إقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Market Acceptance of Cloud Computing in Gaza IT Market

(An Analysis of Market Structure and Price Models)

مدى القبول السوقي للحوسبة السحابية في سوق غزة لتكنولوجيا المعلومات

(تحليل نماذج السوق ونماذج السعر)

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The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification

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(تحليل نماذج السوق ونماذج السعر)

Market Acceptance of Cloud Computing in Gaza IT Market
(An Analysis of Market Structure and Price Models)

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﴿ يَرْفَعِ ٱللَّهُ ٱلَّذِينَ ءَامَنُوا۟ مِنكُمْ

وَٱلَّذِينَ أُوتُوا۟ ٱلْعِلْمَ دَرَجَٰتٍ ۚ وَٱللَّهُ

بِمَا تَعْمَلُونَ خَبِيرٌ ﴾

[سورة المجادلة آية (١١)]

ABSTRACT

As an emerging technology and business paradigm, Cloud Computing embeds fairly large amount of unexplored fields, from technological definition to business models. While the market of Cloud Computing is expected to expand in the near future, few studies of the actual market acceptance of the Cloud Computing services are done.

This thesis aims to study the current and future market acceptance of Cloud Computing regarding the choice of the users and potential users for market structure and price model, in light of service homogeneity and usage frequency of the IT services in Gaza IT market.

The study used the descriptive analytical method and utilized both primary and secondary sources for data collection. The study population is included employees at Information technology and communication companies in the Gaza that registered with PITA. 61 of the 70 distributed questionnaires have been retrieved, forming a recovery percentage of 87.4%.

The results showed that there is a significant relation between (service homogeneity, usage frequency) of IT service and Market structure of cloud computing at significance level $\alpha = 0.05$. Also the results showed that there is a significant correlation between price model and usage frequency of IT services at significance level $\alpha = 0.05$. In addition, the findings stated that there is no significant correlation between Service homogeneity of IT service and price model at significance level $\alpha = 0.05$.

The research recommended that the IT companies should adopt Cloud Computing technology in its operations, which is an attractive technological and economic option to the companies.

ملخص الدراسة

باعتبار الحوسبة السحابية نموذج نشأ حديثا في عالم الاعمال و التكنولوجيا، فان هناك الكثير من جوانبها غير معرفة تكنولوجيا كنماذج اعمال. في حين انه من المتوقع اتساع سوق الحوسبة السحابية في المستقبل القريب في قطاع غزة، فانه لا يوجد دراسات عن القبول الحقيقي لسوق تكنولوجيا المعلومات للحوسبة السحابية .

وتهدف هذه الدراسة إلى توضيح مدى قبول السوق الحالي والمستقبلي للحوسبة السحابية فيما يتعلق باختيار المستخدمين والمستخدمين المحتملين لهيكل السوق ونموذج السعر، في ضوء تجانس الخدمة وتردد استخدام خدمات تكنولوجيا المعلومات في سوق غزة لتكنولوجيا المعلومات.

استخدمت الدراسة المنهج الوصفي التحليلي، واعتمدت على عدد من المصادر الرئيسة والثانوية فيجمع المعلومات؛ حيث مثلت المصادر الأولية في استبانة صممت خصيصاً لهذه الدراسة. ويشمل مجتمع الدراسة موظفي شركات تكنولوجيا المعلومات والاتصالات المسجلة لدى بيتا. حيث تم استرداد 61 استبانة من أصل 70 أي بنسبة 87.4%.

وأظهرت النتائج أن هناك علاقة ذات دلالة إحصائية بين (التجانس ، وتواتر الاستخدام) لخدمات تكنولوجيا المعلومات وهيكل سوق الحوسبة السحابية في مستوى الدلالة $0.05 = \alpha$. كما اشارت النتائج لوجود ارتباط كبير بين اختيار نموذج السعر وتيرة استخدام خدمات تكنولوجيا المعلومات عند مستوى دلالة $\alpha=0.05$. بالإضافة إلى ذلك، ذكرت النتائج أنه لا يوجد ارتباط بين تجانس خدمات تكنولوجيا المعلومات ونموذج السعر عند مستوى الدلالة $\alpha=0.05$.

توصي الدراسة شركات تكنولوجيا المعلومات في قطاع عزة بتبني الحوسبة السحابية في عملياتها، وهو الخيار التكنولوجي والاقتصادي الافضل للشركات.

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DEDICATION

TO MY MOTHER *. . .*

WITH LOVE AND APPRECIATION

TO THE FUTURE OF PALESTINE . . .

MY SON & DAUGHTER. . .

Ahmed & Ranim

TO MY BELOVED HUSBAND …

WHOM WITHOUT HIM I COULD

NOT FINISH THIS WORK

ABBREVIATION

Abbreviation	Description
AWS	Amazon Web Service
CA	Combinatorial Auction
CIO	Chief Information Officer
CPUs	Computing Power Unit
CSPs	Cloud Services Providers
DRM	Distributed Resource Management
IaaS	Infrastructure as a Service
IHS	Information Handling Services
IPM	Initial Price mode.
IT	Information Technology
NIST	National Institute of Standards and Technology
OS	Operating system
P2P	Peer-to-Peer
PaaS	Platform as a Service
PAYG	Pay-As-You Go
PCBS	Palestinian Central Bureau of Statistics
QoS	Quality of Service
RQ	Research questions
RSAPAM	Resource Swarm Algorithm Price Adjustment model
SaaS	Software as a Service
SLAs	Service-Level Agreement

SME	Small and Medium-sized Enterprises
SOA	Service Oriented Architecture
SPs	Service Providers
SPSS	Statistical Package for the Social Sciences
UTAUT	Unified Theory of Acceptance and Use of Technology
VMM	Virtual Machine Monitor
VMs	Virtual Machine
VPN	Virtual Private Network

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Chapter 1
General Introduction

Chapter Outline:

1.1 Introduction

1.2 Research Problem Statement

1.3 Research Question

1.4 Research Variables

1.5 Research Hypotheses

1.6 Research Objectives

1.7 Research Importance

1.8 Previous Studies

1.9 Research Distinction

1.1 Introduction

When you store your photos online instead of on your home computer, or use webmail or a social networking site, you are using a “Cloud Computing” service. If you are an organization, and you want to use, for example, an online invoicing service instead of updating the in-house one you have been using for many years, that online invoicing service is a “*Cloud Computing*” service.

Nowadays, the term “Cloud Computing” has been an important term in the world of Information Technology (IT). Cloud Computing, or the use of Internet-based technologies to conduct business, is recognized as an important area for IT innovation and investment (Armbrust et al., 2011; Goscinski et al., 2011; Tuncay, 2010).

Cloud Computing is a kind of computing which is highly scalable and use virtualized resources that can be shared by the users. Users do not need any background knowledge of the services. Moreover, a user on the Internet can communicate with many servers at the same time and these servers exchange information among themselves (Hayes, 2010). Basically, data and applications on Cloud Computing are available through the Internet, so it can be accessed from everywhere.

Cloud computing popularly termed as the computing system which offers Internet based services on demand in parallel and distributed environment. It is considered as one of the emerging IT technology which relies on distributed sharing of resources over different geographical locations to deliver services efficiently to users upon their request (Pattnaik et al., 2015).

Additionally, Shalini mentioned that the Internet is the "cloud" of applications and services that are available for access to subscribers utilizing a modem from their computer. With Cloud Computing, businesses may prevent financial waste, better track employee activities, and avert technological headaches such as computer viruses, system crashes, and loss of data. When Cloud Computing are used in education, this will likely have a significant impact on teaching and learning environment me (Shalini, 2012).

According to Spreeuwenberg (2012), with Cloud Computing it becomes easier to access data with several devices. Especially for mobile devices this can be really useful since the only thing that is needed, is an Internet connection.

Cloud computing get recently the attention of many organizations, including the capital market and significant benefits from its use in new capital market services. Cloud computing in providing the amount of resources requested by the users is flexible. Customers in the cloud are used only for what they have paid their fees.

In Jan 2015, Forrester Research expects Cloud computing to be a $159.3 billion market by 2020 and Gartner Research in the beginning of 2015 prognosticates a $150 billion clouding business by 2015. The expectations of the business with Cloud computing are high and no competitor on the IT service market can ignore the Cloud Computing paradigm.

The main focus of academic researchers at that time was on the "technical" topic, such as like load balance, resource allocation etc. But the pure technical maturity (given that is already available) does not necessarily lead to a wide acceptance of a new technology, because there are other forces and mechanism influencing the market development of it: on one hand, the market mechanism could probably solve the resource allocation problems in systems, and on the other hand, a technical trend will be of little use if it cannot gain enough commercial exposure. One of the best ways to find out the market acceptance is asking directly the users and potential users of Cloud Computing services. For this reason, a *survey* about the attitudes of current and potential users toward Cloud Computing was designed as a basis research material for this thesis.

Based on this survey, analyses are done in several aspects including general knowledge about Cloud Computing, expectations and concerns, service homogeneity and usage frequency of the services, preferred market structures and price models in Gaza IT market which faces difficulties in importing equipment and tools needed for work, not to mention need to travel to introduce international companies to the local abilities and potential and to enhance trust. And that’s not currently doable except with difficulty, which makes work not grow much despite the global growth.

A simple random sampling is applyed for this survey, because the users and potential users of Cloud Computing services can be any company; even if they aren’t yet using any IT services, they can be potential Cloud Computing customers: they can simply use Cloud Computing services from the very beginning and own no legacy system at all, so samples will be chosen from any company or organization, like universities and hospitals that use IT services or going to use IT services.

The rest of this thesis is organized as following: Chapter 2 provides a comprehensive definition of Cloud Computing as well as a comparison with other similar concepts like Grid Computing and Utility Computing; Chapter 3 gives a review of the status quo for the current market of Cloud Computing, as well as both theoretical frameworks related with market structures and price models; Chapter 4 focuses on the research methodology of this thesis, which mainly includes a survey; at the core of this paper, Chapter 5 demonstrates the survey results and provide an analyses regarding the choice of market structure and price model, based on the survey results, Chapter 6 gives the results of the study and some further research directions.

1.2 Research Problem Statement:

So far, at home and abroad, most of the studies about "cloud" are still rest on the technology level, e.g., the strategy and solution of cloud system architecture, cloud application, cloud security, encryption, privacy protection, access control and other issues. For example, Lim et al, (2013) proposes an overview of the new proposed Cloud Computing reference architecture but focusing on one of the cloud provider components which is cloud service management.

Additionally, Chandio et al, (2015) proposes a novel technique that will not leave consumer alone in cloud environment. There is a presentation of theoretical analysis of selected state of the art technique and identified issues in IaaS (Infrastructure as a service) Cloud Computing. In addition to that, the study proposes Distributed Trust Protocol for IaaS Cloud Computing in order to mitigate trust issue between cloud consumer and provider.

Also (Narula et al, 2015) which provides the review of security research in the field of cloud security. After that, it has presented the working of AWS (Amazon Web Service) Cloud Computing. AWS is the most trusted provider of Cloud Computing which not only provides the excellent cloud security but also provides excellent cloud services.

Behavior Intention is considered to be an important indicator to forecast potential users' acceptance of new technology/ services, however, from the search results on Science Direct, Emerald and CNKI, we find that the study on cloud service user adoption is still very rare. While the Cloud Computing technology is gaining ever more attention from the public, the variety of Cloud Computing services, including forms of market coordination, price models, service level requirements etc., is growing too.

So the main propose of this thesis is to study the current and future market acceptance of Cloud Computing regarding the choice of market structure and price model, in light of service homogeneity and usage frequency of the IT services in Gaza IT market.

1.3 Research Questions

The study deals with the analysis of the Cloud Computing market in terms of market structure and price models to determine the degree of market acceptance of Cloud Computing. Hence, the research question will be:

What is the degree of market acceptance of Cloud Computing in Gaza *IT market?*

For the research question, there are sub-questions defined that help to oversee the steps to achieve a similar answer to the research question.

1.4 Research Variables:

The dependent variables*:*

The main variable*:*

- Market acceptance of Cloud Computing

The sub-variables:

a. Market structure of Cloud Computing services.

b. Price model of Cloud Computing services.

The independent variable:

a. The homogeneity of Cloud Computing services.

b. The usage frequency of Cloud Computing services.

1.5 Research Hypotheses:

There are two main hypotheses for this research:

1. There are significant statistical differences at significant level (α≤0.05) among the respondents' answers regarding market acceptance of Cloud Computing due to personal traits (Gender, Age, Qualifications, Type of Position, Position and Years of Experience).

2. There is a significance effect between independent variables (The homogeneity and the usage frequency of Cloud Computing services) and Market Acceptance of Cloud Computing in Gaza *IT market* (at level of significance α≤0.05).

From this main hypothesis the following sub hypotheses result:

a. There is a statistical significant relation between the service homogeneity of Cloud Computing services and the market structure of Cloud Computing services (at level of significance α≤ 0.05).

b. There is a statistical significant relation between the usage frequency of Cloud Computing services and the market structure of Cloud Computing services (at level of significance α≤0.05).

c. There is a statistical significant relation between the service homogeneity of Cloud Computing services and the price model of Cloud Computing services (at level of significance α≤0.05).
d. There is a statistical significant relation between the usage frequency of Cloud Computing services and the price model of Cloud Computing services (at level of significance α≤0.05).

1.6 Research Objectives:

The main objective of this research is to overcome the problem statement, for that this research is being carried out with several objectives and it is important to state them clearly, to ensure that the research is kept on track.

The second main objective of this research is to determine the degree of Market Acceptance of Cloud Computing in Gaza which can be divided to the following sub objectives:

a. To find out the potential influences of service homogeneity of Cloud Computing on customer's choice of market structures.

b. To find out the potential influences of usage frequency of Cloud Computing on customer's choice of market structures.

c. To find out the potential influences of service homogeneity of Cloud Computing on customer's choice of price model.

d. To find out the potential influences of usage frequency of Cloud Computing on customer's choice of price model.

1.7 Research Importance:

The importance of this study considered as the first empirical study in the market acceptance of Cloud Computing services regarding the market structures and price models in Gaza.

This thesis represents clearly the customer's point of view rather than technical or architectural requirements. It is not to say that technical and architectural requirements are not important, but what the customers pay most attention to are the benefits they can get from the technology. For example, a real-time delivery of products and services is more important than whether the products and services are provided via Peer-to-Peer (P2P) network, Virtual Private Network (VPN) network or direct via Internet.

1.8 Previous Studies

Cloud Computing has been examined from different perspectives and through different research strategies. This section will shed more lights on some of significant studies that took place in different countries in the world; many other studies were referred to and linked with through the thesis:

1. **(Alharbi, 2014)** ***''Trust and Acceptance of Cloud Computing: A Revised UTAUT Model''***

This paper carried out in Saudi Arabia to propose a revised Unified Theory of Acceptance and Use of Technology (UTAUT) for Cloud Computing acceptance taking into account trust as a main construct in the model. The UTAUT is one of the most widely used model for investigating the acceptance of information technology and explaining factors influencing users accepting of information technology. Its validity has been demonstrated in wide range of information system contexts.
A survey including the proposed statements, distributed to software engineers enterprises that deals with Cloud Computing services.
The author concludes the adopting Cloud Computing technology is still facing various challenges mainly establishing trust. The UTAUT is one of the most widely used model for investigating the acceptance of information technology and explaining factors influencing users accepting of information technology

The author suggests statements related to trust categorized in various trust aspects. The validity of the proposed model will be investigated in a further study.

2. **(Stieninger et al, 2014)** ***"Diffusion and Acceptance of Cloud Computing in SMEs: Towards a Valence Model of Relevant Factors"***

This paper carried out in Germany to propose some factors which influence the diffusion and acceptance of Cloud Computing within organizations. The following two research questions (RQ) are assessed by this paper:

- Which influencing factors are addressed by scientifically proven theory models concerning diffusion and acceptance of technological innovations?
- What is the relevance of the influencing factors deduced from the theory models on the attitude of SMEs towards Cloud Computing?

The authors combine the theoretical approach from scientifically recognized literature with a practical evaluation of influences on the diffusion and acceptance of Cloud Computing among SMEs. The analyzed theory models cover four main areas of influence on acceptance and diffusion of technological innovations: The individual, the organization, the technology and the environment. Factors from these established theory models dealing with acceptance and diffusion of innovations served as a vital basis for the data analysis process.

A survey including the proposed statements, distributed to 436 German cloud omputing supporters companies.

The authors conclude that a valence model was created which sheds light on the differing relevance of influencing factors in both positive and negative directions. Thereby it provides a broad overview of essential areas and perspectives which have to be considered from the viewpoint of an SME.

3. **(Huang et al, 2014*) "Pricing strategy for cloud computing: A damaged services perspective"***

This paper carried out in Singapore to propose whether interruptible spot-price on demand Cloud Computing services—which are viewed as damaged services—are valuable to the vendor.

Three types of pricing: fixed prices for reserved services, spot prices for on-demand services, and a mixture of them in a hybrid strategy are compared.

The authors conclude that a vendor should employ a hybrid strategy, but only when: clients are sensitive to services interruptions; or task values are highly differentiated. The vendor may be able to increase its profit by keeping the services interruption risk at a recognizable and substantial level, so that the cannibalization effect between fixed-price services and spot-price services is minimized On the other hand, using a hybrid strategy will enhance the vendor's price discrimination ability: it can segment the market by both clien**t** demand and task value — leading to lower consumer surplus in most cases.

The authors offered some recommendations:

- The vendor, when employing a hybrid strategy, should version the spot price services by introducing interruption risk. The presence of interruptions enables the vendor to implement price discrimination and also gain resource allocation flexibility.
- For hybrid pricing strategy with damaged services to be beneficial to the vendor, clients must be sensitive to services interruptions.
- To gain more profit, the vendor should not minimize the risk of services interruption for spot-price services.

- With competition, a vendor may consider hedging interruption risk for its clients with tools to help them overcome interruption impacts.
- A vendor that employs a hybrid strategy with damaged services can further improve its profit by imposing a limit in the capacity associated with fixed-price non-interruptible reserved-services contracts.

4. **(Zhang et al, 2014) *"Price Competition in a Duopoly IaaS Cloud Market"***

This paper carried out in Japan to propose how to set optimal prices in order to maximize the revenue of CSPs (Cloud services providers) in a competitive IaaS Cloud Computing market while at the same time meeting the cloud users' demand satisfaction is a problem that CSPs should consider. Because of that they study subscription pricing competition in a duopoly IaaS Cloud Computing market. They also present a game theoretic analysis of a cloud market with two CSPs competing non-cooperatively for cloud users.

The study presents a game theoretic analysis of a cloud market with two CSPs competing non-cooperatively for cloud users.
The authors conclude that, when there are *homogeneous Cloud Service Providers*, i.e., the two CSPs have the same capacities, both CSPs will charge the same price, and they have the same market share. The two CSPs are indifferent to cloud users, which imply that the equilibrium solutions of the homogeneous scenario are symmetric.

The authors recommend focusing on the numerical analysis of the effects of resource capacities on equilibrium prices and expected revenues in monopoly cloud market and duopoly cloud market.

5. **(Li et al, 2012) *"A Cloud Computing Resource Pricing Strategy Research-based on Resource Swarm Algorithm"***

This paper carried out in Chaina to propose a model called Cloud Bank to support the research of pricing resources. Cloud Bank model is the one of IaaS application. They combined with relevant principles of economics, Cloud Computing and resource swarm algorithm to discuss how resource swarm algorithm is applied to the resources price adjustment. Make an analysis to the computing resources pricing in Cloud Bank model. Put forward a strategy to solve the problem that pricing resources.

Two important models that are Initial Price model (IPM) and Resource Swarm Algorithm Price Adjustment model (RSAPAM).
The authors improve resource swarm algorithm for enriching the pricing strategy. In the end, this pricing strategy realizes automatic adjustment of computing resources price.

6. **(Breskovic et al, *2011) "Towards Self-Awareness in Cloud Markets: A Monitoring Methodology"***

This paper carried out in Germany to propose a methodology that could enable a market platform to be self-aware, i.e. knowledgeable about its state at multiple levels.

The authors utilize GridSim (Buyya, 2011), as a widely used tool for the simulation of Grid and Cloud market behavior to demonstrate their approach. They have extended GridSim with appropriate market and mechanism sensors as well as simple infrastructure sensors. Based upon the monitoring metrics of the market their monitoring model can sense dynamic changes in market behavior, which is the first step towards establishing self-aware and self-manageable market platforms.

The simple evaluation scenario (a sudden cease in demand) illustrated that a sudden change in demand for resources can lead to market instability, and ultimately crashes, as was painfully demonstrated in the recent financial crisis. This temporarily affected the performance of market goals (both positively and negatively), and in a real deployment would have resulted in excessive and costly utilization of unneeded hardware infrastructure. The authors show that such phenomena can be detected by that monitoring model, which may in the future help to identify and react to sudden changes in the performance of Cloud markets such that they can begin to give these platforms autonomic capabilities and enable them to steer away from and avoid negative market outcomes.

The authors intend to investigate similar phenomena and tune the monitoring model accordingly. They also plan to include additional allocation mechanisms for future studies.

7. **(Rimal et al, 2010)** ***" A Taxonomy, Survey, and Issues of Cloud Computing Ecosystems "***

This paper carried out in Korea to propose explanations of each of the components consisting of modes of Cloud Computing services, virtualization management, core services, security, data governance, and management services.

The authors contribute a great deal of better understanding of the classification of the Cloud Computing and its applications to further research of similar issue including this study.

8. **(Shang et al, 2010)** ***"A Knowledge-based Continuous Double Auction Model for Cloud Market"***

This paper carried out in China to propose a knowledge-based continuous double auction trade model. It introduces a probability based on historical trading information, and use historical bids to determine the probability that future bids will succeed. With this probability agent can then adjust the bidding or quoting price or ask price automatically. Combine this probability with profit to estimate how to place bids to maximize expected profit. If there were many bids made at each price point than the probability could simply be the number of shouts accepted at a particular price point.

The authors develop a simulator to test the related feature. The results show that the model is efficient in resource trading. The mean efficiency of resource trading is 97.770%.That mean that the trading price is more stable. They intend includes applying that model to a real cloud resource environment and conducting experiments of larger scale to test the efficiency of that model.

9. **(Buyya et al, 2009)** ***"Market-Oriented Cloud Computing: Vision, Hype, and Reality for Delivering IT Services as Computing Utilities"***

This paper carried out in Australia to propose architecture for market-oriented allocation of resources within Clouds including (Users/Brokers, Service Level Agreements Resource Allocator, Multiple VMs (Virtual Machine) and Physical Machines). In addition to that, there is discussion about representative platforms for Cloud Computing covering the state-of-the-art. Also the paper presents a vision for the creation of global Cloud exchange for trading services.

The authors conclude that the Cloud technologies have limited support for market-oriented resource management and they need to be extended to support: negotiation of QoS (Quality of Service) between users and providers to establish SLAs; mechanisms and algorithms for allocation of VM resources to meet SLAs; and manage risks associated with the violation of SLAs. Furthermore, interaction protocols needs to be extended to support interoperability between different Cloud service providers.

The authors recommend that several challenges need to be addressed to realize this vision. They include: market-maker for bringing service providers and consumers; market registry for publishing and discovering Cloud service providers and their services; clearing house and brokers for mapping service requests to providers who can meet QoS expectations; and payment management and accounting infrastructure for trading services, Finally, they need to address regulatory and legal issues, which go beyond technical issues.

10. **(Song et al, 2009)** ***"A Novel Cloud Market Infrastructure for Trading Service"***

This paper carried out in South Korea to propose combination of Cloud providers that minimizes the total service price (including collaboration cost) for consumers and also reduces conflicts among providers as well as negotiation time while maintaining the QoS requirements of consumers. Because of that they proposed a novel CA (combinatorial auction)-based trading infrastructure to enable the supply and demand of Cloud services by modifying existing auction policy in terms of its suitability, economic efficiency and system performance. Such market can allow consumers to choose a set of Cloud providers that suits their requirements. Providers can use the market in order to perform effective capacity planning. Also this market can provide feedback in terms of economic incentives for both Cloud consumers and providers.

The authors recommend finding out an appropriate group strategy for the Cloud providers so that they can make dynamic groups and increase their competitive power and compete for winning the bid.

1.9 Research Distinction

Those studies used different types of methodologies, some of them applied the analytical descriptive method, and another part of them carried laboratories pediments, while others used proposed modules. Moreover these studies were conducted in different types of organizations including the governmental institutions, public security establishments, and private sector's firms. These studies conducted in different countries with different societies, environments and cultures.

