anywhere in the world

- Consumption is billed as a utility with minimal upfront costs

- Companies can share resources in one place

- Scalability via on-demand resources

Market Info Group (2011) acknowledges that the global market for cloud computing technologies is going to grow by 23.4% over the next five years, with an aggregate of over $300 billion over that period.As perIDC, cloud services are expected to grow at a compound annual growth rate of 27% and reach $42billion by 2012 and $55 billion by 2014 respectively; spending on non-cloud IT services is expected to grow at 5% [7].A recent study conducted by market-research firm IDC also predicts a $100 billion spending volume in the cloud service market in 2016[8]. Furthermore, cloud computing in just three years has risen to the top of the IT strategic technologies, and has been announced as the top technology to watch in the years 2010-2013[9, 10].

Currently, millions of people are already being used cloud computing in various manifestations including email services, office productivity applications and numerous subscription-based software as a service (SaaS) services [11]. In addition, several companies around the world have started to move their data and ICT operations into the cloud[12]. Some of the potential benefits from cloud computing can actually help companiesreduce high expenditures on hardware, software and IT maintenanceas well as provides businesses with a centralized, virtual data center that is accessible at any time and any location [13, 14]. Lina and Chenb[15] point out that the promised benefits of adopting cloud computing can be very appealing for companies, which offers increased return on investment and maxims competitive advantage.

Despite this proliferation of cloud computing resources and interest in such resources, this technology is not being adopted with its full potential in Palestine. Furthermore, very few studies have been carried out on how businesses are adopting and diffusing cloud computing technology in emerging economies, such as Palestine. This research is an effort to fill this knowledge gap by contributingto identify the current stage of awareness and understanding toward cloud computing technology and to determine the strategies and the plans of adopting this technology in Palestine. This study couldalso provide practical benefits to information technology practitioners in the successful adoption and implementation of cloud computing in Palestinian organizations.

2. LITERATURE REVIEW

A. The Current State of ICT in Palestine

Palestinian industries quickly respond to technological offering. A study conducted by Wihaidi[16] indicates that the Palestinian private and public sectors as well as consumers has strengths in the adoption of proven ICT products and services supported by experienced human resource and advanced and accessible telecom infrastructure.

Despite these encouraging characteristics, the Palestinian organizations faces serious challenges that need to be addressed such as: international perceptions of the technology adoption, ICT market access, travel impediments, access to equity based finance and investment, relatively high telecom cost to do business and inadequate legal and regulatory framework in support of technology industry. Moreover, there are few threats that cannot be overlooked including the ongoing political conflict, commoditization of IT products, lack of policies and government investment in the sector and a growing ICT brain drain [17].

In spite of these challenges, Palestinian ICT sector is on the verge of developing into an innovative high tech industry and has the potential to become the engine of the Palestinian economy [18].

B. An overview of cloud computing

In recent years, the advent of cloud computing has excited an interest for the various organizations, institutions and users. This is a result of the new economic model for the IT department that cloud computing promises. The model promises a shift from an organization required to invest heavily for limited IT resources that are internally managed, to a model where the organization can buy or rent resources that are managed by a cloud provider, and pay per use [19].

The European Network and Information Security Agency (ENISA) has defined cloud computing as "on-demand service model for IT provision, often based on virtualization and distributed computing technologies" [13]. Other common scholarly definitions defines cloud computing as "cloud are 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 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" [20].

According to Gupta, et al. [12], cloud computing is the next stage in evolution of the Internet, which is derived from the idea of businesses and users being able to access applications and services from anywhere in the world on demand. Moreover, cloud computing provides the means through which everything, from computing power to computing infrastructure, applications, business processes to personal collaboration can be delivered to users as a services. Cloud computing is offered in different deployment and delivery models.

C. Cloud Deployment Models

Many researchers [5, 6, 21-23] agreed that there are four models for cloud computing service deployment. These deployment models may have different derivatives which may address different specific needs or situations [21]. According to them, the basic deployment models are public cloud, private cloud, community cloud, and hybrid cloud.