The applied samples vary in their types. Part of the results that were found throughout this study come on line with the previous researches and other findings were the privilege of this study.

This thesis differs from other literature in many other ways. The main contributions of this thesis are found in following:

a. Focus explicitly on the Cloud Computing services, which are defined clearly in comparison with other "Cloud-like" technologies, such as Grid Computing, Utility Computing and so on.

b. Apply certain theoretical frameworks, such as the Transaction Cost Theory, on the current Cloud Computing market, trying to figure out whether these existing theories are able to deliver a framework to understand the new Cloud Computing paradigm.

c. Conduct a survey to test the prediction power of those theoretical frameworks.

d. Provide latest information about the customers and market of Cloud Computing via this survey, such as the customers' concerns about Cloud Computing services, and the stage of market development etc.

Chapter 2

Term Definitions and Classification

Chapter Outline:

2.1 Introduction

2.2 Cloud Computing

2.2.1 What is Cloud Computing

2.2.2 Comparing with Virtualization:

2.2.3 Comparing with Grid Computing

2.2.4 Comparing with Utility Computing

2.3 Market Participants in the Cloud Computing Business

2.4 Market Structure

2.5 Pricing Models

2.6 Homogeneity of Cloud Computing Services

2.1 Introduction

The software industry has undergone tremendous changes with the introduction of-cloud services. Initially various applications were offered as cloud services in what has become commercially known as the-SaaS (Software as a Service) business model. Nowadays, not only applications but also computational infrastructure such as CPUs (computing power unit) and memory (disk space) are offered in a similar service model (sometimes dubbed-IaaS(Infrastructure as a Service)) by companies such as Amazon, Microsoft, many telecommunication companies and more.

A recent Gartner report provides some insight into the market size worldwide (Gartner, 2014):

- By 2015, 50% of all new application independent software vendors will be pure SaaS providers.
- Through 2015, more than 90% of private Cloud Computing deployments will be for infrastructure as a service.
- By 2015, 50% of large global enterprises will rely on external Cloud Computing services for at least one of their top 10 revenue-generating processes.
- By 2016, all large global enterprises will use some level of public cloud services.
- By 2016, most SaaS contracts will include price escalation limitations and the ability to terminate contracts.
- By 2017, over 50% of large SaaS application providers will offer matching business process services and an integrated platform as a service.
- Through 2017, 5% of all IT job turnover will be fallout from poor risk decisions about the use of public Cloud Computing.
- Through 2017, 80% of large enterprises will restrict their private cloud data center services to less than 20% of their total data center services.
- Through 2020, the most common use of cloud services will be a hybrid model combining on-premises and external cloud services.

The market for cloud services, and in particular IaaS, has a variety of unique features which make it different from other markets. One particular aspect is that the goods themselves (memory and CPU) are homogeneous and fully divisible. Thus, the pricing schemes that could prevail may also be unique to this market.

The main purpose of this thesis is to study the current and future market acceptance of Cloud Computing. To notice is, before Cloud Computing, there are already several technical trends with similar characteristics, like Application Service Provider (ASP), Grid Computing etc. Despite the differences between these technologies, the main focus of academic researchers at that time was on the "technical" topic, such as like load balance, resource allocation etc. But the pure technical maturity (given that is already available) does not necessarily lead to a wide acceptance of a new technology, because there are other forces and mechanism influencing the market development of it: on one hand, the market mechanism could probably solve the resource allocation problems in systems, and on the other hand, a technical trend will be of little use if it cannot gain enough commercial exposure. One of the best ways to find out the market acceptance is asking directly the users and potential users of Cloud Computing services. For this reason, a *survey* about the attitudes of current and potential users toward Cloud Computing was designed as a basis research material for this thesis.
Based on this survey, analyses are done in several aspects including general knowledge about Cloud Computing, expectations and concerns, service homogeneity and usage frequency of the services, preferred market structures and price models in Gaza IT market.

2.2 Cloud Computing

2.2.1 What is Cloud Computing?

Cloud Computing is a new subject at both technological and commercial level, therefore various definitions can be found, focusing on different characteristics of Cloud Computing technology, services, and platform. So the definition of Cloud Computing has been defined differently by different industry experts and researchers:

- According to Vangie Beal -the Managing Editor of Webopedia.com-, the word cloud (also phrased as "the cloud") is used as a metaphor for "the Internet," so the phrase cloud computing means "a type of Internet-based computing," where different services — such as servers, storage and applications — are delivered to an organization's computers and devices through the Internet.

- According to Armbrust et al. "Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services. The services themselves have long been referred to as Software as a Service (SaaS). The datacenter hardware and software is what we will call a Cloud. When a Cloud is made available in a pay-as-you-go manner to the general public, it is called a Public Cloud; the service being sold is Utility Computing. Authors use the term Private Cloud to refer to internal datacenters of a business or other organization, not made available to the general public. Thus, Cloud Computing is the sum of SaaS and Utility Computing, but does not include Private Clouds" (Armbrust et al., 2011).

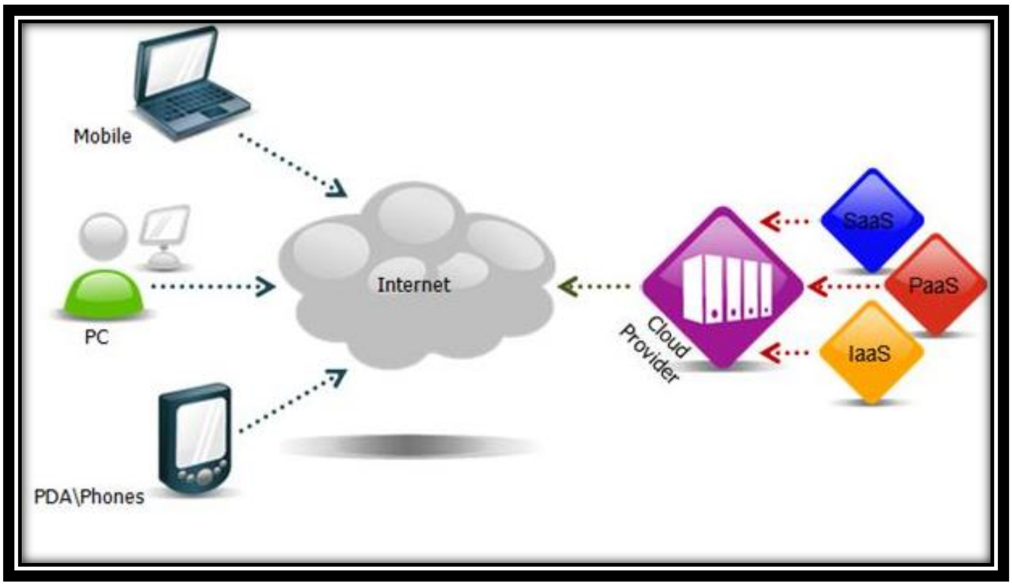

Figure 2.1: Cloud Computing diagram (gethackingsecurity, 2014)

- From a market point of view "Clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically assigned to adjust to a variable load, allowing also for 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 (Service-level agreement) "(Lindner,2009) .

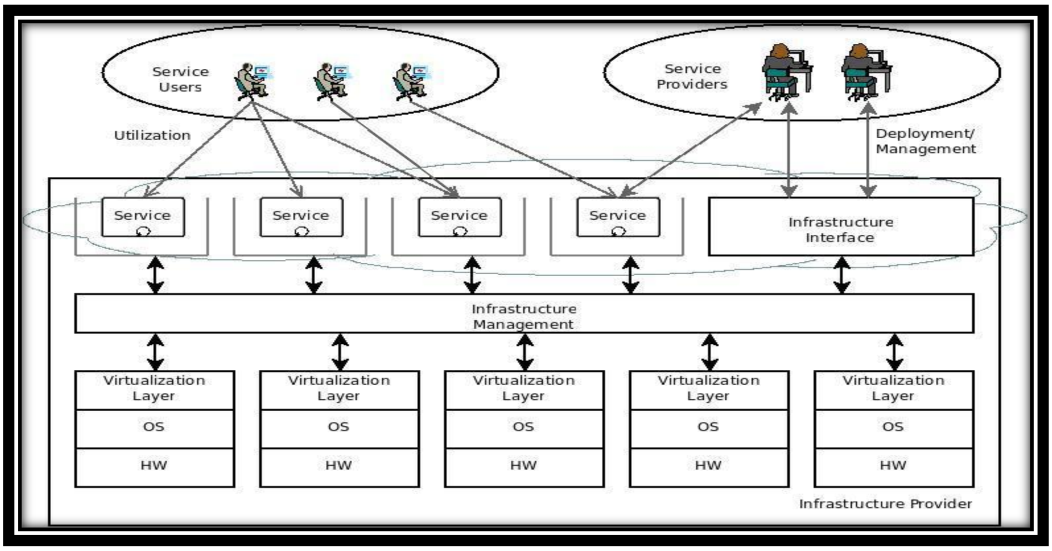

Figure 2.2: Actors in the Service Cloud Market (Lindner, 2009)

According to the official NIST definition, "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. This cloud model is composed of five essential characteristics, three service models, and four deployment models." (Badger et al, 2012).

Table 2.1 Essential Characteristics, Service Models, and Deployment Models of cloud (NIST, 2012)

Essential Characteristics	Service Models	Deployment Models
• On-demand self-service • Broad network access • Resource pooling • Rapid elasticity • Measured Service	• Software as a Service (SaaS) • Platform as a Service (PaaS) • Infrastructure as a Service (IaaS)	• Private cloud • Community cloud • Public cloud • Hybrid cloud

- Other common academic and scholarly definition defines Cloud Computing as "an emerging data interactive paradigm to realize users' data remotely stored in an online cloud server. Cloud services provide great conveniences for the users to enjoy the on-demand cloud applications without considering the local infrastructure limitations. During the data accessing, different users may be in a collaborative relationship, and thus data sharing becomes significant to achieve productive benefits"(Liu et al., 2015).

The term Cloud Computing used in this thesis is defined as*" a parallel and distributed computing environment or service model that enables real-time delivery of products, services and solutions over the Internet or some centralized access points to the clients rather than installed locally on the user's device."*

This thesis represents clearly the customer's point of view rather than technical or architectural requirements. It is not to say that technical and architectural requirements are not important, but what the customers pay most attention to are the benefits they can get from the technology. For example, a real-time delivery of products and services is more important than whether the products and services are provided via P2P network, VPN network or direct via Internet.

Given the scope of this thesis, it is impossible to study all kinds of products and services "in the Cloud", even though the market is still at a very early stage. A detailed review of the current market situation of Cloud Computing and a layered structure of different service providers (SPs) in this market will be given in Chapter 3. In fact, a quite heterogeneous landscape of products and services "in the Cloud" already exists, even for quite a long time: there are services used by normal consumers every day or many times in a day, for example the E-mail services from providers like Yahoo, Google or Microsoft: users do not need to use a specific operation system to get into their mailbox, they do not need to install any specific client software in their local machines to sending or receiving E-mail, and they can log into their E-mail account anytime, anywhere, all they need is a web browser and a Internet connection. The traditional E-mail service is according to this thesis's definition a perfect example of Cloud Computing, but this thesis is giving particular focus on enterprise customers, which traditionally build and own their data center as a property, and run and maintain each server and PC separately. Increasingly, computing addresses collaboration, data sharing, cycle sharing, and other modes of interaction that involve distributed resources. This trend results in an increasing focus on the interconnection of systems both within and across enterprises. The emerging

Cloud Computing can mean a lot for these enterprises because of its potential in cost saving and technological advances (Pike et al, 2010).

Like many other emerging technologies, the concept "Cloud Computing" often leads to confusion about its exact connotation and denotation, because there is no widely accepted framework to define the concept, and this new technology is still associated with many other already existing technologies and concepts. For Cloud Computing, such technologies and concepts include Virtualization, Grid Computing, and Utility Computing. Chapter 2.1.2, 2.1.3 and 2.1.4 provides a detailed comparison of Cloud Computing and these computing concepts.

2.2.2 Comparing with Virtualization:

Virtualization was brought out in 1960 when IBM made a logical partition in their own VM/370 mainframe machines. The idea behind virtualization is to virtualize the underlying physical hardware or software resources either by software or hardware tricks. The virtualized environment is called as VM or Guest and the virtualizing software is referred as virtualization layer or VMM (virtual machine monitor) or hypervisor. Each VM is a logical existence or imitation of underlying physical hardware (Host), and it mimics the real characteristics of host that is capable of running own OS (operating system) (Guest OS).

Virtualization is an abstract concept, and covers the definition of some related to IT resource integration and management. Virtualization refers to through to the user blocking these resources IT resources in physical properties and the boundary of a merger. Specifically, the software and hardware is separate with virtual technology. It separates the software from them in hardware installation. Can be implemented at multiple levels of server architecture virtualization, including storage, server, network, and the application and operating system, realize the effective sharing of resources. For the upper level resource scheduling and load application provide uniform and transparent bottom IT resources platform, and provides the dynamic adjustment and optimization of resource allocation (Liu, 2012).

One of the initial steps toward cloud computing is incorporating virtualization, which is separating the hardware from the software. In the past, transitions of this magnitude meant rewriting code, such as the transition from the mainframe to UNIX.

Fortunately, the transition to VMware does not require the rewrite of code, and this has fueled the speed of the move toward virtualization software. There still will be challenges in this transition but, overall, the consolidation of servers into the virtual world has been fairly rapid with many applications making a seamless transition. The journey to get to cloud computing begins with virtualization with the cloud OS providing infrastructure and application services. The infrastructure services are the ability to virtualize server, storage, and the network, as well as application services that provide availability and security for the applications that are being utilized in the cloud environment. The next step is adding some of the many cloud applications that include how to do charge-backs and other application software. These cloud-like capabilities include billing for usage, the ability to do self-service, and many others. Charging for consumption, even if it is internal, will lead to better management, with the ability to keep track of what services the consumer is utilizing. In addition, with cloud computing, there is the ability to program in more self-service by the end user in order to keep costs down (Kremer, 2013). Virtualization technologies are partition hardware and thus provide flexible and scalable computing platforms. Virtual machine techniques, such as VMware2, and Xen3 offer virtualized IT infrastructures on demand. Virtual network advances, such as Virtual Private Network4 (VPN), support users with a customized network environment to access Cloud resources. Virtualization techniques are the bases of the Cloud Computing since they render flexible and scalable hardware services (Shawish et al, 2014).

The figure bellow shows the ranking of technologies CIO (Chief Information Officer) selected as one of their top five priorities in 2011.

CIO Technologies — Ranking of technologies CIOs selected as one of their top five priorities in 2011.

Ranking	2011	2010	2009	2008
Cloud Computing	1	2	16	*
Virtualization	2	1	3	3
Mobile Technologies	3	6	12	12
IT Management	4	10	*	*
Business intelligence (BI)	5	5	1	1
Networking, voice and data communications	6	4	6	7
Enterprise Applications	7	11	2	2
Collaboration technologies	8	10	5	8
Infrastructure	9	14	7	6
Web 2.0	10	3	15	15

Figure 2.3 Ranking of technologies CIOs (Gartner, 2011)

As it is seen in Figure 2.3 the cloud computing has become the most important technology for operations coming from nowhere in 2008, to rank 16th in 2009, to 2nd in 2010, being 1st in 2011.While virtualization has been considered as important for the last 4 years.

Cloud Computing is not yet the same as virtualization. Firstly, as described before, virtualization was often used to utilize the usage of a single machine rather than to build a combined network; that kind of “single machine virtualization” is not really within the scope of Cloud Computing. Secondly, although virtualization is a useful tool at the operation system (OS) level to provide hardware portability and OS segregation, but virtualization in-and-of-itself does not provide necessary capabilities of Cloud Computing, like scalability, system continuity and certain level of QoS. To deliver the desired usage of Cloud Computing, virtualization technology should be used alongside other components of dynamic IT infrastructure. Compared to virtualization, Cloud Computing is more like a kind of “technology cluster”, which contains more than one distinguishable, but interrelated elements of technology (Rogers, 2013).

Virtualization is certainly one among these elements, but so do distributed technology, load balancing technology, and web services, to name just a few. This kind of bundled innovation package usually leads to greater flexibility in development process and faster adoption in the market.

A good example of how virtualization and Cloud Computing are tightly connected is the Citrix XenDesktop, a desktop virtualization system that centralizes and delivers “desktop as a service” to enterprise users anywhere. This virtualization technology avoids installation of all the different office software on the user’s local machine and provides ubiquitous access to the software they need, and in the meantime, the system update, backup and other maintenance become much easier and more time-efficient. What the XenDesktop delivers, is a typical Cloud Computing service, although the services are not necessarily provided via Internet. Another commonly-used virtualization technology in Cloud Computing is the 3Tera’s Applogic, which can eliminate the binding of software to hardware in a Grid/Cloud Computing system. The Applogic system enables software running in a completely virtualized execution space with virtualized access to storage and networks.

Almost any piece of Linux software can be made into a virtual appliance, which enjoys a great scalability because it consumes no processing resources and only a small amount of storage when it is not running, and the resource used by each appliance in production is only assigned at runtime (3Tera,2010).

2.2.3 Comparing with Grid Computing

Grid Computing is a type of parallel and distributed system that involves the integrated and collaborative use of resources depending on their availability and capability to satisfy the demands of researchers requiring large amount of communication and computation power to execute advanced science and engineering applications. Precedence constrained parallel applications (workflows) are one of the typical application models used in scientific and engineering fields requiring large amount of bandwidth and powerful computational resources (Garg et al,2015).

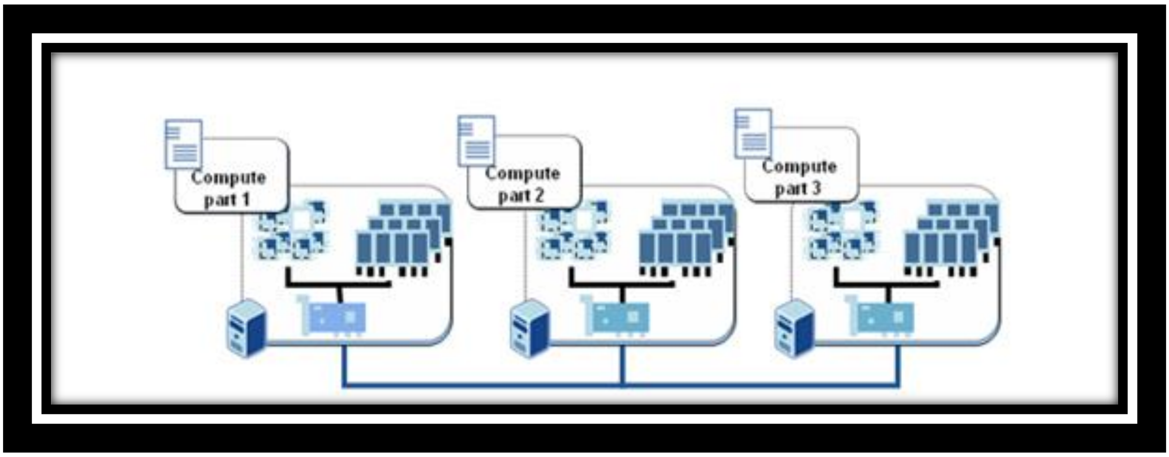

Figure 2.4 Grid architecture (IEEE 2014 projects, 2014)

A well-known example of grid computing in the public domain is the ongoing *SETI* (Search for Extraterrestrial Intelligence) @Home project in which thousands of people are sharing the unused processor cycles of their PCs in the vast search for signs of "rational" signals from outer space. According to John Patrick, IBM's vice-president for Internet strategies, "the next big thing will be grid computing."

A number of corporations, professional groups, university consortiums, and other groups have developed or are developing frameworks and software for managing grid computing projects. The European Community is sponsoring a project for a grid for high-energy physics, earth observation, and biology applications. In the United States, the National Technology Grid is prototyping a computational grid for infrastructure and an access grid for people. Sun Microsystems offers Grid Engine software. Described as a DRM (distributed resource management) tool, Grid Engine allows engineers at companies like Sony and Synopsys to pool the computer cycles on up to 80 workstations at a time (At this scale, grid computing can be seen as a more extreme case of load balancing).

Grid computing appears to be a promising trend for three reasons: (1) its ability to make more cost-effective use of a given amount of computer resources, (2) as a way to solve problems that can't be approached without an enormous amount of computing power, and (3) because it suggests that the resources of many computers can be cooperatively and perhaps synergistically harnessed and managed as a collaboration toward a common objective. In some grid computing systems, the computers may collaborate rather than being directed by one managing computer. One likely area for the use of grid computing will be pervasive computing applications - those in which computers pervade our environment without our necessary awareness.

First, we can compare those from job scheduling of grid computing. Job scheduling is the core value and aim of grid technology, its aim is to use all kinds of resources. It can divide a huge task into a lot of independent and no related sub tasks, and then let every node do the jobs. Even any node fails and doesn’t return result, it doesn’t matter; the whole process will not be affected. Even one node crashes, the task it should be reassigned to other nodes. Just like grid computing, cloud computing will make a huge resource pool through grouping all the resources. But the resources provided by cloud are to complete a special task. For example, a user may apply resource from the resource pool to deploy its application, not submit its task to grid and let grid complete it. From this point, the construction of grid is to complete a specified task, then there will be biology grid, geography grid, national educational grid and also. Cloud computing is designed to meet general application, and there are not grid for a special field (Zhang, 2010).

Second, cloud will have effects in three aspects: the application in internet, product application model and IT product development direction (Kraan and Yuan, 2009).
Of course, this change is not subversion but some new characters that has been added. This advantage is a challenge to grid technology. When grid come it to being, it has some advantages, such as: you can provide unlimited compute power through any

computer, and can get a great deal of information. This environment can help enterprise complete tasks that are very hard before, and use their systems efficiently, to meet the user's requirement and decrease the management cost. Cloud computing extends these advantages. More and more applications will be completed through Internet by cloud computing. Cloud computing will extend the application of hardware and software, and will change the application model of hardware and software. Users can get an application environment or application itself not buying new servers and new software. To the users, the hardware or the software need not at his side or only used by himself, it can be available and virtual resources. And available resources are not limited inside the enterprise, it can be extended hardware and software attained through Internet. The development direction of IT product will be changed to meet the above two conditions.

2.2.4 Comparing with Utility Computing

The idea of computing utility was realized as early as 1966, where it was envisioned that computing networks would mature to reach a point where the idea of 'computer utilities' was made a reality and worked in similar principle to electrical and telephone utilities; able to provision computing service such as computing resources, development platforms or applications to consumers (Leesakul et al, 2014).

A few years later, Leonard Kleinrock, one of the chief scientists of the original Advanced Research Projects Agency Network (ARPANET) project which was the initial form of today's Internet, brought this concept a step further by saying: "As of now, computer networks are still in their infancy. But as they grow up and become more sophisticated, we will probably see the spread of 'computer utilities' which, like present electric and telephone utilities, will service individual homes and offices across the country" (Kleinrock, 2011).

And Utility Computing has defined as following: "Utility Computing has sparked imaginations with visions of Pay-as-You-Go (PAYG) billing, and dynamic resources for years. The concept is simple…businesses subscribe to an utility computing service and pay for the resources they actually use." (3Tera, 2008) And a similar but more concrete definition can be found by M. A. Rappa from the IBM Global Services "Utility Computing is the delivery of infrastructure, applications, and business processes in a security-rich, shared, scalable, and standards-based computer environment over the Internet for a fee. Customers will tap into IT resources - and pay for them – as easily as they now get their electricity or water" (Rapp, 2014). Although the latter definition hasn't literally mentioned "Pay-as-You-Go" (PAYG) model, but the analogy between Utility Computing and electricity or water indicated clearly the inherent price model of Utility Computing.

The vision of Internet and especially of the computing utility mentioned before, based on the service provisioning model (like the electric and telephone utilities), anticipates the massive transformation of the entire computing industry in the 21th century whereby computing services will be readily available in today's society (Buyya et al, 2011).

Here we see a major similarity of the concept Utility Computing and Grid Computing: computing service users need to pay providers only when they access computing services, and they no longer need to invest heavily or encounter difficulties in building and maintaining complex IT infrastructure. Cloud Computing shares these features too, but Cloud Computing is not necessarily built on an entire "Pay-As-You-Go" basis, and migration cost as well as other problems of Cloud Computing services do not necessarily lead to an easily built IT infrastructure. In this thesis, Utility Computing will be seen as part of the whole Cloud Computing concept. For example, some services provided by Amazon AWS, the current leading Cloud Computing SP, can be regarded as typical "utility-like" services. Cloud Computing is a broader concept because it is not just about the basic resources and infrastructure, but about the application design, deployment and operation too.

2.3 Market Participants in the Cloud Computing Business

In recent years there has been an exponential growth in the number of vendors offering cloud services with a corresponding increase in the number of enterprises looking to consume them. Gartner predicts that by 2016, cloud computing services will form the bulk of new IT spending (Gartner, 2014).

In this thesis, We define main participants in the Cloud Computing business as either *service providers* (SPs) , *service buyers/users* , *service broker* or *auctioneer*.

The ***Cloud service providers*** provide Cloud services like computational power, data storage, and software or computer networks. The ***users*** have applications or require different services provided by Cloud resource providers. Each user has a ***broker*** who manages and generates eContract from eContract generator that contains user requirements, QoS policy and price value for the set of services the user agrees to pay in the auction and hands payments to Cloud providers.

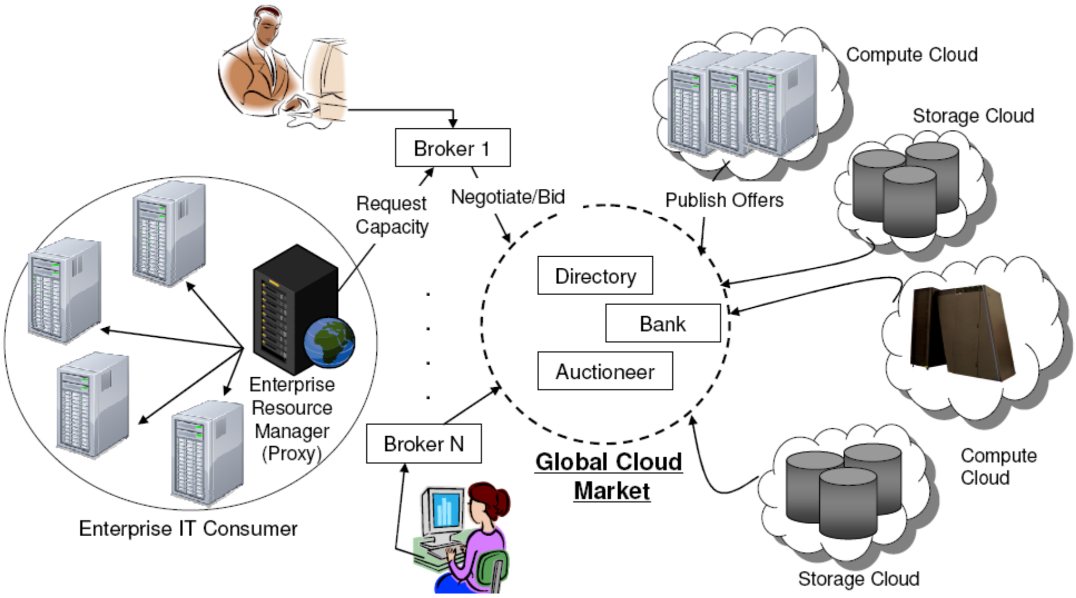

Figure 2.5 Global Cloud exchange and market infrastructure for trading services. (Bai et al, 2010)

A SP in the market is usually responsible for price setting, admission control and resource management. Service buyers/users are their counterparts, and as defined, an organization can be a SP and a service buyer at the same time. Another common type of market participants is the *service broker*. Like other markets, Cloud Computing markets also need *intermediates* (brokers) to create and maintain relationships with multiple cloud service providers. It acts as a liaison between cloud services customers and cloud service providers, selecting the best provider for each customer and monitoring the services.

In the definition of this thesis, the role of market broker is mainly covered by *providers of platforms* for Cloud Computing resource exchange, including raw computing power and applications. The responsibility of an auctioneer includes setting the rules of the auction and conducting the combinatorial auction.

2.4 Market Structure

In terms of market structure of Cloud Computing, this thesis focuses on the forms of transaction, i.e. how transactions of Cloud Computing services are coordinated. Typical forms of market coordination include:

- *The short-term contract*, where service users can buy the desirable service any time they want, from an open and ubiquitous market, without or almost without any long-term commitment to the SPs. This indicates the flexibility by decision-making of both sites as well as the instability of the service contracts.

- *The in-house transaction,* which means the buyers prefer not only to receive the services, but also to own the whole products and infrastructure, therefore gain the whole control of the service activity.

- *The long-term contract*, which is a mixture form between short-term contract and in-house transaction. The long-term contracts are usually based on a certain framework between the SP and the service buyer, and provide the buyer a mixture of standard service and specialized facility. The long-term contracts link sellers and buyers for a long period into a bilateral monopoly in form of a large-scale partnership (Neuhoff, 2010), which can last as long as many years, and during which the both sides have strictly defined rights and obligations.

A common example of short-term contract is staying in a hotel: the buyers can choose any hotel and stay as long as they want, for one day or a month. There are some terms and conditions between the guest and the hotel, like room cleaning service will be provided every day from the hotel, and the guest should pay for anything he damaged, but the guest does not have any long-term commitment to the hotel, i.e. he can move out of the hotel at any time and simply stop the service. By contrary, an “in-house” solution will be building or buying a property, like a house or an apartment. In that case, one pays the whole construction cost of the property, i.e. “buying the product”; instead of paying for each night he stays in the house. A third way of finding a place to stay will be renting a house or an apartment, which is regarded as a typical example of “long-term contract” here.

2.5 Pricing Models

The Pricing mechanism decides how service requests are charged. The price model is important because pricing is usually one of the biggest influencing factors for a business decision. Since Clouds are heterogeneous, elastic and scalable, large system are too complex to be managed centrally. In cloud computing, the complexity of resources distribution causes that resource owner may take different pricing strategies. So there are different methods of pricing resources (Li et al., 2012).

Since cloud services are consumed similar to utility services such as electricity or water, most providers have applied usage-based pricing with services charged by the hour or minute, and user payments are tied to actual usage. Users, however, have shown concern, since it is difficult to calculate total cost.

For the SPs, an inappropriate price model could either lead to excessive reluctance of potential users to migrate and update to new services, or alternatively, to excess demand that they cannot fulfill profitably or scale to meet reliably. Either scenario could be substantially damaging for the development of Cloud Computing.

This thesis derives the "*purchasing cost*" (i.e. not the transaction cost) of using Cloud Computing services directly from those price models. There are many different price models in the business world, and so far, a detailed comparison of different price models from a market's view was not been drawn. Nonetheless, it may become a critical influencing factor in the consumer's decisions about whether and how they want to use Cloud Computing services, because one of the most discussed feature of Cloud Computing is that the users do not need to install the software or applications in every local machines and can use the software as a service, the so-called SaaS model.

Naturally, in such business model, users can be charged based on their actual usage of resources, which is described as the "Pay-as-You-Go" (PAYG) price model. Interestingly, not every SP in the market chooses the PAYG model by now; instead of that, the traditional Flat Rate model, as well as a Mixture model, which combines certain monthly or annually basic charge (Flat Rate) with a PAYG price schedule (for usage surpassing certain amount) are still very popular. This phenomenon leads to the discussion in this thesis about what are the influencing factors in choosing different price models for different Cloud Computing services. A comprehensive comparison of all existing price models is beyond the scope of a master thesis. Therefore, the following price models are chosen as researching objects for this thesis, simply because they are by now the most popular models for existing Cloud Computing services in the markets:

- *PAYG model*: also known as “usage-based price model”, by which the users are charged according to their actual usage of resources. PAYG model provides the business with a more accurate picture of usage; this enables the business hold itself accountable when actual consumption does not match the originally planned usage. Additionally, this information facilitates planning for future consumption; the business can revise up or down future resource needs. Cloud Computing services must change its pricing models and billing strategy to make expenditures more predictable so that the business can budget accordingly. IT must be thorough, including all the elements that make up the price so that the comparison with providers is based on equal pricing models. Pricing can include other aspects that differentiate the service to the business, (e.g., SLA or trust), which may also be the key objectives to the business. Accurate pricing models also help Cloud Computing services plan for demand and supply. Accurate resource planning is the key for Cloud Computing services to ensure sufficient capacity for the projected demand. If a resource is scarce, prices can be increased to drive demand down (Galhardi et al. ,2011).

  Due to the technical obstacles of billing and accounting, PAYG model: (hardware as well as software) was often discussed, but rarely implemented until recently. Another problem about the PAYG model is the matching between price and costs: the software and computing resources are often regarded as typical information goods, for which the traditional marginal cost pricing method cannot be applied, since the marginal cost of information goods is zero. However, researchers like K-W. Huang and A. Sandararajan argued that the On-Demand computing services are not really information goods, because their provision involves “non-trivial variable costs that relate to customer service, billing and monitoring” (Huang, 2010).

- *Flat Rate model*: users are charged a *fixed* amount per time unit, irrespective of actual usage of resources or applications. As the simplest and most convenient price model for both sides of market participants, Flat Rate model requires no accurate measurement for billing and accounting, but provides no incentive of optimizing the resource allocation, because the buyers are insensitive to the actual cost of their service/resource requests. The problem is that flat rate includes no price variation information.

- *Mixture model*: a mixture of PAYG & Flat Rate models. Users are charged a certain fee for resource usage within a certain period, and under a certain cap e.g. 20$ per month for 500 GB online storage space. This fee is fixed no matter the 500 GB storage space is actually used or not. Usage beyond this amount will be charged based on the actual usage then.

2.6 Homogeneity of Cloud Computing Services

One of the many, many splits within the cloud camp is between homogeneous and heterogeneous clouds. Simply put, a homogeneous cloud is one where the entire software stack, from the hypervisor (or remote cloud provider), through various intermediate management layers, all the way to the end-user portal, is provided by one vendor. A heterogeneous cloud, on the other hand, integrates components by many different vendors, either at different levels (a management tool from one vendor driving a hypervisor from another) or even at the same level (multiple different hypervisors, all driven by the same management tool) (bmc.com, 2015).

The argument for homogeneous environments is that because everything comes pre-integrated they are easier to set up, and if something goes wrong there is only one responsible party – “one neck to wring”, as the saying has it. On the other hand, by giving so much power to one vendor, users place themselves at the mercy of that vendor’s commercial and technical strategy

Heterogeneous architectures attempt to bypass this lock-in effect by introducing components from many different vendors and allocating their use according to a common set of strategies. At some point, however, a single management component will need to be introduced. Defenders of homogeneous approaches will counter charges of lock-in by pointing out that this convergence on a single management layer just moves the lock-in further up the stack, but still leaves users at the mercy of the provider of that one component.

The false equivalence between platform lock-in and supposed management lock-in is a neat rhetorical trick, but does not really hold up. Management vendors need to keep up with the development pace of the managed platforms, or risk falling behind the competition from other heterogeneous management vendors. Any attempt at predatory business practices will be nipped in the bud for the same reason (bmc.com, 2015)..

Chapter 3
Theoretical groundwork and frameworks

Chapter Outline:

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3.1.2 Service provider (including Service intermediate)
3.1.2.1 Pyramid model of Cloud Computing market
3.1.2.2 Service providers in Cloud Computing market:
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3.2.1.1 General
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3.2.2 Theoretical groundwork and frameworks for price
3.2.2.1 General
3.2.2.2 PAYG, Flat Rate and Mixture Model
3.2.2.3 Service homogeneity and price model
3.2.2.4 Usage frequency and Price model

3.1 Current Market Overview

3.1.1Genral:

Cloud computing is an affordable option which creates efficiency and effectiveness, reduces costs involving electricity, bandwidth, operations and hardware and does not require functional staff, in-house expertise, space, power and infrastructure. Furthermore, customers just use and are charged for computing resources they need since services are delivered on-demand similar to utility providers.

Due to its many benefits, some of which have been outlined, cloud services are increasingly being embraced by and/or recommended especially for small businesses.

Gartner report provides some insight which says the cloud computing services market was valued at USD 79.60 billion for the year 2011 grows steeply of 23.21% and reach a market size of USD 148.9 billion by year 2014. However, with rising competition and saturation and technology limitations, and grow at a CAGR of 8.39% and reach USD 205.48 USD by year 2018.

Facing the ever larger demand of Cloud Computing services, various analysis institutions have mostly made bullish predictions in the market growth of Cloud Computing in the near future. According to IHS Technology the global business spending for infrastructure and services related to the cloud will reach an estimated $174.2 billion 2014, up a hefty 20 percent from $145.2 billion in 2013. And in a sign of the market’s vigor, spending will enjoy continued strong growth during the next few years as enterprises everywhere race to come up with their own cloud-storage solutions. By 2017, enterprise spending on the cloud will amount to a projected $235.1 billion, triple the $78.2 billion in 2011, as shown in the figure.

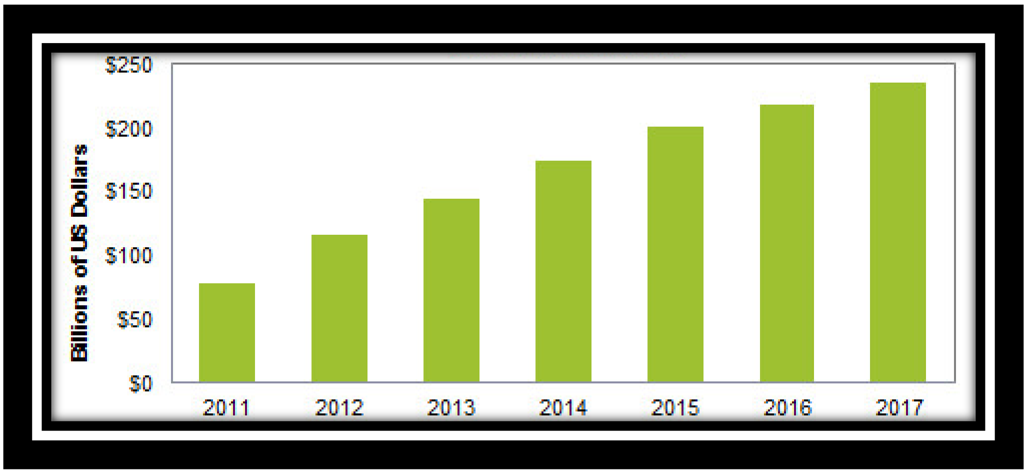

Figure 3.1 Cloud- Related Spending by Businesses to Triple from 2011 to 2017 (IHS, 2014)

With the cloud touching nearly every consumer and enterprise around the globe, spending for cloud-related storage, servers, applications and content will be dedicated toward building a framework that is rapidly scalable, highly dynamic, available on-demand and requiring minimal management. As a leading provider of Cloud Computing service, Amazon Web Services public cloud business as well as advertising services and co-branded credit card agreements — in the second quarter of 2014 came in at 38.39 percent, based on $1.16 billion in revenue.

3.1.2 Service Provider (including Service Intermediate)

3.1.2.1 Pyramid Model of Cloud Computing Market

Cloud computing services as a whole are certainly not homogeneous, and the market for Cloud Computing services is not consisting of all similar providers, either. In fact, services provided in this market are quite different regarding their inherent characteristics as well as their business models. The figure below demonstrates a layered structure of current Cloud Computing market (Blau, 2011) and (Youseff et al., 2008).

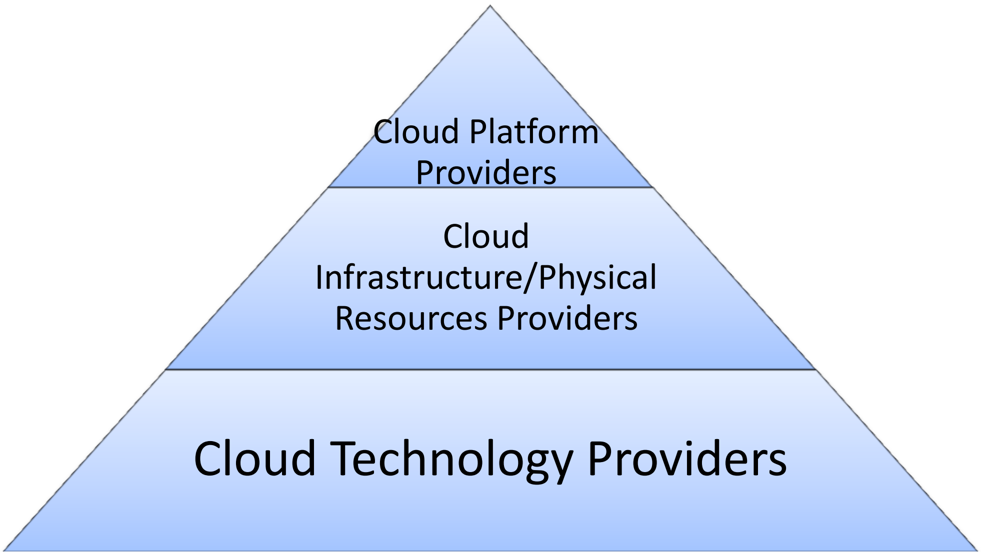

Figure 3.2 “Cloud Pyramid”: Layered Structure of Cloud Computing Services

a. ***Cloud Technology Providers***:

They are basically the “Cloud enablers" because it refer to organizations (typically vendors) who are not cloud providers per se, but make available technology, such as cloud ware, that enables cloud computing. Vendor that provides technology or service that enables a client or other vendor to take advantage of cloud computing.

The Technology Providers on the current market can be divided into two types:

a) Companies developing and implementing Cloud Computing technology by themselves as Amazon, by 2005, Amazon had spent over a decade and millions of dollars to design and implement a whole new, idiosyncratic structure for its ecosystem of Cloud Computing services. Amazon launched Amazon Web Services (AWS) so that other organizations could benefit from Amazon's experience and investment in running a large-scale distributed, transactional IT infrastructure. AWS has been operating since 2006, and today serves hundreds of thousands of customers worldwide. Today Amazon.com runs a global web platform serving millions of customers and managing billions of dollars' worth of commerce every year.

b) Companies focusing purely on technology and delivering the technology to other Cloud SPs as 3tera which is among the pioneers in the cloud computing space, having launched its AppLogic system in February, 2006. Cloud computing is the set of technologies and business practices that enable companies of all sizes to build, deploy, monitor and scale applications using resources accessed over the internet. Web 2.0, SaaS, Enterprise and government users are adopting cloud computing because it eliminates capital investment in hardware and facilities as well as reduces operations labor.

b. Cloud Infrastructure/Physical Resources Providers:

Providers of *Cloud Infrastructure* provide the consumer provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls). (Badger et al, 2012).

The physical resources in Cloud Computing market can be categorized into three categories: a) Computational resources, which are commonly calculated in CPU hours. Typical examples are the Amazon EC2 and Google App Engine; b) Data storage; and c) Communication (Youseff et al, 2008). Among all Cloud Computing services, providing data storage service is relatively easier compared to others, because the physical storage devices are already commodities and the virtualization technology for storage system is already mature. Therefore, the number of mid-sized providers of Cloud storage services is growing fast. Typical examples include Areti, Enki, Terremark etc., as well as some traditional data storage/ data center providers like EMC, AT&T etc.

c. Cloud Platform Providers:

Platform Provider offers computing resources in form of VMs, which have various resource capacities with corresponding charges. (Qiao et al., 2012) These resource capacities typically are including operating system, programming language execution environment, database, and web server. Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers.There are basically two types of Cloud platforms:

a) Platform as a software environment for developing, testing, deploying and running Cloud Computing applications. A known example of this type is Google's App Engine, which provides developers a Phyton runtime environment and specified APIs to develop applications for Google's cloud environment. Another example is Salesforce's AppExchange platform5 that allows developers to extend the Salesforce CRM solution or even develop entire new applications that runs on their cloud environment.

b) Platform for raw computer resources exchange, A known example of this type is the Ebay for computer resources, can only be built in an environment where exchange of raw computer resources is already a common business, and the widely expected standards for the exchange already exist. As these conditions are not yet reached in the market, the only currently available platform for computer resource exchange is the Zimory Marketplace from Zimory GmbH, a spin-off of Deutsche Telekom Laboratories.

d. Cloud Application Providers:

The cloud application providers are the most visible providers to the end customer. The application layer usually accessed through web-portals and thus builds the front-end, the user interacts with when using cloud services. A Service in the application layer may consist of a mesh of various other cloud services, but appears as a single service to the end-customer. Therefore it is the most complex, but also indispensable part of a whole Cloud Computing structure. Examples for applications in this layer are numerous, but the most prominent might be Salesforce's Customer Relationships Management (CRM) system2 or Google's Apps, which include word-processing, spreadsheet and calendaring.

Cloud applications can be categorized into:

a) *elementary applications*
b) *complex applications*

The difference between elementary and complex applications is mainly characterized by the homogeneity of applications rather than the complexity of their functions. The reason is: homogeneous applications are more like commodities; hence their economic characters share more similarity with the basic services in the Cloud Computing structure, i.e. providing the raw computer resources. And as will be discussed in more details in Chapter 3.2.1 and Chapter 3.2.2, the main purpose of this thesis is to examine the possible connection between service homogeneity, market structure, and price model for Cloud Computing services. Rather than to define which applications are elementary or complex, this thesis will make classifications directly based on the results from the customer survey, which will be presented in Chapter 5.

3.1.2.2 Service Providers in Cloud Computing Market:

Though the actual history of cloud computing is not that old (the first business and consumer cloud computing services websites – salesforce.com and Google, were launched in 1999), its story is tied directly to the development of the Internet and business technology, since cloud computing is the solution to the problem of how the Internet can help improve business technology.

Amazon.com introduced Amazon Web Services in 2002. This gave users the ability to store data and put a gigantic number of humans to work on very small tasks (such as Mechanical Turk), amongst other services. Facebook was founded in 2004, revolutionizing the way users communicate and the way they store their own data (their photos and video), inadvertently making the cloud a personal service.

In 2006, Amazon expanded its cloud services. First was its Elastic Compute cloud (EC2), which allowed people to access computers and run their own applications on them, all on the cloud. Then they brought out Simple Storage Service (S3). This introduced the pay-as-you-go model to both users and the industry as a whole, and it has basically become standard practice now.

The PaaS (platform as a service) let companies' developers build, store and run all of the apps and websites they needed to run their business in the cloud. Google Apps launched in 2009, allowing people to create and store documents entirely in the cloud.

Most recently, cloud computing companies have been thinking about how they can make their products even more integrated. In 2010 Salesforce.com introduced the cloud-based database at Database.com for developers, marking the development of could computing services that can be used on any device, run on any platform and written in any programming language.

On March 1, 2011, IBM announced the IBM SmartCloud framework to support Smarter Planet.[22] Among the various components of the Smarter Computing foundation, cloud computing is a critical piece.

On June 7, 2012, Oracle announced the Oracle Cloud. While aspects of the Oracle Cloud are still in development, this cloud offering is posed to be the first to provide users with access to an integrated set of IT solutions, including the Applications (SaaS), Platform (PaaS), and Infrastructure (IaaS) layers.

In 2013, Akamia has a network of over 100,000 servers deployed in more than 90 countries. These servers reside in more than 1,000 of the world's networks gathering real time information about traffic, congestion, and trouble spots. Each Akamai server is equipped with proprietary software that uses complex algorithms to process requests from nearby users, and then serve the requested content.

February 2014, RightScale conducted its third annual State of the Cloud Survey, asking 1,068 technical professionals across a broad cross-section of organizations about their adoption of cloud computing. Twenty-four percent of respondents came from larger enterprises, representing organizations with more than 1,000 employees. This year's survey on cloud computing trends found that public cloud adoption is nearing 90 percent on the journey to hybrid cloud as enterprises seek to expand their portfolio of cloud services.

But as more and more companies see the potential of the Cloud Computing markets, both traditional IT companies like IBM, and new technical startups begin to expand in this new market, and Cloud Computing services are becoming more important than just a way to cover expenditures caused by under-utilized infrastructure.

Below is a list of the 38 most active SPs in current Cloud Computing market. Although the market is still at its early age, listing all the SPs in the market will be far beyond the scope of a master thesis. Therefore, this list of selected SPs is mainly based on the company's influence, the kinds of services they provide.

Table 3.1 the 38 most active SPs in current Cloud Computing market.