1) Public cloud: This cloud infrastructure is available to a large industry group and is owned by a vendor selling cloud services. In this deployment model, public cloud applications, storage, and other resources are made available to the general public by a service provider. These services are free or offered on a pay-per-use model of payment [19].

2) Private cloud: This cloud infrastructure is managed by the organization or a third party and is operated solely for the needs of the organization. A private cloud is a particular model of cloud computing that involves a distinct and secure cloud based environment in which only the specified client can operate [24].

3) Community cloud: This cloud infrastructure is shared by more than one organization and support a specific community that has common considerations. This may be managed by the organizations or a third party [19].

4) Hybrid cloud: This cloud infrastructure is composed of two or more types of clouds listed above that remain unique entities but are connected via standardized technology that affords portability of data and applications [19].

D. Cloud Service/Delivery Models

Regardless of the deployment models adopted, cloud computing services are divided into three classes, according to the abstraction level of the capability provided and the service model of providers [12]. These models are Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

1) Software as a service (SaaS): The vendor provides, manages and controls the underlying cloud infrastructure, including individual applications, network, storage, servers, operating systems, etc. The customer is able to fully access

the vendor's applications in the cloud via a variety of devices (e.g. cell phone, laptop, PDA). SaaS examples include MyErp.com, Salesforce.com and Google Docs,

2) Platform as a service (PaaS): Similar to SaaS, the vendor provides, manages and controls the cloud infrastructure, except for applications, which the customer has control over. The vendor provides tools and resources allowing the customers to create and/or acquire applications to meet their specific needs. PaaS vendor examples include Wolf Frameworks, Google App Engine and Microsoft's Azure [25].

3) Infrastructure as a service (IaaS): The vendor provides, manages and controls the general cloud infrastructure but provides the customer control over operating systems, storage, processing, and networks on demand. IaaS vendor examples include Rackspace and Amazon's Elastic Cloud Compute (EC2) and their Simple Storage Service (S3).

Since this study focuses on Palestinian enterprises, as classified mostly to small and medium enterprises, they do not have the capital to invest in their own data centers to create a private cloud, nor do they have the infrastructure to offer a community cloud, the public cloud will by default become the chosen platform.

3. CLOUD COMPUTING ADOPTION ISSUES

The issues of cloud computing adoption are different for emerging economies than they are for larger economies [11, 26]. According to [11, 15], adopting cloud computing alsoincorporates some notable technical and business potential risks. However, several studiesidentified the most important issues that could inhibit the adoption of cloud computing as follows.

A. Security and Privacy

According to the survey of International Data Corporation (IDC), the biggest concerns about cloud computing adoption are security and privacy[27]. Corporate executives might hesitate to take advantage of a cloud computing because data stored, processing and movement carry outside the controls of their organizations[6].Several authors [13, 15, 28-31] argue that most of the security and privacy issues in cloud computing are due to a lack of control over the physical infrastructure. In other words, enterprises are waryof who monitors and controls the data center in the cloud.

B. Reliability and Availability

Reliability denotes how often resources are available without disruption and how often they fail [6]. According to these authors, availability can be understood as the possibility of obtaining the resources whenever they are needed with the consideration to the time it takes for these resources to be provisioned.Hinde and Belle [26] acknowledge that outage of the service provider or connection affects the cloud computing service availability which, in developing countries, depends critically on the

reliability of internet infrastructure.Avram[21]emphasizes that the lack of Internet connections is a considerable barrier for cloud computing as it relies on the Internet to deliver its services. Moreover, uncertainty of service reliability and availability especially the concern over unexpected system disruption and downtime could hinder organizations from adopting cloud computing because it increases business risks [15, 19].

C. Performance

According to IDC's survey, performance is the second concern in cloud computing adoption [27]. Performance is generally measured by capabilities of applications running on the cloud system [6, 32]. In addition, performance can become an issue because communication lag reduces application responsiveness. This can be exacerbated when a larger number of users are simultaneously making data-intensive requests over a limited bandwidth channel; this is a typical circumstance for small and medium businesses in developing nations [11, 15].Sajid and Raza [6] stress that poor performance could results in end of service delivery, loss of customers, reduce bottom line revenues.