No.	Companies	**Active/**	**A/P/R**	No.	Companies	Active	A/P/R/
1	10Gen	B	**P, A**	20	Eucalyptus	A	T
2	37signals	A	**A**	21	FlexiScale	A	R
3	3Tera	A	**R, T**	22	Fortress ITX	A	R
4	Adobe	B	**A**	23	Gh.o.st	B	A
5	Akamai	A	**A, T**	24	GoGrid/	B	R
6	Amazon		**R**	25	Google	A	R, P
7	Aptana	B	**R, P**	26	IBM	A	A, T
8	Areti	A	**R**	27	Joyent	A	R, A
9	AT&T	A	**R**	28	Microsoft	A	R, A, P
10	Cassatt	A	**A,**	29	Mosso	A	P
11	Cisco	A	**A, T,**	30	NetSuite	A	A
12	Citrix (inc.	A	**A, T**	31	Project	B	P
13	Cloudwork	A	**R, A**	32	QuickBase	A	P, A
14	cohesiveFT	A	**P, T**	33	Right Scale	A	A, T
15	Dell	A	**R, T**	34	Salesforce	A	P, A
16	Elastra	A	**R, P,**	35	SUN	A	R, A
17	EMC (inc.	A	**R, T,**	36	Terremark	A	R
18	Enki	A	**R**	37	Workday	A	A
19	Enomaly	B	**T**	38	Zoho	A	P, A

The above table indicates following facts:

1. *The Cloud computing market is expanding quickly*: while many projects or startups are still in beta or preview release, more and more companies, especially the "traditional players" in IT services like Dell, IBM, Microsoft and SUN are providing formal release of their Cloud Computing services. Just during the past two months from end 2014 to Feb. 2015, Amazon AWS has added new services (Amazon WorkMail) into their ecosystem of Cloud Computing and Amazon EC2

Container Service is now available in the US West (Oregon) region. Many other companies in the Cloud Computing market have experienced the same or even higher speed of expansion.

2. *Many companies are trying to open up more than one market segment*: in the early stage of market development, a mature market structure is not yet available, and companies are often forced to provide "*bundle*" of resources and services, because there are no other partners in the market who can provide those resources or services for them. So as Google or Salesforce wanted to build a platform for sale and exchange of On-Demand software, they had to use their own computing resources to deploy them; and as IBM or EMC wanted to sell their new Cloud Computing applications to attract more data center customers, it must develop their own technology to support them. Besides, companies are also not sure about how each market segment will develop, and which segment is the potential best fit for them. An example of companies changing their service catalog is the *Network.com* from SUN. When this service was announced back to 2004, it was highlighted by SUN as a Utility Computing service for enterprise customers, but after being proofed unattractive for the massive business use, SUN is conducting a transition of the Network.com now, preparing to provide a more mature service combining the basic computing resources with useful applications. This example shows that at the infancy stage of a technical trend, the best strategy for the SPs in the market, especially the big ones with more resources, may be "try-and-fail": opening up more market segments parallel, and then focusing on those with the most success.

3. *Traditional IT service companies and startups are following different routes of development*: companies like Dell, IBM and EMC are trying to provide Cloud Computing services as "add-on" or additional service. This is because they regard Cloud Computing as a technology in its early age, and thus are not eager to put it into mass use; in the meantime, this also helps them to introduce Cloud Computing services to their existing, but more innovative customers, even makes the research and test of services easier by targeting a small scope of "pioneer" customers. By contrast, startups are usually focusing more on the most innovative services, like Utility Computing and SaaS. This is partly because the traditional

players in these fields, like Seagate, the leading storage device provider, or SAP, the leading ERP system provider, are not yet very active in putting their products or services “into Cloud”

4. *Open source projects are playing an important role in the Cloud Computing market*: there is no wonder that Cloud Computing services are welcomed by various open source projects, since they have the potential in lowering costs, especially initial investments of the projects, and surpassing the barriers for software development too. In the meantime, open source projects help to enrich the services provided in the Cloud Computing market or a Cloud Computing ecosystem, e.g. the Eucalyptus, imitates the experience of using Amazon EC2, but give the users the possibility of choosing computing resources by themselves, which means they can run the Cloud Computing service internally too.

3.1.3 Service Buyer

I think many of the discussions of cloud computing focus too much on the implementation side and not enough on who the potential users are and what will be their needs. Many users don’t have or need a very precise definition of “cloud computing.” Indeed, I think that for many people it simply matters whether their applications and data live on their machines or devices, or if they are run through a browser or reside somewhere out on the network, respectively. Here are some possible users for cloud computing.

a. A user of a virtualized desktop on a thin or fat client: This type of user could employ software such as Virtual Bridges VERDE server to run desktop applications on a powerful server somewhere, but have the screen output delivered down to a local device such as a netbook, laptop, or desktop machine. While today many people speak of virtualized Linux desktops, we can imagine a future where many organizations run native local Linux desktops and then virtualize down from the cloud a Windows desktop for only light and occasional use of applications that have not yet been ported or replaced.

b. A non-technical end user who accesses services through a browser or via applications such as disk backup to remote storage: This is a very broad view of how a user might use the "cloud." Here he or she would have a sense that instead of running a local application, software like a word processor or CRM front-end is used in a browser like Firefox. These cloud-based applications are helping to reduce users' dependencies on working on any particular operating system, and therefore allowing more and more use of Linux and Mac/OS X in businesses and organizations. On the other hand, traditional desktops can be extended to use the cloud for remote storage. For example, I use Jungle Disk to automatically backup certain folders and files nightly to Amazon S3. (They also support Rackspace Cloud Files, which helps make my point.)

c. *A "cloud choreographer" who strings together cloud-based services to implement business processes:* Here I'm borrowing the notion of choreography from web services or SOA (Service Oriented Architecture). The idea is that new applications are constructed from program logic and across-the-network calls into cloud services. It starts to get interesting when more than one cloud is used, and therefore further emphasizes the need for open standards and cloud interoperability. Security issues are always important, but privacy ones strongly enter into this scenario because of the possibility of improperly sharing information across services and clouds. This case most clearly shows where SaaS might be subsumed into the general notion of cloud computing.

d. *A service provider who needs to handle peak load demand:* A service provider wants to have the right level of software and hardware resources to provide an acceptable quality of service to his or her customers. Cloud computing can help deliver this by allowing the service provider to purchase and configure datacenter resources for average use, and then use processors or storage from the cloud to handle spikes.

e. *A developer who employs dynamic resource allocation in clouds to speed application or solution creation:* While a software developer might spend a lot of time thinking and working in an integrated development environment where the need for computer resources is small, other activities such as compiling, linking, and testing may be very computer resource intensive. For those times, a private or public cloud could be used so that local capital expense for servers can be minimized. It's very important to observe and measure how and when developers use computing resources before contracting for cloud services. For example, does an entire workgroup of developers need the resources at the same time, or do the individuals need fairly randomly? In international efforts such as computer animations, can one shift of developers use resources no longer needed by others in a different time zone?

f. *An IT system administrator who does not build clouds but deploys onto them, probably in addition to traditional managed systems:* This is the lowest ("closest to the metal") level of user who uses clouds but does not build them. Someone else configures the datacenter but it is this admin's job to decide how to best deploy applications onto either traditional dedicated servers or shared cloud servers. He or she would need to understand the resource needs of the applications, as well as the security parameters.

Each customer segment will move to the cloud in different ways. While Transformational customers have the highest adoption rates today, Heterogeneous customers will nearly match them within three years. Safety-conscious customers will adopt more slowly, but at twice the size, this segment will cause a significant increase in spending growth. For Price-conscious customers, adoption will nearly quadruple as prices come down. Finally, Slow and Steady customers, who have barely begun to experiment, will see meaningful adoption over the next three years. The segment represents a sizable opportunity.

As mentioned in Chapter 2.1.1, this thesis is focusing on the enterprise customers rather than the individuals consumers. Currently, the customers of Cloud Computing are mainly small companies and startups.

3.2 Research Status

3.2.1 Theoretical Groundwork and Frameworks for Market Structure

3.2.1.1 General

As mentioned in Chapter 2.3, *transaction forms* of Cloud Computing services are categorized into three different types in this thesis: the short-term contract, the long-term contract and the in-house transaction. The short-term contracts of Cloud Computing services are also regarded as "Public Cloud", because they can be directly gained from the open market; the in-house transactions are regarded as "Private Cloud", because they are usually not publicly accessible, and in between of them, the long-term contracts can be seen as a hybrid model sharing characteristics from both sides. These different kinds of market coordination forms are assigned different names from various researchers and many others described the short-term contracts as "markets", in-house transaction as "hierarchies" and the long-term contracts between them as "networks".

In this thesis, we also use the term "*market structure*" to describe these transaction forms.

3.2.1.2 Public Cloud, Private Cloud, and Hybrid model

There are three different models for using cloud computing. These deployment models may have different derivatives which may address different specific needs or situations (Amrhein et al., 2010, CSA, 2009). The basic deployment models are public cloud, private cloud, community cloud, and hybrid cloud (CSA, 2009, Dustin Amrhein et al., 2010, Grance, 2010).

a. **Public Cloud**: The first model is public cloud witch allowing users to access through the web browser interface. Users such as municipal utility bill instead use time fee to pay. This feature helps to the operating costs of IT declined, however, in terms of security in public clouds compared to the other models are more vulnerable to attacks and abuse are one of the ways to prevent incidents of security controls on both the client and a provider of cloud. It should be noted that both sides need to identify the scope and authority with their operational constraints (Jadeja et al., 2012).

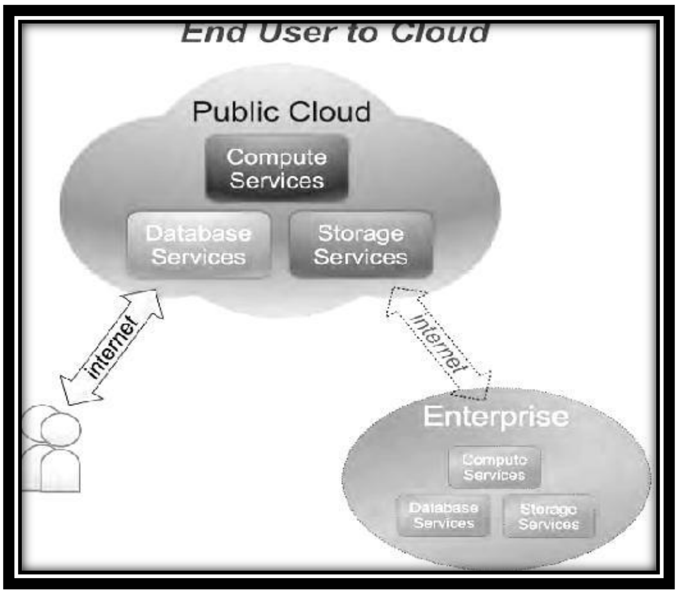

Figure 3.4: Public Cloud (Amrhein et al., 2010).

b. **Private Cloud**: The second model is the private cloud. A private cloud data center operation within an organization is carried out. The advantage to manage the maintenance, security, update, improve and control the development and application have been considered. Resources and programs are managed by the organization itself. This type of cloud security is improved because only members of the organization are allowed to use cloud services (Jadeja et al., 2012). This type of cloud for organizations with large area and can be managed by a third party.

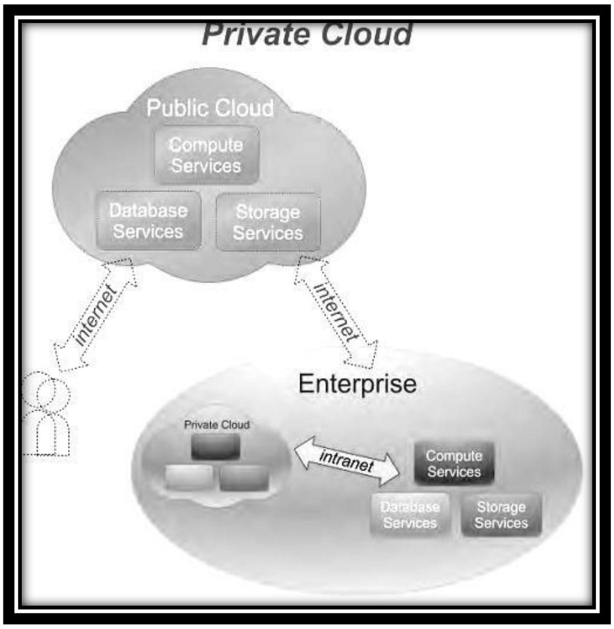

Figure 3.5: Private Cloud (Amrhein et al., 2010)

c. **Hybrid Cloud:** The third model is a hybrid cloud is a combination of public and private cloud group. In this model, a private cloud is connected to one or more external cloud service. The main activities that lead to a competitive advantage for them to be done by the private cloud side, whereas the activities of other clouds (public or associative) are complete (Jeyd et al., 2014).

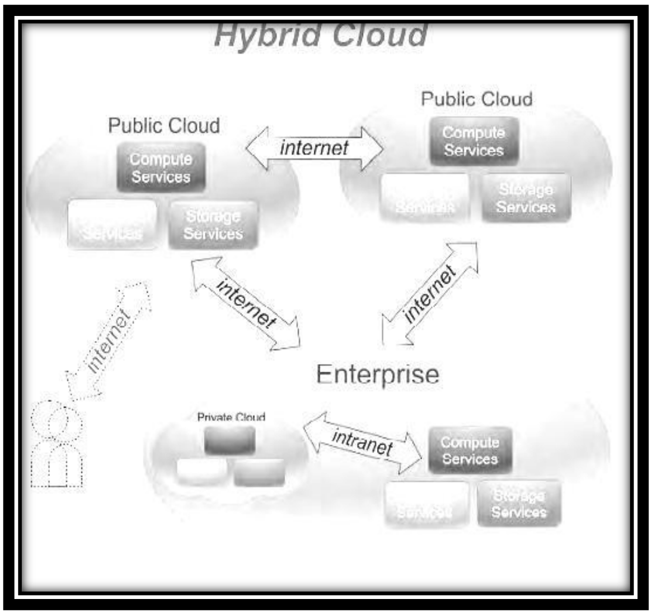

Figure 3.6: Hybrid Cloud (Amrhein et al., 2010)

The Public Cloud, such as Amazon EC2, Google App Engine, or Zimory.com, is the broadly accepted form of Cloud Computing, and is usually associated with other terms like Software-as-a-Service (SaaS) and Utility Computing. On the contrary, the term "Private Cloud" can be controversial for people believing that a Cloud Computing service must be delivered via *Internet*, which is not necessarily the case. The Internet is the largest, truly global-scale "Cloud", but besides that, plenty of smaller "Cloud" can be built at organizational or enterprise level, which enable the sharing of computer resources for members of different projects or departments within the organization. Most cloud vendors let you come and go as you please. The minimum order through XCalibre's FlexiScale cloud, for example, is one hour, with no sign-up fee. Amazon EC2's policy is equally as lenient. This makes clouds an ideal place to prototype a new service, conduct test and development, or run a limited-time campaign without IT resource commitments (Staten,2008). While the description of services provided by FlexiScale and Amazon EC2 is true, there is also a noticeable number of SPs, such as IBM and Dell, which are providing more complex Cloud Computing services in the market. These services can only be delivered in a *customized* manner and therefore bundled with long-term contracts. Back to the definition of Cloud Computing in Chapter 2.1.1, it is clear that this thesis will not restrict Cloud Computing services in a short-term framework.

The following table gives a brief comparison for the three market structures:

Table 3.2 Comparison of Public Cloud, Private Cloud and Hybrid Model

	Public Cloud	**Hybrid Model**	**Private Cloud**
Deployment location	External	External	Internal
Service delivery via	Internet	Internet	Internal networks
Initial investment	Low	Medium	High
Ex-ante contracting	No	Yes	Yes
Long-term commitment	No	Yes	Yes
SLA guarantees	complex & hard to achieve	Easy to achieve	Easy to achieve
Service provider (SP)	Startups	Traditional SPs	Both

Choosing between Public or Private Cloud services can be important for users in terms of the different models of service delivery, contracting and pricing.

A report from showed that one of the biggest advantages of the Private Cloud over Public Cloud is that users can directly connect to the Cloud services via a VPN network rather than Internet, which greatly increase the speed and stability of applications.

As for this thesis, the focus of study is on the cost side, therefore, it is interesting to examine whether the Transaction Cost Theory can provide a useful framework to explain the constellation of those different market structures, i.e. Public Cloud, Private Cloud and Hybrid Model. The short-term contracts are adopted by the majority of SPs; where we have less clarity is, whether the short-term contracts are still the dominant transaction form if ranked by *contract volume* instead of the number of SPs, because the traditional IT SPs, like Dell, IBM and EMC, are all in favor of the other two forms, and their contract volumes are usually much bigger than those of the startups. A comparison of these transaction forms by contract volume may shed more light on the current market constellation, but is beyond the scope of this thesis.

Please note that the Public Cloud, Private Cloud or Hybrid Model discussed here are all transaction-based, not entity-based. A company as an entity can purchase Cloud Computing services in different forms simultaneously, or even use more than one form from these three for a same service.

3.2.1.3The Transaction Cost Theory:

The term "transaction cost" is frequently thought to have been coined by Ronald Coase, who used it to develop a theoretical framework for predicting when certain economic tasks would be performed by firms, and when they would be performed on the market. However, the term is actually absent from his early work up to the 1970s. While he did not coin the specific term, Coase indeed discussed "costs of using the price mechanism" in his 1937 paper *The Nature of the Firm*, where he first discusses the concept of transaction costs, and refers to the "Costs of Market Transactions" in his seminal work, *The Problem of Social Cost* (1960). The term "Transaction Costs" itself can instead be traced back to the monetary economics literature of the 1950s, and does not appear to have been consciously 'coined' by any particular individual (Kissell et al., 2003).

Arguably, transaction cost reasoning became most widely known through Oliver E. Williamson's *Transaction Cost Economics*. Today, transaction cost economics is used to explain a number of different behaviors. Often this involves considering as "transactions" not only the obvious cases of buying and selling, but also day-to-day emotional interactions, informal gift exchanges, etc. Oliver E. Williamson was awarded the 2009 Nobel Memorial Prize in Economics (Nygaard and Dahlstrom, 2010).

According to Williamson’s theory, transaction costs are largely influenced by the following three parameters:

- *Asset specificity:* an investment conducted by a party of the transaction can either be nonspecific, or idiosyncratic, depending on whether this investment can only be used for the specific transaction or not. The asset specificity defined by Williamson is “the degree to which durable investments that are undertaken in support of particular transaction, the transaction-specific skills and assets that are utilized in the production processes and provision of services for particular customers” (Williamson,1985).

Williamson classified asset specificity into four types:

a. Human asset specificity, in those employment relationships which embedded “learning-by-doing” processes.
b. Physical asset specificity.

c. Site specificity, by investments with great setup and/or relocation costs.
d. Dedicated assets, which are usually purchased or produced on special requirements of certain clients, i.e. expanding existing plant on behalf of a particular buyer.

- *Uncertainty:* refers to the cost associated with explaining and understanding products. A higher uncertainty means either that the probability distribution of disturbances remains unchanged but more numerous disturbances occur, or that disturbances become more consequential (Williamson, 1991).

- *Frequency of transaction*: whether the transactions are occasional or recurrent. One-time transaction belongs to "occasional transactions" too, as suggested by Williamson, because they have little difference in terms of participants' behaviors and economic features (Williamson, 1979).

The Transaction Cost Theory is the first organizational theory emphasizing the importance of asset specificity. And among all the influencing factors/dimensions, asset specificity is regarded as the most important for the transaction cost analysis According to Williamson, a higher asset-specificity of investments leads to more hierarchical contract structures, as opposed to market exchange. This relationship was already confirmed by many researchers for various industries.

The Transaction Cost Theory was used by researchers to explain the emergence of electronic markets too. It is obvious that electronic markets advance the physical markets in terms of search cost and many other concrete transaction costs, but beyond that, the original purpose of Transaction Cost Theory was trying to explain the difference between organizations, a more fundamental difference than pure cost effect. That is why it seems interesting to compare the theory from Williamson with the reality in the Cloud Computing market: according to the 3-dimensional model from Williamson, the choice of market structure by the consumers should be strongly influenced by the factor specificity of various Cloud Computing services too.

The relationship between asset specificity and choice of market structure is one of the most important hypotheses this thesis is trying to verify for the Cloud Computing services market, based on the customer survey described in more details in Chapter 4

The transaction costs can be categorized into two types:

- *Ex ante transaction costs*: According to Williamson, the ex-ante transaction costs are “the costs of drafting, negotiating, and safeguarding an agreement” (Williamson, 1985), i.e. the costs such as advertisement, inviting bids from interested parties and so on. For Cloud Computing services/applications, such as a specialized simulation software for a financial institution, these costs by open market transaction can be very high, because the services provided there are usually standardized, not individually customized (“*nonstandard contracting*”); if the users aim to hold the property of the software, the negotiating process will usually become much easier, because the customization cost can be easily covered by the purchasing cost of the users then. For standardized services, the open market is associated with less ex ante transaction costs because the service can easily be defined with a few parameters and structures, and the effect of *economies of scale* can be highly noticeable.
- *Ex post transaction costs*: ex post costs take several forms and mainly caused by contract misalignments (Williamson, 1985). For Cloud Computing services such as Amazon EC2, the typical ex post transaction cost is the business loss of service users caused by the Amazon’s system outage. Again, for highly special services traded in open market, the chance of finding a substitute service in such situation is very small, hence the potential loss, i.e. the “*switching cost*”, is considerably high; but for standardized services, the substitute or compensation methods can be defined in a form of SLA with little difficulty.

In a *reduced-form analysis*, Williamson concluded that with nonspecific investments, market participants will choose open market as the main form of transaction; with highly idiosyncratic investments, they will choose hierarchy, i.e. the “*firm*”; and with “mixed” investments between nonspecific and idiosyncratic, they will choose a hybrid model between open market an hierarchy, i.e. long-term contracts as the form of transactions (Williamson, 1991). Based on the assertion of Williamson, users should prefer Public Cloud for services with low factor specificity and Private Cloud for services with high factor specificity.

In a more complex analysis considering both asset specificity and frequency as the influencing factors for the optimal market structure, Williamson categorized the market structures into 4 types:

a. The “*market governance*”, which is equal to short-term contracts in the open market.
b. The “*trilateral governance*”, which involves no long-term commitment from either sides of transaction, but assistance from a third party.
c. The “*bilateral governance*”, which is equal to the long-term contracts.
d. The “*unified governance*”, i.e. “internal organization”, which equals to the in-house transactions.

According to the characteristics of these 4 market structures, Williamson drew a matrix with asset specificity and frequency as two dimensions:

Table 3.3 Matching Market Structures with Asset Specificity and Frequency (Williamson, 1979)

<table>
<tr><th></th><th></th><th colspan="3">Asset Specificity</th></tr>
<tr><th></th><th></th><th>Nonspecific</th><th>Mixed</th><th>Idiosyncratic</th></tr>
<tr><th rowspan="2">Frequency</th><th>Occasional</th><td rowspan="2">Short-term Contracts
(Market Governance)</td><td colspan="2">Short-term Contracts
(Trilateral Governance)</td></tr>
<tr><th>Recurrent</th><td>Long-term Contracts
(Bilateral Governance)</td><td>In-house Transaction
(Unified Governance)</td></tr>
</table>

In other words, we can re-formalize the assertion of Williamson as following:

- For *transactions with high frequency*, the optimal market structure is determined by the degree of asset specificity. And for both mixed and idiosyncratic investments, the ideal transaction form should be “*transaction-specific*”.

- For *transactions with low frequency*, both parties always prefer the short-term contracts, no matter how specific the involved investments are. As argued by Williamson for one-time or very infrequent service, the contracting costs involving long-term commitments are always too high for the market participants.

Therefore, the short-term contracts are consistently the preferred transaction form; the only question is, whether the both sides conduct the transaction directly, or via some market intermediate ("trilateral governance").

3.2.1.4 Physical Asset Specificity and Service Homogeneity

As mentioned in the Chapter 3.2.1.3, asset specificity has many different forms and sources. One kind of asset specificity is associated with the physical investments, like a special machine for certain products, or even a plant. This type of asset specificity was described by Williamson as "*physical asset specificity*". The form of asset specificity is an important factor by shaping the bilateral contracting behaviors, and plays, along with other forms of asset specificity, a central role in the Transaction Cost Theory. Physical asset specificity in service industry is directly determined by how homogeneous the service is. Illustrating an example, where all applications requiring computing resources are running on a single platform (operating system), either Unix, Linux, or Windows, the providers of computing resources have no need to invest in the development of interoperable environment then; this feature of service reduces the physical asset specificity and the costs, both the service providers and service users (e.g. the application developers) can easily shift their existing investments into other market or market segments because of the inherent interoperability of a single platform.

3.2.2 Theoretical Groundwork and Frameworks for Price Model

3.2.2.1 General

Pricing is the process of determining what a service provider will receive from an end user in exchange for their services. The cloud computing success in the IT market can be obtained only by developing adequate pricing techniques. The pricing process can be as follows: fixed, in which the customer is charged the same amount all the time; dynamic, in which the price charged changes dynamically; or market-dependent, in which the customer is charged based on the real-time market conditions. Fixed pricing mechanisms include the pay-per-use model, in which the customers pay for the amount they consume of a product or the amount of time they use a certain service. Subscription is another type of fixed pricing, in which the customer pays a fixed amount of money to use the service for longer periods at any convenient time or amount. A list price is another form of fixed pricing, in which a fixed price is found in a catalog or a list. On the other hand, differential or dynamic pricing implies that the price changes dynamically according to the service features, customer characteristics, amount of purchased volumes, or customer preferences. Market-dependent pricing, however, depends on the real-time market conditions such as bargaining, auctioning, demand behavior, and yield management. The following are the most pertinent factors that influence pricing in cloud computing (Sharma et al, 2012):

a. *Initial costs:* This is the amount of money that the service provider spends annually to buy resources.
b. *Lease period*: This is the period in which the customer will lease resources from the service provider. Service providers usually offer lower unit prices for longer subscription periods.
c. *QoS:* This is the set of technologies and techniques offered by the service provider to enhance the user experience in the cloud, such as data privacy and resource availability. The better QoS offered, the higher the price will be.
d. *Age of resource:*. This is the age of the resources employed by the service provider. The older the resources are, the lower the price charged will be. This is because resources can sustain wear over time, which reduces their financial value.
e. *Cost of maintenance:* This is the amount of money that the service provider spends on maintaining and securing the cloud annually.

The main influences on pricing are supply and demand. Demand refers to the level at which a service or good is desired by customers. The law of demand states that, when the price of a good or service is higher, fewer customers will demand that good or service. Supply, on the other hand, reflects the amount of goods or services that the market can produce for a certain price. Therefore, price is considered a reflection of supply and demand. As mentioned before, this thesis is focusing on market acceptance of Cloud Computing services by studying the current and potential customers (demand) of these services. One of the most important factors determining whether many customers are willing to use the Cloud Computing services is the price, and it is not only about how high the price is, but also about what the price model is. The thesis herein uses the term “purchasing cost” for production costs and price, as in the view of service buyers. The most direct way to determine the cost is investigating the pricing mechanism of services, because the purchasing cost of a service is simply determined by the price for each unit of service (which can be measured by use time, connection time, volume, transaction etc.) and the consumed units.

A customer will evaluate a prospective service provider based on three main parameters: pricing approach, QoS, and utilization period, in this interest with the pricing, which is approach describes the process by which the price is determined. The pricing approach could be one of the following: fixed priced regardless of volume, fixed price plus per-unit rate, assured purchase volume plus per-unit price rate, per-unit rate with a ceiling, and per-unit price. (Iveroth et al, 2012) The fixed price regardless of volume charges the customer a fixed price regardless of the volume of the service or product utilized. The fixed price plus per-unit charges the customer a fixed price plus a unit rate. In the assured purchase volume plus per-unit price rate, the customer pays a fixed price for a certain quantity. If the customer's utilization exceeds that quantity, the customer has to pay a fixed rate per unit for the extra utilization. In the per-unit rate with a ceiling approach, the customer pays the per-unit rate up to a certain limit. The provider will not charge the customer above that limit. In the price per unit approach, the customer is charged a different price per unit.

It is clear that a technically (or theoretically) highly efficient (and often complex) price model does not necessarily gain popularity in the real business world, this thesis intends to accomplish a more detailed study on the commonly existing price models including Flat Rate pricing, PAYG pricing and a mixture of these two models, instead of proposing some new price models.

3.2.2.2 PAYG, Flat Rate and Mixture Model

In cloud computing, the complexity of resources distribution causes that resource owner may take different pricing strategies. So there are different models of pricing resources. However, the most common models employed in cloud computing are the pay-as-you go model, Flat Rate model and the Mixture Model.

- *Pay-as-you go model*, customers pay a fixed price per unit of use. Amazon considered the market leader in cloud computing, utilizes such a model by charging a fixed price for each hour of virtual machine usage. The "pay-as-you-go" model is also implemented by other leading enterprises such as Google App

Engine and Windows Azure .Another common scheme employed by these leading enterprises is the “pay for resources” model. A customer pays for the amount of bandwidth or storage utilized.

- *Flat Rate model*, where a customer pays in advance for the services he is going to receive for a pre-defined period of time, is also common.
- *Mixture Model*, mixture of PAYG & Flat Rate models, where Users are charged a certain fee for resource usage within a certain period, and under a certain cap.

Table 3.4 Classification of different payment structures

	Flat Rate	PAYG	Mixture
One-Time Purchase	X		
Periodical Payment	X		
Subscription-based Payment		X	
Usage-based Payment		X	
Periodical Fee with Payment			X

The table below compares pricing models inclusively in terms of fairness, pros, and cons. Pricing models fall into two main types: static and dynamic. In static pricing models, the price remains unchanged after it has been determined. In dynamic pricing, the price changes dynamically according to factors such as the resources required, demand, and more.

Table 3.5 Pricing Model Comparison (Al-Ebrahim et al, 2013)

Pricing model	Pricing Approach	Fairness	Pros	Cons
Pay-as-you-go model	Price is set by the service provider and remains constant (static)	Unfair to the customer because he might pay for more time than needed	Customer is aware of the exact price to be paid Resources are reserved for the customer for the paid period of time	Service provider might reserve the resources for longer than the customer’s utilized Service provider cannot raise the price when demand is high; when demand is low, the user pays higher than the market price
Flat Rate model	Price is based on the period of subscription (static)	Customer might sometimes overpay or underpay	Customer might underpay for the resources reserved if he uses them extensively	Customer might overpay for the resources reserved if he does not use them extensively

Mixture Model	Price changed according to the job queue wait times (static/dynamic)	Fair to customers because of the price authority entity, which dynamically adjusts prices within static limits	Simple and has low computational overhead	Must reach an agreement on common base prices and variation limits

3.2.2.3 Service Homogeneity and Price Model

Clouds computing must provide a good pricing model that is beneficial for both parties. It is sometimes hard to find a balance in which both sides agree with the price set. A good pricing model is defined as a price that will bring no loss to neither the provider nor the consumer. From the consumer's point of view a better pricing model is one where they will pay a lower price for the resources requested, while from the provider's point of view, they should not go beyond the lowest price that provides 0% profit for them as well as increasing the utilization.

Among the research literature of price models of IT services, we have especially studied the papers about price models of computer utility services, since utility service is an important part of the Cloud Computing services. 50 years ago, Diamond and Selwyn compared various price models for computer utility services, including Flat Rate model, resource usage based model (PAYG model), connection time based model, and transaction based model. They discussed about the different price models from a market-oriented view, and suggested several criteria for the proper price model, which reflected possible customer preferences. Their criteria included:

a. Cost of using the computer utility services should be predictable.
b. Users are only willing to pay for services they have actually used.
c. Users want to maximize service for given expenditure.
d. Users can pay proper share of common costs.
e. Users pay for the "value" of services.
f. Users want to obtain priority service (Diamond and Selwyn, 1968).

While these criteria are useful in understanding customer behaviors in the computer utility service market, they do not provide a systematical framework to explain and predict which price model will be chosen under which circumstances.The argument for homogeneous environments is that because everything comes pre-integrated they are easier to set up, and if something goes wrong there is only one responsible party –

"one neck to wring", as the saying has it (Wellington, 2012). Because of that we find that users are often willing to pay a certain premium for a basic network access service, i.e. they are willing to pay more for the same bandwidth consumption in a Flat Rate model than in a usage-based model (PAYG model) Considering basic network access service as a typical commodity service with nearly no heterogeneity, we can find customers prefer a Flat Rate model for Cloud Computing services with high homogeneity. But from the SPs' point of view, when services are homogeneous, SPs are willing to provide services in a PAYG model, only if the marginal costs of investments in a PAYG model are significantly lower than that in a Flat Rate model; on the contrary, in a heterogeneous service market, SPs almost always prefer the PAYG model, as long as the marginal costs of investments is not significantly higher than that in a Flat Rate model.

The implication of this paper will be as follows: the participants generally prefer Flat Rate model for homogeneous services and PAYG model for heterogeneous services.

Yet interesting evidence from the reality is: most utility services, which are regarded as the most homogeneous, including electricity, water, heat, light and gas, are all charged in a PAYG model. In fact, PAYG is regarded as "one characteristic that figures prominently in the utility business model and sets it apart from other models. These partly conflicting research conclusions and realities have aroused our interest in the actual influence of service homogeneity on the preferred price model in the Cloud Computing markets.

3.2.2.4 Usage Frequency and Price Model

Usage frequency to be another potential influencing factor in choosing price model, too. The reason is simple: in a world with no uncertainty, the PAYG model is clearly a superior price model compared to Flat Rate, because no one ever needs the guarantee and flexibility of usage provided by a Flat Rate option. From a pure cost-efficient point of view, the Flat Rate pricing will lead to a suboptimal solution for the Internet access service, as long as the Internet is not congestion-free, researchers have not been unanimous about why most SPs of Internet access services choose Flat Rate, or a price model containing Flat Rate option. Paper by Lambrecht and Skiera summarized different explanations of this "Flat Rate bias" and examined them using empirical analysis. According to their analysis, there are three major causes of the Flat Rate bias:

a. Insurance effect, which means that “Risk-averse consumers who cannot predict their future demand exactly can choose a flat rate to insure against the risk of high costs in periods of greater-than-average usage.
b. Overestimation effect by the consumers.
c. Taxi meter effect”, which means that consumers may enjoy their usage more on a Flat Rate than on a PAYG price model (Lambrecht et al, 2006).

It is noticed that the first two causes are tightly associated with the usage uncertainty of services; therefore, the choice of price model should be affected by the degree of uncertainty.

The uncertainty is a complex issue: there is uncertainty about the timing, the volume, and the length etc. of service requests. We consider the usage frequency as a good indicator for the service uncertainty, because the need for a recurrently used service is more observable, and therefore more predictable.

When the customers in the markets are highly concentrated and mainly low-usage consumers, Flat Rate model is a good strategy, when the markets mature, and the average usage level increases, the service providers should consider either increasing their fixed fee, or shifting into PAYG model. If this assumption is true, high usage frequency should be associated with low uncertainty, and leads to a preference for PAYG price model.

Chapter 4
Methodology

Chapter Outline:

4.1 Introduction

4.2 Research Design

4.3 Research Methodology

4.3.1 Data Collection Methodology:

4.3.1.1 Secondary Data

4.3.1.2Primary Data

4.3.2 Questionnaire Content

4.3.2.1 Questionnaire Structure

4.3.3 Population and Sampling

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4.5 Methodology of Data Analysis

4.5.1 Data Preparation

4.5.2 Statistical Analysis Tools

4.6 Validity of the Research

4.6.1 Content Validity of the Questionnaire

4.6.2 Statistical Validity of the Questionnaire

4.6.3 Criterion Related Validity

4.6.3.1 Internal Consistency:

4.6.4 Structure Validity of the Questionnaire

4.7 Reliability of the Research

4.7.1 Cronbach's Coefficient Alpha

4.7.2 Half Split Method

4.1 Introduction

This chapter describes the methodology that was used in this research. The adopted methodology to accomplish this study uses the following techniques: the information about the research design, research population, questionnaire design, statistical data analysis, content validity and pilot study.

4.2 Research Design

The first phase of the research thesis proposal included identifying and defining the problems and establishment objective of the study and development research plan.

The second phase of the research included a summary of the comprehensive literature review. Literatures on claim management were reviewed.

The third phase of the research included a field survey which was conducted with*"***Market Acceptance of Cloud Computing** in **Gaza IT Market** *(An analysis of market structure and price models)."*

The fourth phase of the research focused on the modification of the questionnaire design, through distributing the questionnaire to pilot study, The purpose of the pilot study was to test and prove that the questionnaire questions are clear to be answered in a way that help to achieve the target of the study. The questionnaire was modified based on the results of the pilot study.

The fifth phase of the research focused on distributing questionnaire. This questionnaire was used to collect the required data in order to achieve the research objective.

The sixth phase of the research was data analysis and discussion. Statistical Package for the Social Sciences, (SPSS) was used to perform the required analysis.

The seventh phase of the research includes the conclusions and recommendations.

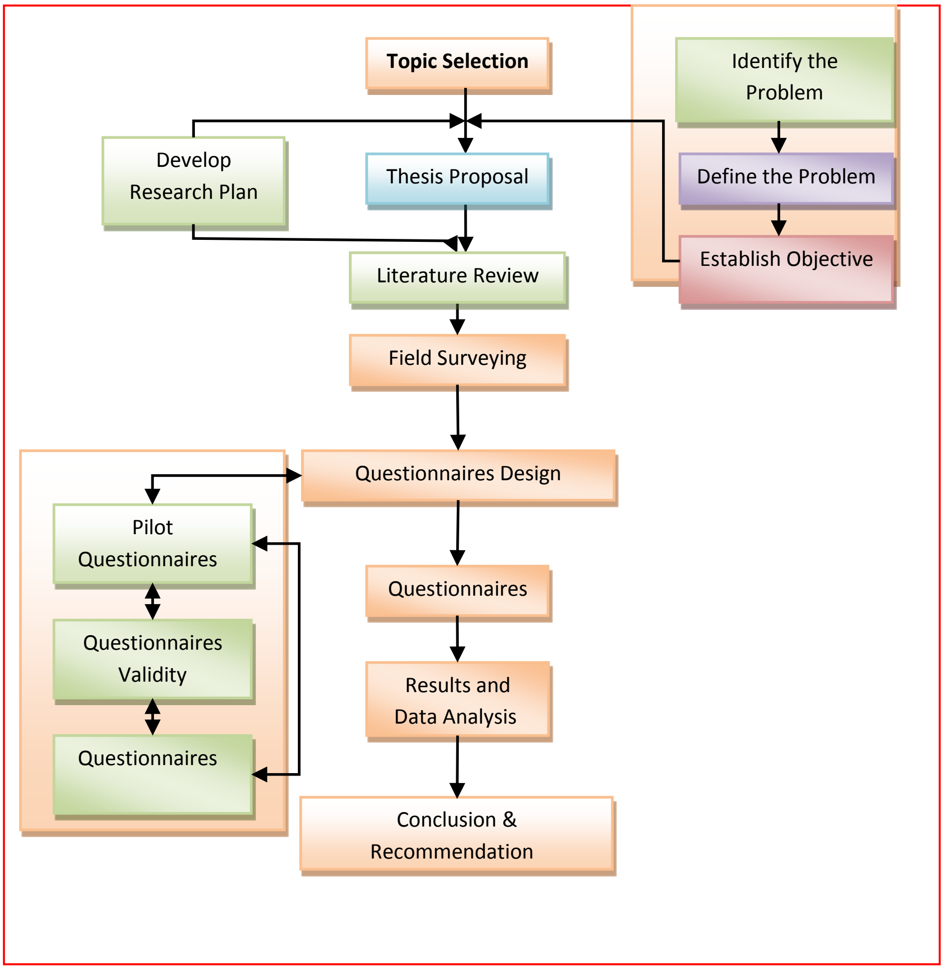

Figure 4.1 Illustrates the methodology flow chart

4.3 Research Methodology

4.3.1 Data Collection Methodology:

As the study follows the analytical descriptive methodology, different tools to collect primary and secondary data were utilized as follows:

4.3.1.1 Secondary Data

To introduce the theoretical literature of the subject, the following data sources were used:

a. Books and references in both English and Arabic about MBI and decision making.
b. Periodicals, published papers and articles.
c. Reports and statistics
d. Web sites

4.3.1.2 Primary Data

To collect the primary data of the research, a questionnaire was developed and distributed to the sample of the study in order to get their opinions about *"***Market Acceptance of Cloud Computing** in **Gaza IT Market** *(An analysis of market structure and price models)."*

Research methodology depends on the analysis of data on the use of descriptive analysis, which depends on the poll and use the main program (SPSS).

4.3.2 Questionnaire content

The questionnaire was provided with a covering letter explaining the purpose of the study, the way of responding, the aim of the research and the security of the information in order to encourage a high response. The questionnaire included multiple choice questions: which used widely in the questionnaire, The variety in these questions aims first to meet the research objectives, and to collect all the necessary data that can support the discussion, results and recommendations in the research.

4.3.2.1 Questionnaire Structure

The behaviors of SPs in a market are often more observable than the behaviors of service users, especially potential users. As mentioned in Chapter 3, we have found from the composed market data that the majority of SPs in current Cloud Computing market prefer short-term contracts to other market structures; and that the PAYG model is their favorite price model. Nevertheless, other types of market structures, as well as price models, have been in use among the SPs too. Thus we conclude an optimal choice of market structure and price model is not yet found; or more possibly, that an optimal choice exists only, when certain characteristics of service and other factors are predetermined. These factors can have influence on SPs, customers, or both. We also acknowledge that there is no way we can exhaust all the influencing factors in a thesis. Therefore, as mentioned in Chapter 3.2.1 and 3.2.1.4, this thesis focuses on two possible influencing factors: the service homogeneity and the usage frequency.

Survey is a common tool for the purpose of testing a certain theory or causal relations in reality. To find out the potential influences of these two factors on customer's choice of market structures and price models, a survey is developed for focusing on the market acceptance of Cloud Computing in Gaza IT Market. The survey is also used for discovering more information about the customers' knowledge and preferences about Cloud Computing. In accordance with achieving the aimed goal of this study; this survey is designed in two parts:

Part one: Include the general information of study Respondents.
Part two: Include the five dimensions of the study, which are:

The first dimension *(general information and knowledge of Cloud Computing)***:** general questions about the company (type of company, IT activities and budget) and questions about the status quo of Cloud Computing market, including how many companies among the respondents are already using or plan to use Cloud Computing services, as well as their opinions on the pros and cons of Cloud Computing services.

The second dimension *(service homogeneity of IT service*): questions about the respondents' opinion on the service homogeneity of the IT services they use.

The third dimension *(usage frequency of IT service*): questions about the respondents' opinion on the Usage frequency of the IT services they use.

The fourth dimension *(market structure)*: this section contains a question about the respondents' preferred market structure.

The fifth dimension *(price model)*: this section contains a question about the respondents' preferred price model.

- ❖ Questions answered in different scales illustrated in questioners.

4.3.3 Population and Sampling

The research population consists of staff that has relations in computer and IT fields (Director, Manager, Head of Section, Head of Unit, Engineer or Administrator) at Information technology and communication companies in the Gaza Strip that registered with PITA (Palestinian information technology association) which totaling 32 companies. Table 1 in Appendix D shows the companies that the questionnaires were distributed to their employees

About 70 Questionnaires were distributed to the research population and 61 questionnaires are received.

4.4 Pilot Study

A pilot study for the questionnaire was conducted before collecting the results of the sample. It provides a trial run for the questionnaire, which involves testing the wordings of question, identifying ambiguous questions, testing the techniques that used to collect data, and measuring the effectiveness of standard invitation to respondents.

4.5 Methodology of Data Analysis

4.5.1 Data Preparation

All the raw data obtained from the survey are *nominal* or *ordinal*, or the so-called "nonmetric data". Typical nominal data are sex, religion, ethnicity, geographic location etc. In our survey, the nominal data are such as the preferred market structure, the preferred price model, and whether a service is regarded as a homogeneous service. In statistics, data in the nominal level are usually used for classification or categorization. Other data set from the survey are ordinal data, e.g. the popular *Likert scale* (Strongly Agree – Agree – Neutral – Disagree – Strongly Disagree), and the *usage frequency of IT services* (Very Frequently – Frequently – Normal – Infrequently – Very Infrequently) employed in this survey.

These data can be used to rank or order objects. We usually transfer these data into a reduced form, i.e. a scale of 1-5 or 1-3 before analysis, but they are still "ordinal" data, because the numbers do not really represent the numerical relationship between the options, e.g. if we assign the scale 1-5 for the Likert scale, by which Strongly Agree = 1 and Strongly Disagree = 5, this scale does not mean that intervals between people choosing "Strongly Agree" and "Agree", and the intervals between people choosing "Disagree" and "Strongly Disagree", are the same.

4.5.2 Statistical Analysis Tools

Data analysis both qualitative and quantitative data analysis methods would be used. The Data analysis will be made utilizing (SPSS 20). The researcher would utilize the following statistical tools:

a. Frequencies and Percentile
b. Alpha-Cronbach Test for measuring reliability of the items of the questionnaires
c. Person correlation coefficients for measuring validity of the items of the questionnaires.
d. Spearman –Brown Coefficient
e. One sample t test
f. 6- Chi-square test
g. The One-Way Analysis of Variance (ANOVA)

4.6 Tests of Normality

1-Sample K-S test will be used to identify if the data follow normal distribution or not, this test is considered necessary in case testing hypotheses as most parametric Test stipulate data to be normality distributed and this test used when the size of the sample are greater than or equal 50.

Results test as shown in table (17), clarifies that the calculated p-value is greater than the significant level which is equal 0.05 (p-value. > 0.05), this in turn denotes that data follows normal distribution, and so parametric Tests must be used.

Table 4.1 1-Sample k-s

Section	Statistic test	P-value
Service homogeneity of cloud computing	0.727	0.751
Market structure of cloud computing	0.849	0.316
price model	0.960	0.150
Usage frequency of cloud computing	1.045	0.224
why cloud computing seems attractive to your company include	1.323	0.091
using Cloud Computing now or in near future	0.475	0.978
All items	1.045	0.224

4.7 Validity of the Research

We can define the validity of an instrument as a determination of the extent to which the instrument actually reflects the abstract construct being examined. "Validity refers to the degree to which an instrument measures what it is supposed to be measuring". High validity is the absence of systematic errors in the measuring instrument. When an instrument is valid; it truly reflects the concept it is supposed to measure. Achieving good validity required the care in the research design and sample selection. The amended questionnaire was by the supervisor and three expertises in the tendering and bidding environments to evaluate the procedure of questions and the method of analyzing the results. The expertise agreed that the questionnaire was valid and suitable enough to measure the purpose that the questionnaire designed for.

4.7.1 Content Validity of the Questionnaire

Content validity test was conducted by consulting two groups of experts. The first was requested to evaluate and identify whether the questions agreed with the scope of the items and the extent to which these items reflect the concept of the research problem. The other was requested to evaluate that the instrument used is valid statistically and that the questionnaire was designed well enough to provide relations and tests between variables. The two groups of experts did agree that the questionnaire was valid and suitable enough to measure the concept of interest with some amendments.

4.7.2 Statistical Validity of the Questionnaire

To insure the validity of the questionnaire, two statistical tests should be applied. The first test is Criterion-related validity test (Pearson test) which measures the correlation coefficient between each item in the field and the whole field. The second test is structure validity test (Pearson test) that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of similar scale.

4.7.3 Criterion Related Validity

4.7.3.1 Internal Consistency:

Internal consistency of the questionnaire is measured by a scouting sample, which consisted of 30 questionnaires, through measuring the correlation coefficients between each questions in one field and the whole filed.

Table 4.1 below shows the correlation coefficient and p-value for each paragraph of the "The reason(s) why cloud computing seems attractive to your company include(s)" and the total of the field. As show in the table the p- Values are less than 0.05 or 0.01,so the correlation coefficients of this field are significant at α = 0.01 or α = 0.05, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 4.2 The correlation coefficient between each question in the field and the whole field
(Why cloud computing seems attractive to your company include?)