D. Integration

Organizations need to adopt different types of applications from different cloud providers and these applications might need to interact with each other. Consequently, the integration between the data from these different applications needs to be achieved and this issue poses many technical and business challenges for cloud providers and adopters[11, 33]. On the other hand, integration with internal legacy systems is also an important issue where the organization already has a number of information systems implemented[34-36]. Further, cloud computing professionals have reported about the difficulties during the integration between services obtained from different cloud providers as well as between cloud resources and existing systems [24, 32, 34]. As organizations are operating well with their current infrastructure, any changes required by cloud integration can be a daunting task [37, 38].

E. Other Concerns

The lack of standardization of application program interfaces and platformtechnologies means that interoperability among platforms ispoor and organizations will not be able to transfer easily from onecloud provider to another. Consumers hence face vendor and datalock-in. This perceived lack of control can discourage companiesfrom adopting cloud computing[24, 30]. Other concern cited include the lack of existing skills and knowledge of IT professionals' in organizations to implement and manage cloud computingresources[29, 39, 40].Other underlying concerns are legal and regulatory issues[33, 38, 41]. There is an urgent need for the government and international agencies to be proactive in dealing with the unique challenges presented by the cloud computing environment. The underlying idea of cloud computing is to store data and information on virtual data centers that can be located in distributed locations in the world. However, conflicts may

arise as there are no of internationally accepted set of rules and regulations[32, 42].

In summary, cloud computing poses both opportunities and challenges in general, and IT professionals in particular. However, various issues of cloud computing adoption have been discussed in this section still there are many other compelling issues particularly relevant for organizations in emerging nations such as Palestine needs to be considered.

4. METHODOLOGY

The objectives of this research project are to identify the current stage of awareness and understanding toward cloud computing technology and to determine the strategies and the plans of adopting cloud computing in the Palestinian industries. The proposedresearch includes twoapproaches:qualitative and quantitative. In this stage of research we will discuss the qualitative approach; the quantitative approach will be discussed in the next stage of this research.

A. Research Design

Flick [43]claims that focus groupsis one of the main methods of qualitative research. Many have argued that focus groups method is a powerful qualitative tool that provides useful real world information[43-46]. Powell et al. [47] define a focus group as a group of individuals selected and assembled by researchers to discuss and comment on, from personal experience, the topic that is the subject of the research. Focus groups however rely on interaction within the group based on topics that are supplied by the researcher [44].In a way focus groups resemble interviews, but focus group transcripts can be analyzed so as to explore the ways in which the participants interact with each other and influence each other's expressed ideas, which obviously cannot happen with one-to-one interview material [43].

In this research, qualitative approach conducted a focus group session with the ICT industry and the wider digital economy in Palestine to develop a better understanding of their experiences and knowledge toward cloud computing technology and the obstacles of adopting this technology in Palestine. We wanted to speak with a wide range of respondents to begin to identify some possible insights and trends. A further reason for using focus group is to enable dialogue and interaction directly between us and the participants that can used to understand, clarify, explore, and raise new issues provided by the participants in their social context.

B. Data Collection

The focus group discussions used as the primary data collection method in this study. Discussions with participants were convened within Gaza from different business organizations include representatives of enterprises that employ ICT staff.The focus group lasted approximately two hours. The meeting was conductedat the Palestinian Information Technology Association (PITA) office. Discussions of the focus group were recorded with the permission of the participants. Discussions began with a brief explanation about cloud computing technology, models, benefits, and challenges. The researcher was then subtracted some questions that were done in beforehand to take part and talk freely about the subject. These questions designed to elicit enterprises plans for cloud computing adoption, respondents experience, the key requirements for moving to cloud computing, challenges and barriers faced by them in the adoption of cloud computing and their views on the practices, which could help in overcoming the obstacles of the adoption of cloud computing.

C. Data Analysis

According to Flick[43], the procedure for analyzing qualitative data is the same whether the qualitative data has been collected through interviews, focus groups or observation.The analysis technique that is most fit to our approach considers three activities, they are:data reduction, data display and conclusion drawing. The data obtained were summarized and simplified with the intention of condensing it, while data display was concerned with organizing and assembling information, which finally enabled us to reach our conclusions[45].