No.	Question	Pearson coefficient	p-value
1	Less capital lockup	0.608	0.000
2	Less sunk costs and separate capex & opex	0.659	0.000
3	Less administration and maintenance costs	0.706	0.000
4	High scalability of the system continuity and avilability	0.554	0.001
5	Less data loss or other security issues	0.829	0.000
6	The interoperability of cloud computing services	0.653	0.000
7	Quick integration into existing implementations	0.671	0.000
8	Less deployment time and complexity	0.730	0.000
9	Better monitoring tools and accountability of services	0.593	0.001
10	Consolidation of legacy systems	0.596	0.001
11	Environment awareness(Green IT)	0.737	0.000

Table 4.2 below shows the correlation coefficient and p-value for each paragraph of the " Your concern(s) about using Cloud Computing now or in near future is/are:" and the total of the field. As show in the table the p- Values are less than 0.05 or 0.01,so

the correlation coefficients of this field are significant at α = 0.01 or α = 0.05, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 4.3 The correlation coefficient between each question in the field and the whole field
(Your concern(s) about using Cloud Computing now or in near future is/are)

No.	question	Pearson coefficient	p-value
1	Technology immaturity	0.433	0.017
2	Technology complexity	0.372	0.043
3	Potential system failure due to hardware problems	0.482	0.007
4	Security issues (data loss, confidential information etc.)	0.619	0.000
5	Legacy infrastructure	0.588	0.001
6	Legal compliance	0.532	0.002
7	High deployment costs	0.496	0.005
8	Lock in problem and opportunity cost by following the wrong trend	0.446	0.014
9	Hostile software licensing regime	0.756	0.000

Table 4.3 below shows the correlation coefficient and p-value for each paragraph of the" Which *service homogeneity* would you prefer for each of the following IT service" and the total of the field. As show in the table the p- Values are less than 0.05 or 0.01,so the correlation coefficients of this field are significant at α = 0.01 or α = 0.05, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 4.4 The correlation coefficient between each question in the field and the whole field
(service homogeneity of IT service)

No.	Question	Pearson coefficient	p-value
1	Storage, archiving and disaster recovery	0.502	0.005
2	Raw computing power (CPU, Memory etc)	0.457	0.011
3	Dedicated data center or servers (e.g. Dell, HPC etc.)	0.442	0.014
4	Basic office applications (e.g. Microsoft Office)	0.446	0.013
5	Business applications (e.g. SAP ERP system)	0.417	0.022
6	Specialized applications or solutions (e.g. simulation software for financial industry)	0.393	0.032
7	Specialized IT services, such as security, management and compliance	0.597	0.000
8	Cloud Operating System (e.g. Windows Azure from Microsoft)	0.532	0.002
9	Online Application Exchange Platform (e.g. Salesforce.com)	0.433	0.017

Table 4.4 below shows the correlation coefficient and p-value for each paragraph of the" How frequently does your company use the following IT services? " and the total of the field. As show in the table the p- Values are less than 0.05 or 0.01,so the correlation coefficients of this field are significant at $\alpha = 0.01$ or $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 4.5 The correlation coefficient between each question in the field and the whole field
(*usage frequency of IT service)*

No.	Question	Pearson coefficient	p-value
1	Storage, archiving and disaster recovery	0.748	0.000
2	Raw computing power (CPU, Memory etc)	0.737	0.000
3	Dedicated data center or servers (e.g. Dell, HPC etc.)	0.739	0.000
4	Basic office applications (e.g. Microsoft Office)	0.519	0.003
5	Business applications (e.g. SAP ERP system)	0.594	0.001
6	Specialized applications or solutions (e.g. simulation software for financial industry)	0.387	0.035
7	Specialized IT services, such as security, management and compliance	0.774	0.000
8	Cloud Operating System (e.g. Windows Azure from Microsoft)	0.502	0.005
9	Online Application Exchange Platform (e.g. Salesforce.com)	0.711	0.000

Table 4.5 below shows the correlation coefficient and p-value for each paragraph of the" Which transaction type would you prefer for each of the following cloud computing service?" and the total of the field. As show in the table the p- Values are less than 0.05 or 0.01,so the correlation coefficients of this field are significant at α = 0.01 or α = 0.05, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 4.6 The correlation coefficient between each question in the field and the whole field (*Market structure)*

No.	Question	Pearson coefficient	p-value
1	Storage, archiving and disaster recovery	0.619	0.000
2	Raw computing power (CPU, Memory etc)	0.588	0.001
3	Dedicated data center or servers (e.g. Dell, HPC etc.)	0.482	0.007
4	Basic office applications (e.g. Microsoft Office)	0.496	0.005
5	Business applications (e.g. SAP ERP system)	0.446	0.014
6	Specialized applications or solutions (e.g. simulation software for financial industry)	0.756	0.000
7	Specialized IT services, such as security, management and compliance	0.516	0.004
8	Cloud Operating System (e.g. Windows Azure from Microsoft)	0.557	0.001
9	Online Application Exchange Platform (e.g. Salesforce.com)	0.628	0.000

Table 4.6 below shows the correlation coefficient and p-value for each paragraph of the" Which price model would you prefer for each of the following cloud computing service?" and the total of the field. As show in the table the p- Values are less than 0.05 or 0.01,so the correlation coefficients of this field are significant at α = 0.01 or α = 0.05, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 4.7 The correlation coefficient between each question in the field and the whole field *(Price model)*

No.	question	Pearson coefficient	p-value
1	Storage, archiving and disaster recovery	0.570	0.001
2	Raw computing power (CPU, Memory etc)	0.788	0.000
3	Dedicated data center or servers (e.g. Dell, HPC etc.)	0.565	0.001
4	Basic office applications (e.g. Microsoft Office)	0.554	0.002
5	Business applications (e.g. SAP ERP system)	0.673	0.000
6	Specialized applications or solutions (e.g. simulation software for financial industry)	0.756	0.000
7	Specialized IT services, such as security, management and compliance	0.735	0.000
8	Cloud Operating System (e.g. Windows Azure from Microsoft)	0.558	0.001
9	Online Application Exchange Platform (e.g. Salesforce.com)	0.624	0.000

4.7.4 Structure Validity of the Questionnaire

Structure validity is the second statistical test that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of liker scale.

As shown in table 4.7 the significance values are less than 0.01, so the correlation coefficients of all the fields are significant at $\alpha = 0.01$, so it can be said that the fields are valid to be measured what it was set for to achieve the main aim of the study.

Table 4.8 Structure Validity of the Questionnaire

section	Pearson **correlation coefficient**	**p-value**
Service homogeneity of cloud computing	0.792	0.000
Market structure of cloud computing	0.863	0.000
price model	0.920	0.000
Usage frequency of cloud computing	0.608	0.000
why cloud computing seems attractive to your company include	0.716	0.000
using Cloud Computing now or in near future	0.828	0.000

4.8 Reliability of the Research

Reliability of an instrument is the degree of consistency with which it measures the attribute it is supposed to be measuring. The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient. For the most purposes reliability coefficient above 0.70 are considered satisfactory. Period of two weeks to a month is recommended between two tests Due to complicated conditions that the consumer is facing at the time being, it was too difficult to ask them to responds to our questionnaire twice within short period. The statistician's explained that, overcoming the distribution of the questionnaire twice to measure the reliability can be achieved by using Kronpakh Alpha coefficient and Half Split Method through the SPSS software.

4.8.1 Cronbach's Coefficient Alpha

This method is used to measure the reliability of the questionnaire between each field and the mean of the whole fields of the questionnaire. The normal range of Cronbach's coefficient alpha value between 0.0 and + 1.0, and the higher values reflects a higher degree of internal consistency. As shown in Table 4.8 the Cronbach's coefficient alpha was calculated. The general reliability for all items equal 0.8924. This range is considered high; the result ensures the reliability of the questionnaire.

Table 4.9 Cronbach's Alpha For Reliability

Sub-section	**Cronbach's Alpha**
Service homogeneity of cloud computing	0.8678
Market structure of cloud computing	0.8896
price model	0.8391
Usage frequency of cloud computing	0.9157
why cloud computing seems attractive to your company include	0.9045
using Cloud Computing now or in near future	0.8721
All items	0.8924

4.8.2 Half Split Method

This method depends on finding Pearson correlation coefficient between the means of odd rank questions and even rank questions of each field of the questionnaire. Then, correcting the Pearson correlation coefficients can be done by using Spearman Brown correlation coefficient of correction. The corrected correlation coefficient (consistency coefficient) is computed according to the following equation :

Consistency coefficient = 2r/(r+1), where r is the Pearson correlation coefficient. The normal range of corrected correlation coefficient 2r/(r+1) is between 0.0 and + 1.0 As shown in Table No.(12), and the general reliability for all items equal 0.8717, and the significant (α) is less than 0.05 so all the corrected correlation coefficients are significance at α = 0.05. It can be said that according to the Half Split method, the dispute causes group are reliable.

Table 4.10 Split-Half Coefficient method

Sub-section	person-correlation	Spearman-Brown Coefficient	Sig. (2-(Tailed
Service homogeneity of cloud computing	0.7296	0.8436	0.000
Market structure of cloud computing	0.7525	0.8588	0.000
price model	0.6924	0.8182	0.000
Usage frequency of cloud computing	0.7895	0.8824	0.000
why cloud computing seems attractive to your company include	0.8124	0.8965	0.0000
using Cloud Computing now or in near future	0.7568	0.8616	0.0000
All items	0.7725	0.8717	0.0000

CHAPTER Five

RESEARCH ANALYSIS AND FINDINGS

<u>Chapter Outline:</u>

5.1 The First Dimensions (general information)

5.1.1 Knowledge About Cloud Computing

5.1.2 IT-related Investments

5.1.3 Current Market Acceptance of Cloud Computing

5.1.4 Reason for Using Cloud Computing Services

5.1.5 Reason Against Using Cloud Computing Services

5.2 Hypothesis #1 Test (Test Statistical description of the study population)

5.2.1 Gender

5.2.2 Qualification

5.2.3 Age

5.2.4 Field of Specialization

5.2.5 Position

5.2.6 Years of Experience at this company

5.2.7 Department

5.3 Hypothesis #2 Test

5.3.1 Hypothesis a

5.3.2 Hypothesis b

5.3.3 Hypothesis c

5.3.4 Hypothesis d

5.1 The First Dimension (general information):

5.1.1 Knowledge about Cloud Computing

One basic characteristic of the survey respondents is a basic or advanced knowledge about Cloud Computing, which is guaranteed by the ("I am familiar with the idea of Cloud Computing"). If a respondent chooses the option "Strongly Disagree" for this question, the survey will be ignored (In all 61 full responses we received, 1 of them have chosen this option).

This result shows that, despite the optimistic forecasts from many institutions, Cloud Computing is not yet widely used in the mass market: E. M. Rogers has proposed a 5-stages development process of technology innovation regarding the types of main users, or so-called "user segments" (Roge, 2013). According to him, the normal development process of customers of an innovative technology in the market is as following: "innovators" ⟶"early adopters"⟶"early majority"⟶"late majority"⟶"laggards". At the first two stages of the development, by which the main users of the technology are "innovators" and "early adopters" respectively, a strong ability to understand and apply complex technical knowledge is needed, and the users are often tightly connected with the source of the innovation in one or another way (Roge, 2013). Therefore, the majority of the survey respondents fit perfectly into the "innovators" and "early adopters" categories of Rogers.

5.1.2 IT-related Investments

Figure 5.1 shows the percentage of IT-related investments to the overall revenues of corresponding companies. It is surprise to find out that the percentage of respondents, who confirmed that they spent more than 5% of their total revenues from the previous year on IT-related projects, is considerably high (21.7% from the sample agrees that company spend on IT related projects in 2014 from 5% to 20% of 2013 revenue, and 11.7% from the sample agrees that company spend on IT related projects in 2014 more than 20% of 2013 revenue).

One possible reason for the high spending on IT-related projects among the respondents is that all of responses came from IT companies. Their high expenditure on IT-related investments, i.e. their main business, leads to a *bias* in the total sample pool.

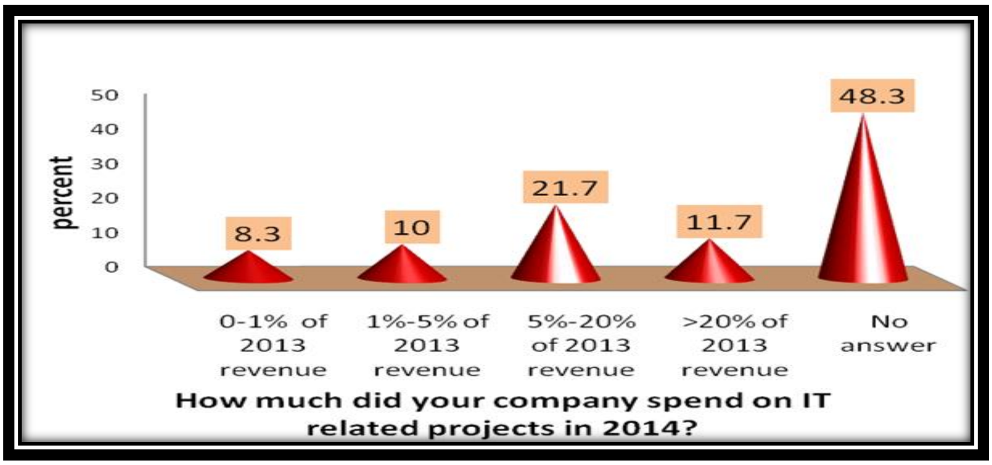

Figure 5.1 Corresponding Companies' IT budgets in Percentage of Total Revenue from Previous Year (2013)

5.1.3 Current Market Acceptance of Cloud Computing

Figure 5.2 shows the responses to "the best description of Cloud Computing's current role in your company is". The percentage of companies already using certain Cloud Computing services is surprisingly high (46.7% of them stated they are already using some Cloud Computing services and expect to use more; 11.7% of them stated that they are already using some Cloud Computing services and do not expect to use more). One possible reason for that high ratio of Cloud Computing usage is: as a new concept, Cloud Computing has gained a range of different definitions, even from people familiar with it. For people who consider the services like web email service as Cloud Computing services too, it will be much easier to confirm that their companies have already used certain Cloud Computing services. However, with the majority among the existing users of Cloud Computing choosing "expecting more", their positive attitude towards Cloud Computing services is quite clear. Together with another one third of the respondents saying that their companies are planning to use Cloud Computing services, this result provides a solid evidence for the potential growth of Cloud Computing market.

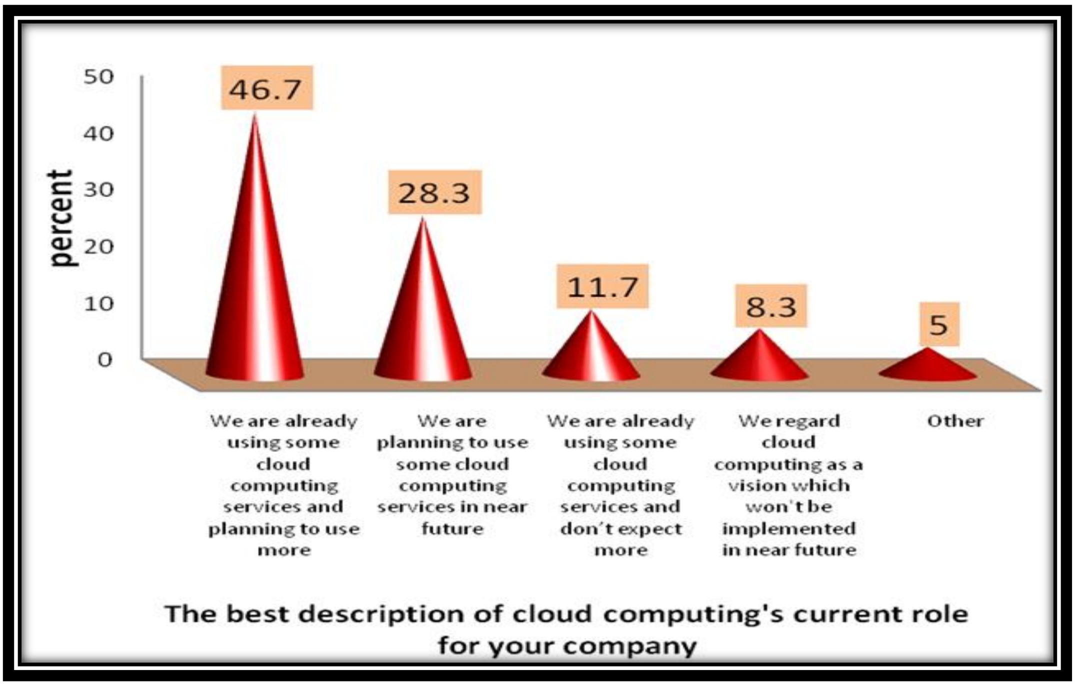

Figure 5.2 The Current Acceptance of Cloud Computing Services

5.1.4 Reason for Using Cloud Computing Services

Figure 5.3 shows the reasons why the users and potential users think Cloud Computing services are attractive. We find out that the *cost reason* is clearly the most influential one for buying Cloud Computing services: nearly all the respondents have chosen “Strongly Agree” or “Agree” for “*less capital lockup*”, “*less sunk costs*” and “*less administration & maintenance costs*” as reasons for using Cloud Computing services. We believe this is partly a result due to that *Public Cloud* is regarded by many market participants as the only form of Cloud Computing: in the Software as a Service (SaaS) and Infrastructure as a Service (IaaS) model, users do not need to invest heavily in the applications and infrastructure in advance.

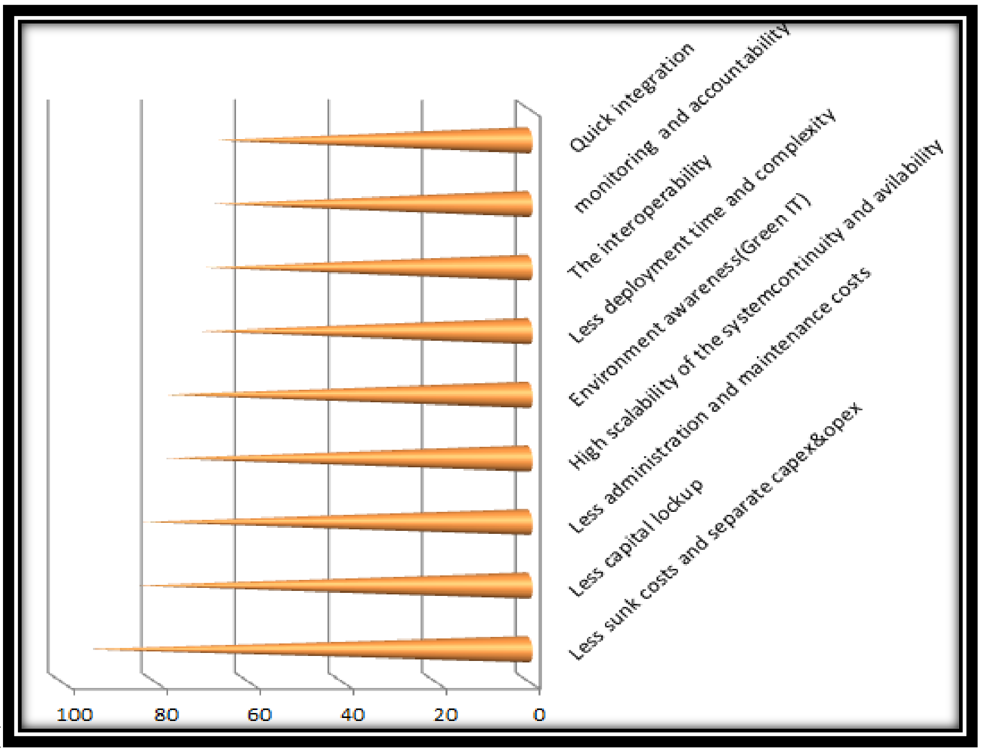

Figure 5.3 Reasons of Using Cloud Computing Services

However, in the case of a *Private Cloud*, service users should own the infrastructure and applications they use in the Cloud, and there is *no* clear evidence that this will leads to a reduction of capital lockup and sunk costs. Other important reasons for using Cloud Computing services are performance oriented, such as "*system continuity and availability*" as well as "*high scalability of the system*". To our best knowledge, there is yet no empirical research on how these expectations are met by the SPs. We have tracked the Amazon AWS to obtain a rough picture of the current system continuity of Cloud Computing services, because Amazon AWS is widely regarded as the most mature (Public) Cloud Computing platform.

About half of the respondents have chosen "Strongly Agree" or "Agree" for "*system interoperability*", "*less deployment time & complexity*", "*Green IT*", and "*less data loss*" as reasons for using Cloud Computing services. The first two are strongly technical oriented subjects, which usually receive more attention in the implementation stage. As for "Green IT", the main potential contribution of Cloud Computing is improving the *utilization ratio* in data centers and accelerating the data center consolidation. However, as this survey result suggests, the idea of "Green IT" does not yet enjoy a high priority by the IT-related investments at the corresponding companies. It is hard to believe that companies treat security issues like data loss as trivial problem, so the result indicates that many respondents think Cloud Computing is unable to prevent these things from happening. This is also confirmed by the question about customers' concerns for Cloud Computing, by which the "security issue" received most attention from the respondents.

The least chosen reasons for using Cloud Computing services are "*monitoring tools and accountability*", "*quick integration*" and "*consolidation of legacy systems*".

Despite the inherent monitoring tools of those Cloud Computing platforms, the only third-party monitoring tool we know is provided by Right Scale, for Amazon AWS. As for the latter two reasons, which are in fact associated with each other, more researches are needed to confirm these advantages of Cloud Computing compared to traditional IT services.

5.1.5 Reason Against Using Cloud Computing Services

Figure 5.4 shows the concerns of users and potential users for Cloud Computing services. We see the biggest concern among the responses is the "*security issue*". Since the users of Cloud Computing services do not always own the infrastructure and applications (as in the case of Public Cloud and Hybrid Model), they have easily the concern of where their data are stored, and whether they are secure. The security issues are addressed in some SPs' service agreement or description, such as at Amazon AWS. The Amazon AWS uses a range of security measures to mitigate the potential risk, including SOX79 certification, physical security in data center, and backup services.

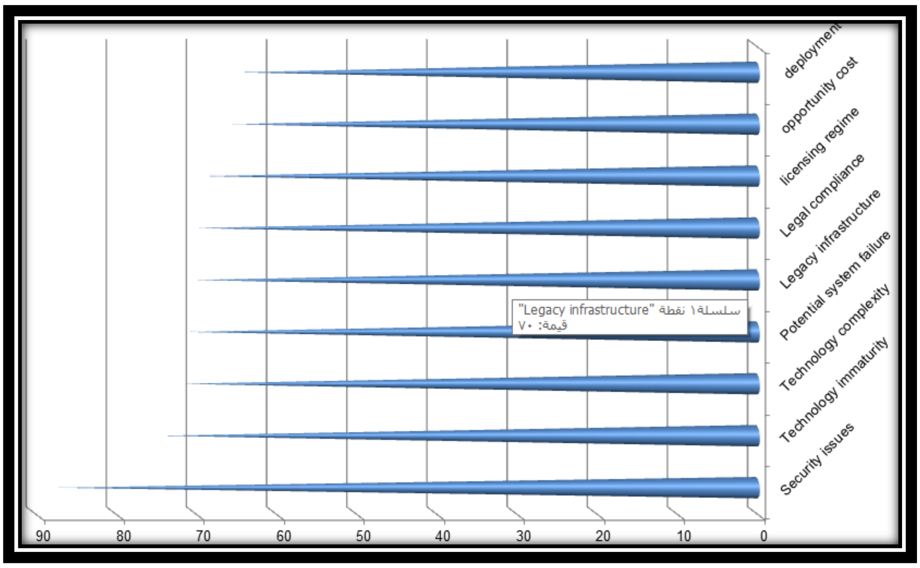

Figure 5.4 Concerns of Using Cloud Computing Services

However, this survey result shows that users and potential users are not yet convinced by the effort made. This finding is also consistent with that from J. Staten, who said that many enterprises are not using Cloud Computing services because they are not secure enough. (Stat, 2012) The nest things bother users of Cloud Computing are the "*technology immaturity*" and "*technology complexity*": more than 70 % of the respondents either agree or strongly agree that these are concerns against using Cloud Computing services.

Although many of the technologies supporting Cloud Computing are already mature, e.g. the virtualization technology, but the technology immaturity of Cloud Computing as a whole is partly confirmed by the relatively frequent system outages we mentioned in Chapter 5.2.1.2, as well as by the characteristics of current users (i.e. mainly "innovators" and "early adopters"). More controversial is the problem about technology complexity: while the unanimous definitions of Cloud Computing, the lack of interoperability between current Cloud Computing platforms, and generally the immature stage of technology development do increase the complexity of Cloud Computing for the users and potential users, Cloud Computing actually promises a lot of *simplicity*: e.g. the users should not care about where exactly the data are hold, have an ubiquitous access to the data and services they need, and enjoy a great usage flexibility because the high scalability of their systems. The survey result shows that the respondents are not yet convinced by the benefits mentioned above. More research efforts are needed, to find out whether they can "simplify" Cloud Computing for the customers in the long run. Nearly 64% of the respondents believe there can be certain "*lock-in*" problem by the Cloud Computing services. The lock-in problem occurs when the customers of a certain SP are unable to change the SP, or can only do that with prohibitively high costs of money or time, so that they are forced to stay in contracting relationship with this SP. The lock-in problem is one form of *ex post transaction cost* in the Transaction Cost Theory. (Williamson, 1979) For Cloud Computing services, this problem is represented by the lack of standards and interoperability between systems. Generally, the standardization of Cloud Computing systems in both interface level and technical level has not yet received much attention.

To our best knowledge, there are quite few customers of Cloud Computing already replaced their IT systems with the new Cloud Computing services.

As mentioned in Chapter 3.1.3, the most current users are using Cloud Computing services for their non-core IT activities. In this case, legacy infrastructure can hardly be a problem, but it does not mean that in the future, when Cloud Computing is becoming a massively adopted IT practices, consolidating the legacy infrastructure will still be a trivial task.

The least concerned problem by the respondents is the potential "*high deployment costs*". The respondents tend to believe that Cloud Computing is not associated with high deployment costs at all. Combined with the results from Chapter 5.2.1.5, the survey shows that at this time, the biggest attraction of Cloud Computing seems to be the *cost advantages*.

5.2 Hypothesis #1 Test (Test Statistical description of the study population)

The main hypothesis stated that there is a statistically significant differences attributed to the personal information of the respondents at the level of α = 0.05 about market acceptance of cloud computing in Gaza IT market**.**

And these hypothesis divided into sub-hypotheses as follows:

5.2.1 Gender

"There is a statistically significant differences at the level of α ≤ 0.05 about market acceptance of cloud computingin Gaza it market refer to gender"

To test the hypothesis the Independent Samples Test is used and the result illustrated in table no.(36) which show that the p-value equal 0.495 which is greater than 0.05 that's mean there is no statistically significant differences at the level of α = 0.05 about market acceptance of cloud computing in Gaza it market refer to gender .

Table 5.1 Independent Samples Test for differences about market acceptance of cloud computing in Gaza it market refer to gender

Field	Gender	N	Mean	Std. Deviation	T	P-value
Service homogeneity of cloud computing	Male	49	2.333	0.329	-1.496	0.140
	female	11	2.495	0.295		
Market structure of cloud computing	Male	49	2.687	0.571	-0.262	0.794
	female	11	2.737	0.593		

price model	Male	49	2.766	0.493	-1.715	0.092
	female	11	3.040	0.401		
Usage frequency of cloud computing	Male	49	3.859	0.943	-0.949	0.347
	female	11	4.162	1.011		
why cloud computing seems attractive to your company include	Male	49	3.770	0.966	1.227	0.225
	female	11	3.405	0.364		
using Cloud Computing now or in near future	Male	49	3.494	0.486	-0.251	0.803
	female	11	3.535	0.506		
All items	Male	49	3.152	0.338	-0.687	0.495
	female	11	3.229	0.333		

5.2.2 Qualification

"There is a statistically significant differences at the level of α ≤ 0.05 about market acceptance of cloud computing in Gaza it market refer to Qualification"

To test the hypothesis the one way ANOVA is used and the result illustrated in table no.(37) which show that the p-value equal 0.139 which is greater than 0.05 , that's means There is no statistically significant differences at the level of α = 0.05 about market acceptance of cloud computing in Gaza it market refer to Qualification.

Table 5.2 One way ANOVA test for differences about market acceptance of cloud computing in Gaza it market refer to Qualification

Field	Source	Sum of Squares	df	Mean Square	F value	Sig.(P-Value)
Service homogeneity of cloud computing	Between Groups	0.904	2	0.452	4.760	0.012
	Within Groups	5.414	57	0.095		
	Total	6.318	59			
Market structure of cloud computing	Between Groups	0.027	2	0.014	0.040	0.961
	Within Groups	19.155	57	0.336		
	Total	19.182	59			
price model	Between Groups	0.690	2	0.345	1.481	0.236
	Within Groups	13.281	57	0.233		
	Total	13.971	59			
Usage frequency of cloud computing	Between Groups	1.557	2	0.778	0.851	0.433
	Within Groups	52.156	57	0.915		
	Total	53.713	59			
why cloud computing seems attractive to your company include	Between Groups	0.349	2	0.174	0.212	0.810
	Within Groups	46.922	57	0.823		
	Total	47.271	59			

using Cloud Computing now or in near future	Between Groups	1.667	2	0.833	3.879	0.026
	Within Groups	12.246	57	0.215		
	Total	13.913	59			
All items	Between Groups	0.446	2	0.223	2.046	0.139
	Within Groups	6.213	57	0.109		
	Total	6.659	59			

5.2.3 Age

"There is a statistically significant differences at the level of α ≤ 0.05 about market acceptance of cloud computingin Gaza it market refer to Age"

To test the hypothesis the one way ANOVA is used and the result illustrated in table no.(38) which show that the p-value equal 0.547 which is greater than 0.05 , that's means There is no statistically significant differences at the level of α = 0.05 about market acceptance of cloud computing in Gaza it market refer to **Age**.

Table 5.3 One way ANOVA test for differences about market acceptance of cloud computing in Gaza it market refer to Age

Field	Source	Sum of Squares	df	Mean Square	F value	Sig.(P-Value)
Service homogeneity of cloud computing	Between Groups	0.558	2	0.279	2.759	0.072
	Within Groups	5.760	57	0.101		
	Total	6.318	59			
Market structure of cloud computing	Between Groups	0.316	2	0.158	0.478	0.623
	Within Groups	18.866	57	0.331		
	Total	19.182	59			
price model	Between Groups	0.817	2	0.408	1.770	0.180
	Within Groups	13.154	57	0.231		
	Total	13.971	59			
Usage frequency of cloud computing	Between Groups	0.911	2	0.455	0.492	0.614
	Within Groups	52.802	57	0.926		
	Total	53.713	59			
why cloud computing seems attractive to your company include	Between Groups	0.204	2	0.102	0.124	0.884
	Within Groups	47.066	57	0.826		
	Total	47.271	59			
using Cloud Computing now or in near future	Between Groups	0.273	2	0.136	0.569	0.569
	Within Groups	13.641	57	0.239		
	Total	13.913	59			
All items	Between Groups	0.140	2	0.070	0.611	0.547
	Within Groups	6.520	57	0.114		
	Total	6.659	59			

5.2.4 Field of Specialization

"There is a statistically significant differences at the level of α ≤ 0.05 about market acceptance of cloud computingin Gaza it market refer to Field of Specialization"

To test the hypothesis the one way ANOVA is used and the result illustrated in table no.(39) which show that the p-value equal 0.938 which is greater than 0.05 , that's means There is no statistically significant differences at the level of α = 0.05 about market acceptance of cloud computing in Gaza it market refer to Field of Specialization.

Table 5.4 One way ANOVA test for differences about market acceptance of cloud computing in Gaza it market refer to Field of Specialization

Field	Source	Sum of Squares	df	Mean Square	F value	Sig.(P-Value)
Service homogeneity of cloud computing	Between Groups	0.118	2	0.059	0.541	0.585
	Within Groups	6.200	57	0.109		
	Total	6.318	59			
Market structure of cloud computing	Between Groups	0.406	2	0.203	0.617	0.543
	Within Groups	18.776	57	0.329		
	Total	19.182	59			
price model	Between Groups	0.530	2	0.265	1.125	0.332
	Within Groups	13.441	57	0.236		
	Total	13.971	59			
Usage frequency of cloud computing	Between Groups	0.770	2	0.385	0.414	0.663
	Within Groups	52.943	57	0.929		
	Total	53.713	59			
why cloud computing seems attractive to your company include	Between Groups	1.173	2	0.586	0.725	0.489
	Within Groups	46.098	57	0.809		
	Total	47.271	59			
using Cloud Computing now or in near future	Between Groups	0.571	2	0.286	1.221	0.303
	Within Groups	13.342	57	0.234		
	Total	13.913	59			
All items	Between Groups	0.015	2	0.008	0.065	0.937
	Within Groups	6.644	57	0.117		
	Total	6.659	59			

5.2.5 Position

"There is a statistically significant differences at the level of α ≤ 0.05 about market acceptance of cloud computingin Gaza it market refer to Position"

To test the hypothesis the one way ANOVA is used and the result illustrated in table no.(40) which show that the p-value equal 0.338 which is greater than 0.05 , that's means There is no statistically significant differences at the level of α = 0.05 about market acceptance of cloud computing in Gaza it market refer to Position.

Table 5.5 One way ANOVA test for differences about market acceptance of cloud computing in Gaza it market refer to Position

Field	Source	Sum of Squares	df	Mean Square	F value	Sig.(P-Value)
Service homogeneity of cloud computing	Between Groups	1.382	5	0.276	3.023	0.018
	Within Groups	4.936	54	0.091		
	Total	6.318	59			
Market structure of cloud computing	Between Groups	1.911	5	0.382	1.195	0.324
	Within Groups	17.271	54	0.320		
	Total	19.182	59			
price model	Between Groups	2.218	5	0.444	2.038	0.088
	Within Groups	11.753	54	0.218		
	Total	13.971	59			
Usage frequency of cloud computing	Between Groups	2.495	5	0.499	0.526	0.755
	Within Groups	51.218	54	0.948		
	Total	53.713	59			
why cloud computing seems attractive to your company include	Between Groups	6.940	5	1.388	1.859	0.117
	Within Groups	40.330	54	0.747		
	Total	47.271	59			
using Cloud Computing now or in near future	Between Groups	2.219	5	0.444	2.049	0.086
	Within Groups	11.694	54	0.217		
	Total	13.913	59			
All items	Between Groups	0.649	5	0.130	1.166	0.338
	Within Groups	6.010	54	0.111		
	Total	6.659	59			

5.2.6 Years of Experience

"There is a statistically significant differences at the level of α ≤ 0.05 about market acceptance of cloud computingin Gaza it market refer to Years of Experience"

To test the hypothesis the one way ANOVA is used and the result illustrated in table no.(41) which show that the p-value equal 0.901 which is greater than 0.05 , that's means There is no statistically significant differences at the level of α = 0.05 about market acceptance of cloud computing in Gaza it market refer to Years of Experience.

Table 5.6 One way ANOVA test for differences about market acceptance of cloud computing in Gaza it market refer to Years of Experience

Field	Source	Sum of Squares	df	Mean Square	F value	Sig.(P-Value)
Service homogeneity of cloud computing	Between Groups	0.634	3	0.211	2.081	0.113
	Within Groups	5.684	56	0.101		
	Total	6.318	59			
Market structure of cloud computing	Between Groups	0.453	3	0.151	0.451	0.717
	Within Groups	18.729	56	0.334		
	Total	19.182	59			
price model	Between Groups	0.408	3	0.136	0.561	0.643
	Within Groups	13.563	56	0.242		
	Total	13.971	59			
Usage frequency of cloud computing	Between Groups	0.790	3	0.263	0.279	0.841
	Within Groups	52.923	56	0.945		
	Total	53.713	59			
why cloud computing seems attractive to your company include	Between Groups	0.999	3	0.333	0.403	0.751
	Within Groups	46.271	56	0.826		
	Total	47.271	59			
using Cloud Computing now or in near future	Between Groups	0.475	3	0.158	0.659	0.581
	Within Groups	13.439	56	0.240		
	Total	13.913	59			
All items	Between Groups	0.068	3	0.023	0.193	0.901
	Within Groups	6.591	56	0.118		
	Total	6.659	59			

5.2.7 Department

"There is a statistically significant differences at the level of α ≤ 0.05 about market acceptance of cloud computingin Gaza it market refer to Department"

To test the hypothesis the one way ANOVA is used and the result illustrated in table no.(42) which show that the p-value equal 0.679 which is greater than 0.05 , that's means There is no statistically significant differences at the level of α = 0.05 about market acceptance of cloud computing in Gaza it market refer to Department.

Table 5.7 One way ANOVA test for differences about market acceptance of cloud computing in Gaza it market refer to Department

Field	Source	Sum of Squares	df	Mean Square	F value	Sig.(P-Value)
Service homogeneity of cloud computing	Between Groups	0.344	4	0.086	0.791	0.536
	Within Groups	5.974	55	0.109		
	Total	6.318	59			
Market structure of cloud computing	Between Groups	0.730	4	0.182	0.544	0.704
	Within Groups	18.452	55	0.335		
	Total	19.182	59			
price model	Between Groups	0.771	4	0.193	0.803	0.529
	Within Groups	13.200	55	0.240		
	Total	13.971	59			
Usage frequency of cloud computing	Between Groups	4.313	4	1.078	1.201	0.321
	Within Groups	49.399	55	0.898		
	Total	53.713	59			
why cloud computing seems attractive to your company include	Between Groups	2.611	4	0.653	0.804	0.528
	Within Groups	44.660	55	0.812		
	Total	47.271	59			
using Cloud Computing now or in near future	Between Groups	0.476	4	0.119	0.487	0.745
	Within Groups	13.438	55	0.244		
	Total	13.913	59			
All items	Between Groups	0.269	4	0.067	0.579	0.679
	Within Groups	6.390	55	0.116		
	Total	6.659	59			

5.3 *Hypothesis #2 Test*

In the following tables a one sample t test is used to test if the opinion of the respondent in the content of the sentences are positive (weight mean greater than "60%" and the p-value less than 0.05) or the opinion of the respondent in the content of the sentences are neutral (p- value is greater than 0.05) or the opinion of the respondent in the content of the sentences are negative (weight mean less than "60%" and the p-value less than 0.05)

5.3.1 Hypothesis a

There is a statistical significant relation between the service homogeneity of cloud computing services and the market structure of cloud computing services (at level of significance α≤ 0.05).

Chi-Square Tests are used to examine the correlation between service homogeneity of IT service and market structure of cloud computing at significance level α = 0.05, and cross-table 5.8 shows the frequency ant percentile, also table 5.9 shows that the chi-square test equal 30.631, p-value =0.000 < 0.05, so there is a significant correlation between Service homogeneity of IT service and Market structure of cloud computing at significance level α = 0.05.

Table 5.8 Service homogeneity * Market structure Crosstabulation

			Market structure of cloud computing				Total
			Short term transaction	Long term transaction	In-house transaction	No answer	
Service homogeneity of IT service	homogeneos	Count	69	75	90	40	274
		% of Total	12.8%	13.9%	16.7%	7.4%	50.7%
	heterogeneos	Count	50	28	80	30	188
		% of Total	9.3%	5.2%	14.8%	5.6%	34.8%
	No answer	Count	13	25	40	0	78
		% of Total	2.4%	4.6%	7.4%	.0%	14.4%
Total		Count	132	128	210	70	540
		% of Total	24.4%	23.7%	38.9%	13.0%	100.0%

Table 5.9 Chi-Square Tests

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.631[a]	6	.000
Likelihood Ratio	41.348	6	.000
Linear-by-Linear Association	.094	1	.759
N of Valid Cases	540		

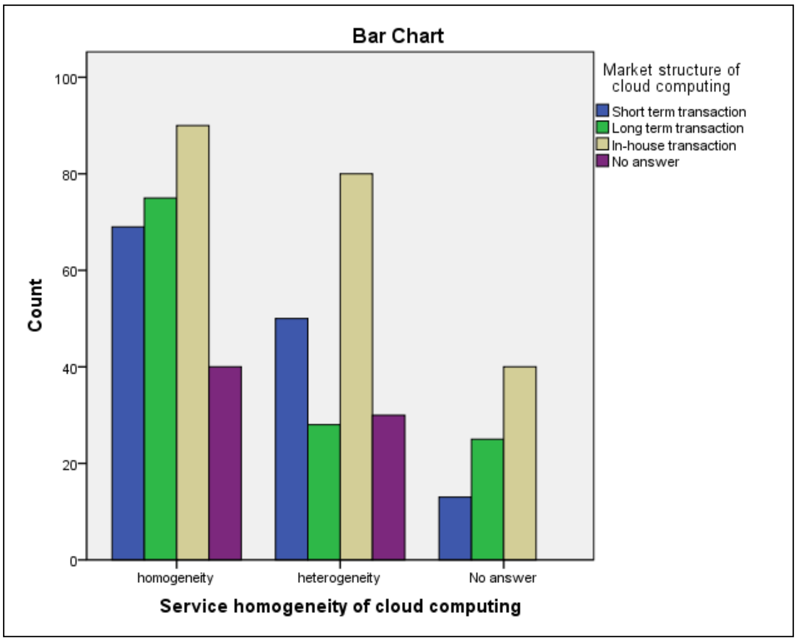

Figure 5.6 Service homogeneity * Market structure

5.3.2 Hypothesis b

There is a statistical significant relation between the usage frequency of IT service and the market structure of cloud computing services (at level of significance α≤0.05).

Chi-Square Tests are used to examine the correlation between usage frequency of IT service and market structure of cloud computing at significance level $\alpha = 0.05$, and cross-table 5.10 show the frequency ant percentile, also table 5.11 show that the chi-square test equal 54.347, p-value =0.000 < 0.05, so there is a significant correlation between usage frequency of IT service and Market structure of cloud computing at significance level $\alpha = 0.05$.

Table 5.10 Usage frequency * Market structure Crosstabulation

			Usage frequency of IT service						
			Very frequently (many times in a day)	Frequently (daily)	Normal(daily-weekly)	Infrequent (monthly)	Very Infrequent(rare)	No answer	Total
Market structure of cloud computing	Short term transaction	Count	21	44	25	9	13	20	132
		% of Total	3.9%	8.1%	4.6%	1.7%	2.4%	3.7%	24.4%
	Long term transaction	Count	24	30	13	15	12	10	104
		% of Total	4.4%	5.6%	2.4%	2.8%	2.2%	1.9%	19.3%
	In-house transaction	Count	47	60	35	25	16	25	208
		% of Total	8.7%	11.1%	6.5%	4.6%	3.0%	4.6%	38.5%
	No answer	Count	10	11	41	9	15	10	96
		% of Total	1.9%	2.0%	7.6%	1.7%	2.8%	1.9%	17.8%
Total		Count	102	145	114	58	56	65	540
		% of Total	18.9%	26.9%	21.1%	10.7%	10.4%	12.0%	100.0%

Table 5.11 Chi-Square Tests

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	54.347[a]	15	.000
Likelihood Ratio	52.919	15	.000
Linear-by-Linear Association	.882	1	.348
N of Valid Cases	540		

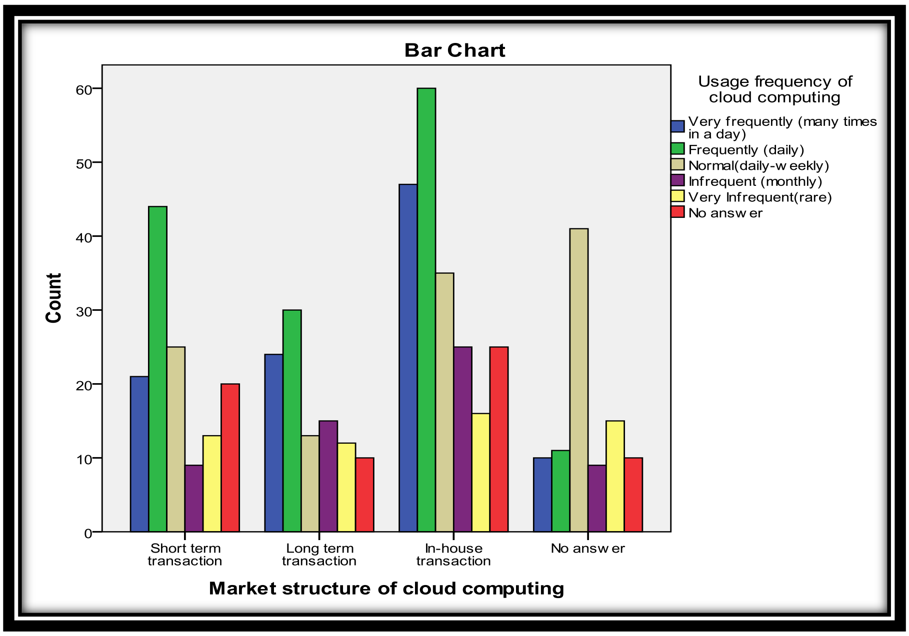

Figure 5.7 Usage frequency * Market structure

5.3.3 Hypothesis c

There is a statistical significant relation between the service homogeneity of IT service and the price model of cloud computing services (at level of significance α≤0.05).

We use Chi-Square Tests to examine the correlation between Service homogeneity of IT service and price model at significance level α = 0.05, and cross-table 5.12 show the frequency ant percentile, also table 5.13 show that the chi-square test equal 10.718, p-value =0.098 > 0.05, so there is no significant correlation between Service homogeneity of IT service and price model at significance level α = 0.05.

Table 5.12 Service homogeneity * price model Crosstabulation

			price model				Total
			Flat Pricing	Pay as you go Pricing	Mixture of Flat & Pay as you go	No answer	
Service homogeneity of IT service	Homogeneity	Count	82	105	60	27	274
		% of Total	15.2%	19.4%	11.1%	5.0%	50.7%
	heterogeneity	Count	55	72	42	19	188
		% of Total	10.2%	13.3%	7.8%	3.5%	34.8%
	No answer	Count	22	40	16	0	78
		% of Total	4.1%	7.4%	3.0%	0.0%	14.4%
Total		Count	159	217	118	46	540
		% of Total	29.4%	40.2%	21.9%	8.5%	100.0%

Table 5.13 Chi-Square Tests

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.718[a]	6	.098
Likelihood Ratio	17.117	6	.009
Linear-by-Linear Association	1.598	1	.206
N of Valid Cases	540		

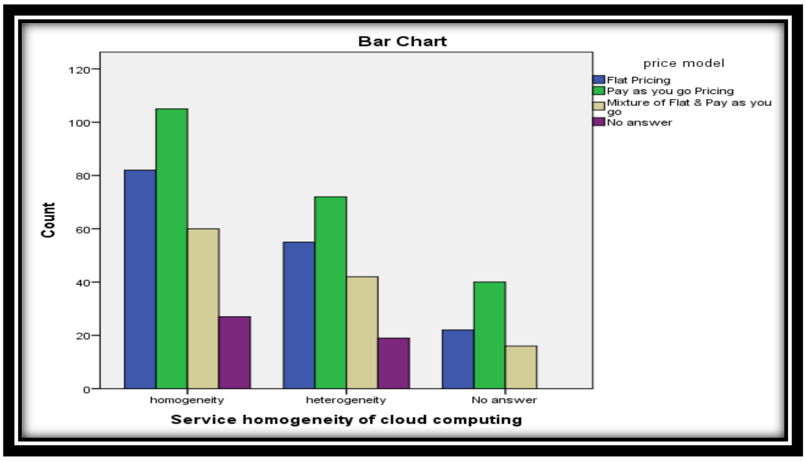

Figure 5.8 Service homogeneity * price model

5.3.4 Hypothesis d

There is a statistical significant relation between the usage frequency of IT services and the price model of cloud computing services (at level of significance α≤0.05).

We use Chi-Square Tests to examine the correlation between usage frequency of IT services and price model at significance level α = 0.05, and cross-table 5.14 show the frequency ant percentile, also table 5.15 show that the chi-square test equal 48.559, p-value =0.000 < 0.05, so there is a significant correlation between price model and Usage frequency of IT services at significance level α = 0.05

Table 5.14 usage frequency* price model Crosstabulation

			Usage frequency of cloud computing						Total
			Very frequently (many times in a day)	Frequently (daily)	Normal(daily-weekly)	Infrequent (monthly)	Very Infrequent(rare)	No answer	
price model	Flat Pricing	Count	30	42	34	10	20	45	181
		% of Total	5.6%	7.8%	6.3%	1.9%	3.7%	8.3%	33.5%
	Pay as you go Pricing	Count	60	45	29	20	10	18	182
		% of Total	11.1%	8.3%	5.4%	3.7%	1.9%	3.3%	33.7%
	Mixture of Flat & Pay as you go	Count	17	33	32	15	10	14	121
		% of Total	3.1%	6.1%	5.9%	2.8%	1.9%	2.6%	22.4%
	No answer	Count	9	19	14	3	4	7	56
		% of Total	1.7%	3.5%	2.6%	.6%	.7%	1.3%	10.4%
Total		Count	116	139	109	48	44	84	540
		% of Total	21.5%	25.7%	20.2%	8.9%	8.1%	15.6%	100.0%

Table 5.15 Chi-Square Tests

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	48.559[a]	15	.000
Likelihood Ratio	46.825	15	.000
Linear-by-Linear Association	4.683	1	.030
N of Valid Cases	540		

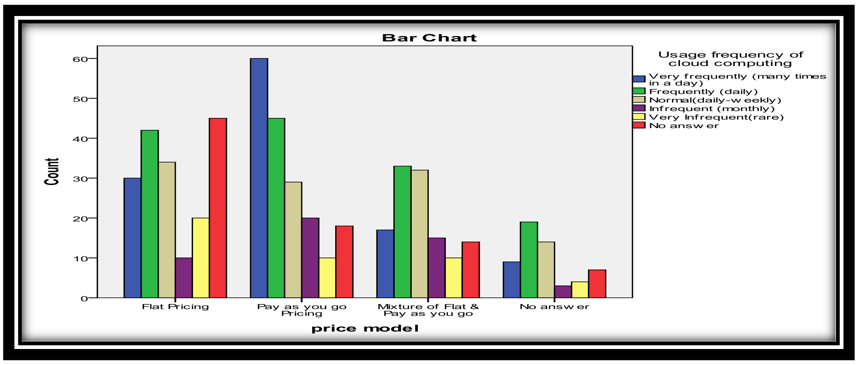

Figure 5.9 Usage frequency*price model

Chapter Six

Results & Further Research Directions

<u>Chapter Outline:</u>

6.1 Introduction:

6.2 Research Results

6.2.1 QuestionnaireParagraphs

6.2.2 Relation of Research Variables

6.3 Evaluation of research methodology

6.4 Concluding Remarks and Further Research Directions

6.1 Introduction:

The main propose of this thesis is to study the current and future market acceptance of Cloud Computing regarding the choice of market structure and price model, in light of service homogeneity and usage frequency of the IT services in Gaza IT market. As well as to measure the effects of the demographic factors such as gender, age, qualifications, type of position, position, years of experience.