D. Sampling

A total of 12 ICT professionals were attended the focus group session. They were categorized into three main groups based on their adoption stage of cloud computingservices (Table I). These were enterprises that have been adopting parts of cloud computing services, enterprises that have been planning to adopt cloud computing services and finally, enterprises that do not intend to adopt any of cloud computing services.

TABLE I. TABLE TYPE STYLES

No.	Industry	Adoption stage	Job title
P1	Higher education	has been adopting	Educationaldepartment manager
P2	Higher education	has been adopting	ICT manager
P3	Higher education	has been adopting	ICT manager
P4	Financial services	has been adopting	IT consultant
P5	Government	has been planning to adopt	IT manager
P6	Government	has been planning to adopt	DB administrator
P7	Government	has been planning to adopt	IT manager
P8	Utilities	has been planning to adopt	IT manager
P9	Healthcare	has been planning to adopt	Technical manager
P10	Financial services	has been planning to adopt	Business analyst
P11	Telecommunications	do not intend	IT manager

		to adopt	
P12	Insurance	do not intend to adopt	Operations manager

5. FINDINGS AND DISCUSSION

Given the table above, we find that the Higher Education institutions are the most interested in adopting and implementing cloud computing services. This because that most of popular cloud computing providers frees Higher Educationinstitutions from the constraints of space, time and cost, and enablesthe delivery of education services anytime and anywhere [48].Participants (P1, P2, and P3) mentioned that they are adopting Gmail or Hotmail to replace their email systems.As mentioned in the table,the financial service firms become the second adopter of cloud computing. The reason of this refers to the availability of the financial resources and budgets provided by these firms to keep up with new technologies as well as employs external consultants. Participant (P4) concluded that the rapid increasing rate of changing in IT products and services forces their company to allocate additional budget to realize this growing.In addition, we found that the government organizations have been planning to adopt one of the cloud computing development models (i.e. private cloud), but they are facing many barriers that we will be dealing with it later in this section. The majority of prospectors (P5-P7) justified their interest in cloud computing, indicating their expectation that cloud computing make them more competent and effective. For the telecommunication company, they don't intend to adopt cloud computing by reason of that they are a company provided and equipped cloud computing services to others (P11). The participant (P12) from the insurance company justified his decision not to adopt cloud computing by stating that their existing information systems and infrastructure are satisfactory to meet the company business operation needs.

With regard to the service models (i.e. SaaS, PaaS, and IaaS), almost all of adopters would not use the cloud computing to develop new software but would use existing technology such as software as a service (SaaS). The reason of this include: reliability and stability of cloud computing, time pressure of software development, and learning curves of using the cloud computing. Early adopters (P1-P4) saw that the cloud computing is immature and therefore using it for software development is much risky.

Concerning the development models (i.e. public, private, and hybrid), government sector has established their plan about the adoption of cloud computing based on the private cloud model. Participants (P5-P7) confirmed that the government regulations prevent storing data offshore. Usually the data for the government sector must be secure therefore the attemptsrelatedto using public or hybrid cloud development models should be eliminated. In addition to this, the issue of privacy is also particularly important to this sector (P6). Whereas the financial service firms prefer Hybrid cloud as stated by (P4). He also argued thatthe privacy and integrity of customers' data is critical and this is

contrary to the use of cloud services as unsafe and non-compatible with the security requirements for the financial services sector.In turn, participants from higher education, utilities, and healthcare sectors indicated that the public cloud model is the most appropriate for them. They are clearly expressed their satisfaction about the public cloud. Furthermore, (P1, P8, and P9) agreed that security and privacy arenot obstacles against the characteristics and benefits offered by the public cloud, which include reduced costs, scalability, accessibility, ease of implementation, and many others.

In terms of cloud computing adoption concerns, participants stressed that there are some significant barriers.The main barrier to cloud computing adoption mentioned by participants that have not implemented cloud computing was the lack of top management awareness toward cloud computing techniques and its features. The discussion has highlighted some other concerns, most notably, insufficient financial resources and budgets granted to the development of information technology in organizations in general and cloud computing in particular (P2, P4, P5, P8, P10, and P11). Both adopters and non-adopters asserted that there is a lack of sufficient expertise in the area of cloud computing. For instance, P7 stated that in terms of building private cloud computing center, there are no prospect of existence experts have skills in the cloud computing architecture design approachesas well as a shortage of hardware equipment required to design and build such centers. Furthermore, there are shortage of IT staff who have the ability to create a cloud adoption plan (P12). P1 and P5 emphasized that weakness of capabilities of ICT private sector companies in developing and implementingcloud computing technologies is one of the current and future challenges.

Moreover, many participants (P4, P6, P10, and P11) consider their data very sensitive. According to them, security and privacy of data is crucial when considering implementing cloud computing services.Other aspects that were raised around cloud computing include the legal and regulatory issues. P3, P5, P6 and others concluded that new laws should be proposed to creates new dynamics in the relationship between an organization and its information, involving the presence of a third party which is the cloud provider. One of the major concerns acknowledged by participants about using cloud-based services has been the compatibility with the existing IT systems in companies. According to (P5, P7, P8, P10, and P12), the problem arises out of the fact that companies would have to replace much of its existing IT infrastructures and platforms in order to make the system compatible on the cloud.In addition, the top most concern that everybody seem to agree as a challenge with cloud is the network bandwidth. P3 stated that many cloud applications are still too bandwidth intensive. Other participants commented that the network bandwidth provided by Palestinian Telecommunication Company is not adequate and expensive.

Indeed, participants concluded that all these barriers should not be discouraged us in the pursuit of cloud computing. It is rather important to give serious consideration to these issues and the possible ways out before adopting this technology.

6. CONCLUSIONS AND IMPLICATIONS

This study is an early attempt to explore and identify a cloud computing adoption opportunities in Palestinian organizations. Through a focus group conducted in Palestine with IT and business managers from 12 organizations, in order to analyze, in depth, awareness and understanding toward cloud computing technology, current stage of cloud computing adoption, and barriers hindering the adoption of cloud computing. It has been shown that participants have sufficient knowledge about cloud computing technology. Concerning the current stage of adoption, results shown that few organizations has been used the SaaS model. Furthermore, findings revealed that the most important barriers influencing the adoption of cloud computing in Palestinian organizations were lack of top management awareness, insufficient financial resources and budgets, shortage of cloud computing experts and professionals, inadequate network bandwidth, weakness of IT companies capabilities, sensitivity of data, legal and regulatory issues, and compatibility with the existing IT systems.

An implication for business could be that using the facilities and services provided by cloud computing will support the sustainable developmental transformations process in Palestinian organizations more especially in the current economic meltdown. More particularly, using cloud computing will eliminate the problems of licensing of some applications used within organizations and the money for that can be used elsewhere. Furthermore, the findings of this study have much value to the ICT managers in terms of formulating better plans for cloud computing adoption.

A limitation of this study is that the research was conducted in Palestine with few firms in limited industries. However, although many other firms could adopt or plan to adoptcloud computing services, this study cannot be generalized. Besides, the identified barriers of cloud computing adoption could be a little different in other sectors or countries. Therefore, the results of this research might not be applicable to all of them.

An implication for future research is that it could expand this study by investigating the adoption of cloud computing in other sectors and settings and in different countries in both a quantitative and qualitative approaches. More specifically, this research chosen a focus group data collection method to identify the opportunities of adopting cloud computing in Palestine. Although this method is useful into in-depth analysis, it limits the ability to generalize the results. In addition, future research could consider conducting a focus group or an interview with different stakeholders (e.g. top managers, end users, staff in the IT department, etc.) within the same organization.

Finally, businesses that take early action to educate their staff and collaborate with experts will be better able to transition to the cloud while other companies struggle to fill the growing skills gap and see meager returns on their cloud investments.Additionally, issues still being studied concerns risk and security challenges as it relates with data and confidential information of organizations.

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