The findings of applied and field study were obtained through collected questionnaires field study, unloading operations, conduct appropriate statistical hypothesis testing, and extraction and presentation of results. Then make the necessary recommendations and suggestions that would help Gaza IT market to take advantage of Cloud Computing Technology to improve and develop their organizations. Finally, setting of proposals for future studies that could be conducted.

6.2 Research Results

Through the results of the statistical analysis of the respondent's views, the most important findings of this study could be summarizing as following:

6.2.1 Questionnaire paragraphs

a. **Familiarity of Cloud Computing:**

35.0% from the sample are familiar strongly with the idea of Cloud Computing, and 63.3 % from the sample are familiar with the idea of Cloud Computing. Only 1.6% from the sample aren't familiar with the idea of Cloud Computing.

b. **IT-related investments**

21.7% from the sample agrees that company spend on IT related projects in 2014 from 5% to 20% of 2013 revenue, and 11.7% from the sample agrees that company spend on IT related projects in 2014 more than 20% of 2013 revenue. One possible reason for the high spending on IT-related projects among the respondents is that the majority of the responses came from IT companies.

c. Current Market Acceptance of Cloud Computing

46.7% of responses said they are already using some Cloud Computing services and expect to use more; 11.7% of responses said that they are already using some Cloud Computing services and do not expect to use more). One possible reason for that high ratio of Cloud Computing usage is: as a new concept, Cloud Computing has gained a range of different definitions, even from people familiar with it.

d. Reason for using Cloud Computing services

We find out that the *cost reason* is clearly the most influential one for buying Cloud Computing services: nearly all the respondents have chosen "Strongly Agree" or "Agree" for "*less capital lockup*", "*less sunk costs*" and "*less administration & maintenance costs*" as reasons for using Cloud Computing services. The least chosen reasons for using Cloud Computing services are "*monitoring tools and accountability*", "*quick integration*" and "*consolidation of legacy systems*".

e. Reason against using Cloud Computing services

The biggest concern among the responses is the "*security issue*". Nearly 64% of the respondents believe there can be certain "*lock-in*" problem by the Cloud Computing services The least concerned problem by the respondents is the potential "*high deployment costs*". The respondents tend to believe that Cloud Computing is not associated with high deployment costs at all

f. service homogeneity of IT service

Table 1 in Appendix C shows that 50.74% of the respondents prefer homogeneous IT services and only 34.81% of the respondents of the respondents prefer heterogeneous IT services. Heterogeneity makes it hard for a firm to standardize the quality of its services. Opposite of homogeneity.

g. Usage frequency of IT service

A summary of the usage frequency of various IT services is shown in Table 2 in Appendix C. Not surprisingly, the most frequently-used IT services are basic office applications (e.g. Microsoft Office software), raw computing resources (servers, storage discs and bandwidth etc.), and business applications (ERP software, CRM software etc.). Although we know that these data cannot fully represent the usage frequency of equivalent Cloud Computing services, we do notice that these services are among the first offered Cloud Computing services in the market. As shown in the Table 3.1 in Appendix A, companies like Google and Zoho are the pioneers providing online documents editing services, as an equivalent for the traditional Microsoft Office® software. Although these services are not yet widely accepted by large enterprises, it does offer the individuals an alternative for buying the software from Microsoft. As for business applications, we have already described the success of Salesforce.com on the On-Demand CRM application market in Chapter 3.1. And the situation by raw computing resources is even more obvious: the most Cloud Computing service providers on the current market are providing some sort of storage, backup, or synchronization services. So we believe that the Cloud Computing services on the current market match quite well the need of customers and potential customers for general IT services.

Compared to the services mentioned above, much fewer respondents said their companies use specialized applications and special IT services frequently. This is understandable because these services are "special", which means they are used only for certain proposes, products or customers. We have also observed that even fewer companies are starting to use Cloud Operating System. The Cloud Operating Systems are not necessarily an equivalent for Windows or Linux system. The word "Operating" here has a wider range of meaning. These systems work in a distributed system, or between many distributed systems, and are used as a platform for managing applications as well as resources in a network.

h. Market structure

Table 3 in Appendix C shows that the percent of short term transaction is 24.4% , and the percent of Long term transaction is 23.7% , and the percent of In-house transaction is 38.9%.

The high percent of In-house transaction means the buyers prefer not only to receive the services, but also to own the whole products and infrastructure, therefore gain the whole control of the service activity.

i. Price model

Table 4 in Appendix C shows that the percent of Flat Pricing is 29.4% , and percent of Pay as you go model is 40.2% , and percent of Mixture of Flat & Pay as you go is 21.9% , and percent of No answer = 8.5%.The high percent of Pay as you go model means that the users prefer to charge according to their actual usage of resources.

6.2.2 Hypothesis Testing Results

a. There is a significant correlation between service homogeneity of IT service and Market structure of cloud computing at significance level α = 0.05.
b. There is a significant correlation between usage frequency of IT service and Market structure of cloud computing at significance level α = 0.05.
c. There is no significant correlation between service homogeneity of IT service and price model at significance level α = 0.05.
d. There is a significant correlation between price model and Usage frequency of IT services at significance level α = 0.05

6.2.3 Answers of research questions

a. "What's the potential influence of the homogeneity of cloud computing services on customer’s choice of market structures of cloud computing services?"

According to table 5.8, customers prefer In-house transaction for homogeneous IT services and try to avoid long term transaction for heterogeneous IT services.

b. "What's the potential influence of usage frequency of cloud computing services on customer’s choice of market structures of cloud computing services?"

According to table 5.10, customers prefer In-house for all kind of IT services, when the usage frequency is high.

c. "What's the potential influence of the homogeneity of cloud computing services on customer’s choice of price model of cloud computing services?"

According to table 5.12, the homogeneity of cloud computing services doesn't effect on customer's choice of price model.

d. "What's the potential influence of usage frequency of cloud computing services on customer’s choice of price model of cloud computing services?"

According to table 5.14, customers prefer PAYG model when the usage frequency of cloud computing services is high.

6.3 Evaluation of Research Methodology

AS it is acknowledged that the service homogeneity and the usage frequency are not the only influencing factors for market structure and price model. For example, security issues may cause general concerns about the implementation of Cloud Computing outside the company, therefore users and potential users may prefer to use in-house Cloud Computing solutions, even when the services are highly homogeneous, and the transaction cost of obtaining the service from open market may be lower. While considering all these potential influencing factors is far beyond the scope of a master thesis, it seems there are certainly other factors worth further research efforts.

6.4 Concluding Remarks and Further Research Directions

This is the *first* empirical study in the market acceptance of Cloud Computing services in Gaza regarding the market structures and price models. Based on the customer survey, there are the following findings:

a. Generally, In Gaza the Cloud Computing market is still *at its early stage of development*. The main users in the market are so-called “innovators” and “early adopters”, and users still have many concerns facing the uncertainty of the technology evolvement as well as the business model development. However, the general attitude toward Cloud Computing services among the users and potential users is very positive.

b. *Service homogeneity* serves as a good indicator for the preferred *market structure* of certain Cloud Computing service. Generally, the users and potential users tend to choose open market transaction, i.e. Public Cloud for homogeneous services, and in-house transaction, i.e. Private Cloud for heterogeneous services.

c. The *usage frequency* does have certain influence on the preferred *price model*. Users tend to choose PAYG model for high-frequency services, and Flat Rate model for low-frequency services. Since the correlation between the usage frequency and price model is not extremely high, we recommend further investigation of the potential influencing factors on price models of Cloud Computing services.

d. Compared to the preferences from users and potential users of Cloud Computing services provided in the market match well their general need for IT services, but not the current need for Cloud Computing services.

   The services mostly promoted by the SPs, are the services with high usage frequency too, such as raw computing resources, basic office applications and business applications, but currently, most companies are not using Cloud Computing services for their core IT activities. While this mismatch can be solved in the market development of Cloud Computing in the future, it does have negative influence on the SPs' profitability by now.

This thesis can deliver hints for the development of Cloud Computing market as well as for further theoretical analyses in the future.

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Appendices

Appendix (A)

List of SPs

Companies	***Active/ Beta***	***A/P/R /T***	***PAYG /Mixture /Flat Rate***	***Service / Products***	***Notes***
10Gen	B	**P, A**		Hosting service	Open source
37signals	A	**A**		CRM solutions	
3Tera	A	**R, T**		Grid Hosting, AppLogic System	
Adobe Acrobat	B	**A**		Collaboration solutions	
Akamai	A	**A, T**		Application Performance Solutions	
Amazon AWS		**R**	PAYG	Cloud Computing ecosystem, (EC2, S3, SimpleDB, SQS, and FPS)	Cooperation with Salesforce
Aptana	B	**R, P**	PAYG	Computing service, "Aptana Studio" (platform)	
Areti (Alentus)	A	**R**	Mixture	Grid hosting (Ares), managed hosting, co-location	Using 3Tera's AppLogic
AT&T	A	**R**		Managed hosting	
Cassatt	A	**A,**		Hosting, Utility Computing (“Cassatt Active Response”)	

Cisco Systems	A	**A, T, P**		WebEx Connect platform, Data Center solutions	
Citrix (inc. XenSource)	A	**A, T**		Dynamic Application Delivery System, Citrix Cloud Center	
Cloudworks	A	**R, A**	PAYG	Storage service and backups	Supported by Citrix
cohesiveFT	A	**P, T**		Development platform, VM Management software	
Dell	A	**R, T**	Flat Rate	Dell Cloud Computing solutions	
Elastra	A	**R, P, T**	PAYG	"Elastic computing", system monitoring tools	Supported by Amazon S3
EMC (inc. VMware & Mozy)	A	**R, T, A**		storage & backup service, data center solutions	
Enki	A	**R**	PAYG	“Computing Utility” (Private Data Centers), co-location	Using 3Tera's AppLogic
Enomaly	B	**T**		"Enomalism Cloud Computing"	Open source
Eucalyptus	A	T		Eucalyptus Public Cloud	Open source
FlexiScale (Xcalibre)	A	R	PAYG	Server hosting	

Fortress ITX	A	R		Managed hosting, co-location	Using 3Tera's AppLogic
Gh.o.st	B	A		Virtual desktop	Supported by Amazon S3
GoGrid/ ServePath	B	R	PAYG	Grid hosting, “Cloud Connect”, storage	
Google	A	R, P	PAYG	App Engines (platform), storage	Python Environment
IBM	A	A, T	Flat Rate	"Blue Cloud", "Bluehouse"	
Joyent	A	R, A	Mixture	Computing and storage solution, Web application platform	
Microsoft (Azure platform etc.)	A	R, A, P		Azure platform, Collaboration solutions, ECM, Exchange Hosted Services, CRM	
Mosso	A	P	Mixture	Cloud storage, web hosting	
NetSuite	A	A		CRM, ERP and eCommerce	
Project Caroline (SUN)	B	P		“Platform as a Service” (PaaS)	Open source
QuickBase	A	P, A	Mixture	Online project management, online CRM etc.	
Right Scale	A	A, T	Flat Rate	Cloud computing Management	Based on Amazon AWS

Salesforce	A	P, A	Mixture	"AppExchange" (platform)	
SUN Network.com	A	R, A		Utility Computing (Network.com)	
Terremark	A	R	PAYG	Managed hosting, co-location	Member of "Green Grid"
Workday	A	A		HR management, financial management etc.	
Zoho	A	P, A		Online document software, CRM software, Zoho Marketplace	

Appendix (B)

Final Questionnaire in English

Islamic University of Gaza

Dean of Postgraduate Studies

Faculty of Commerce

Department of Business Administration

Questionnaire

Dear All…...

The researcher puts in your hands this questionnaire prepared for collecting data about a study entitled:

"Market Acceptance of Cloud Computing in Gaza IT Market

(An analysis of market structure and price models)"

Which this study be submitted in a partial fulfillment of the requirement for MBA degree, I hope you to cooperate and provide information to assist in the completion of this study.

The questionnaire aim to find out the potential influences of service homogeneity of cloud computing and the usage frequency of cloud computing on customer's choice of market structures and price models to focus on Market Acceptance of Cloud Computing in Gaza IT Market.

As you have the experience and professional in your work field, and also your currently position which related to the subject of the research, the researcher request you to see all questionnaire items in carefully ,and answer all of them in objectively and high professional. Your feedback and comments would be a matter of interest and they will have great impact regarding the enrichment of this study. Please note that its use will be limited to scientific research purposes. Moreover, the questionnaire will be treated confidentially.

Definition of Cloud Computing:

Cloud computing is computing environment or service model that enables real-time delivery of products or services and solutions over the Internet. A typical Cloud Computing service would be the Elastic Compute Cloud from Amazon. Furthermore, a popular field of Cloud Computing application is called Software as a Service (SaaS), where software is delivered via Internet or some centralized access points to the clients rather than installed locally on the user's device.

Research variables:

The dependent variables	The independent variables
The main variable: • Market acceptance of Cloud Computing **The sub-variables:** • Market structure of Cloud Computing. • Price model of Cloud Computing.	• Service homogeneity of the IT services. • Usage frequency of the IT services.

In accordance with achieving the aimed goal of this study; this questionnaire is designed in two parts:

Part one: Include the general information of study Respondents.

Part two: Include the four dimensions of the study, which are:

he first dimension *(general information and knowledge of Cloud Computing)***:** general questions about the company (type of company, IT activities and budget) and questions about the status quo of Cloud Computing market, including how many companies among the respondents are already using or plan to use Cloud Computing services, as well as their opinions on the pros and cons of Cloud Computing services.

The second dimension (*service homogeneity of IT service*): questions about the respondent's opinion on the service homogeneity of the IT services they use.

The third dimension (*usage frequency of IT service*): questions about the respondents' opinion on the Usage frequency of the IT services they use.

The fourth dimension *(market structure)*: this section contains a question about the respondents' preferred market structure.

The fifth dimension *(price model)*: this section contains a question about the respondents' preferred price model.

Thank you for your cooperation

Researcher

Eng. Faten Abu Dagga

Part One: Personal Functional Information

Please put out the signal (√) in front of the correct answer

1. **Gender:**
    - ☐ Male
    - ☐ Female
2. **Qualification:**
    - ☐ Bachelor
    - ☐ Master
    - ☐ PhD
3. **Age (in years)**
    - ☐ Below 30 years
    - ☐ From 30 – below40
    - ☐ From40 –below50
    - ☐ Above 50 years
4. **Field of Specialization**
    - ☐ Commerce
    - ☐ Engineering
    - ☐ IT
    - ☐ Other Specify____________
5. **Position**
    - ☐ Director
    - ☐ Manager
    - ☐ Head of Department
    - ☐ Head of Unit
    - ☐ Engineer Administrator
6. **Years of Experience at this company**
    - ☐ Less than 5
    - ☐ From 5 – less than 10
    - ☐ From10–less than 15
    - ☐ Above 15 years
7. **Department**
    - ☐ Technical
    - ☐ Commercial
    - ☐ Financial
    - ☐ Corporate supply chain
    - ☐ Human Resources

Part Two:

The first *dimension* (*general information and knowledge of Cloud Computing***):**

****Please put out the signal (√) in front of the correct answer*

1. I am familiar with the idea of Cloud Computing.

- ☐ Strongly Agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly Disagree

2. How much did your company spend on IT related projects in 2014?

- ☐ 0-1% of 2013 revenue
- ☐ 1%-5% of 2013 revenue
- ☐ 5%-20% of 2013 revenue
- ☐ >20% of 2013 revenue
- ☐ Not sure

3. The best description of Cloud Computing's current role for your company is:

- ☐ We are already using some Cloud Computing services and don't expect more.
- ☐ We are already using some Cloud Computing services and planning to use more.
- ☐ We are planning to use some Cloud Computing services in near future.
- ☐ We regard Cloud Computing as a vision which won't be implemented in near future.
- ☐ Other

4. The reason(s) why Cloud Computing seems attractive to your company include(s):

	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
Less capital lockup					
Less sunk costs and separate capex & opex					
Less administration and maintenance costs					
High scalability of the system continuity and avilability					
Less data loss or other security issues					
The interoperability of Cloud Computing services					
Quick integration into existing implementations					
Less deployment time and complexity					
Better monitoring tools and accountability of services					
Consolidation of legacy systems					
Environment awareness(Green IT)					

5. Your concern(s) about using Cloud Computing now or in near future is/are :

Item	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
Technology immaturity					
Technology complexity					
Potential system failure due to hardware problems					
Security issues (data loss, confidential information etc.)					
Legacy infrastructure					
Legal compliance					
High deployment costs					
Lock in problem and opportunity cost by following the wrong trend					
Hostile software licensing regime					

The second dimension *(service homogeneity of IT service)*:

1. Which *service homogeneity* would you prefer for each of the following IT service:

Item	Homogeneous service	Heterogeneous service	No answer
Storage, archiving and disaster recovery			
Raw computing power (CPU, Memory etc)			
Dedicated data center or servers (e.g. Dell, HPC etc.)			
Basic office applications (e.g. Microsoft Office)			
Business applications (e.g. SAP ERP system)			
Specialized applications or solutions (e.g. simulation software for financial industry)			
Specialized IT services, such as security, management and compliance			
Cloud Operating System (e.g. Windows Azure from Microsoft)			
Online Application Exchange Platform (e.g. Salesforce.com)			

The third dimension *(usage frequency of IT service*)

1. How frequently does your company use the following IT services?

Item	Very frequently (many times in a day)	Frequently (daily)	Normal (daily-weekly)	Infrequent (monthly)	Very Infrequent (rare)	No answer
Storage, archiving and disaster recovery						
Raw computing power (CPU, Memory etc)						
Dedicated data center or servers(e.g. Dell, HPC etc.)						
Basic office applications (e.g. Microsoft Office)						
Business applications (e.g. SAP ERP system)						
Specialized applications or solutions (e.g. simulation software for financial industry)						
Specialized IT services, such as security, management and compliance						
Cloud Operating System (e.g. Windows Azure from Microsoft)						
Online Application Exchange Platform (e.g. Salesforce.com)						

The fourth dimension ***(market structure)***

1. Which transaction type would you prefer for each of the following Cloud Computing service:

Item	Short term transaction	Long term transaction	In-house transaction	No answer
Storage, archiving and disaster recovery				
Raw computing power (CPU, Memory etc)				
Dedicated data center or servers (e.g. Dell, HPC etc.)				
Basic office applications (e.g. Microsoft Office)				
Business applications (e.g. SAP ERP system)				
Specialized applications or solutions (e.g. simulation software for financial industry)				
Specialized IT services, such as security, management and compliance				
Cloud Operating System (e.g. Windows Azure from Microsoft)				
Online Application Exchange Platform (e.g. Salesforce.com)				

The fifth dimension *(price model)*

1. Which price model would you prefer for each of the following Cloud Computing service?

Item	Flat Pricing	Pay as you go Pricing	Mixture of Flat & Pay as you go	No answer
Storage, archiving and disaster recovery				
Raw computing power (CPU, Memory etc)				
Dedicated data center or servers (e.g. Dell, HPC etc.)				
Basic office applications (e.g. Microsoft Office)				
Business applications (e.g. SAP ERP system)				
Specialized applications or solutions (e.g. simulation software for financial industry)				
Specialized IT services, such as security, management and compliance				
Cloud Operating System (e.g. Windows Azure from Microsoft)				
Online Application Exchange Platform (e.g. Salesforce.com)				

Appendix (C)
Survey Results

Table (1) service homogeneity of IT service

No.	Items		homogeneity	heterogeneity	No answer
1	Storage, archiving and disaster recovery		٤٦	١٤	٠
2	Raw computing power (CPU, Memory etc)		٤٠	١٧	٣
3	Dedicated data center or servers (e.g. Dell, HPC etc.)		٣٣	١٨	٩
4	Basic office applications (e.g. Microsoft Office)		٤١	١٨	١
5	Business applications (e.g. SAP ERP system)		٢٥	٢٧	٨
6	Specialized applications or solutions (e.g. simulation software for financial industry)		٢٧	٢٢	١١
7	Specialized IT services, such as security, management and compliance		٣١	٢٨	١
8	Cloud Operating System (e.g. Windows Azure from Microsoft)		١٣	٢٥	٢٢
9	Online Application Exchange Platform (e.g. Salesforce.com)		١٨	١٩	٢٣
	All items	count	274	188	78
		%	50.74	34.81	14.44

Table (2) usage frequency of IT service

No.	**Items**		Very frequently (many times in a day)	Frequently (daily)	Normal(daily-weekly)	Infrequent (monthly)	Very Infrequent(rare)	No answer
1	Storage, archiving and disaster recovery		30	16	4	4	4	2
2	Raw computing power (CPU, Memory etc)		19	15	11	1	6	8
3	Dedicated data center or servers (e.g. Dell, HPC etc.)		12	14	9	6	9	10
4	Basic office applications (e.g. Microsoft Office)		22	18	11	4	1	1
5	Business applications (e.g. SAP ERP system)		7	9	15	10	10	9
6	Specialized applications or solutions (e.g. simulation software for financial industry)		8	18	15	6	8	5
7	Specialized IT services, such as security, management and compliance		10	21	15	5	7	2
8	Cloud Operating System (e.g. Windows Azure from Microsoft)		4	11	10	5	10	20
9	Online Application Exchange Platform (e.g. Salesforce.com)		1	14	7	10	11	17
	All items	count	102	145	114	58	56	65
		%	18.9%	26.9%	21.1%	10.7%	10.4%	12.0%

Table (3) Market structure

No.	**Items**		Short term transaction	Long term transaction	In-house transaction	No answer
1	Storage, archiving and disaster recovery		14	15	29	2
2	Raw computing power (CPU, Memory etc)		21	10	22	7
3	Dedicated data center or servers (e.g. Dell, HPC etc.)		18	10	27	5
4	Basic office applications (e.g. Microsoft Office)		16	12	25	7
5	Business applications (e.g. SAP ERP system)		16	16	19	9
6	Specialized applications or solutions (e.g. simulation software for financial industry)		9	12	27	12
7	Specialized IT services, such as security, management and compliance		13	11	29	7
8	Cloud Operating System (e.g. Windows Azure from Microsoft)		13	9	16	22
9	Online Application Exchange Platform (e.g. Salesforce.com)		12	9	14	25
	All items	count	132	128	210	70
		%	24.4%	23.7%	38.9%	13.0%

Table (4) Price model

No.	**Items**	Flat Pricing	Pay as you go Pricing	Mixture of Flat & Pay as you go	No answer
1	Storage, archiving and disaster recovery	25	22	12	1
2	Raw computing power (CPU, Memory etc)	19	23	14	4
3	Dedicated data center or servers (e.g. Dell, HPC etc.)	22	23	14	1
4	Basic office applications (e.g. Microsoft Office)	18	27	13	2
5	Business applications (e.g. SAP ERP system)	11	25	17	7
6	Specialized applications or solutions (e.g. simulation software for financial industry)	12	25	19	4
7	Specialized IT services, such as security, management and compliance	25	26	6	3
8	Cloud Operating System (e.g. Windows Azure from Microsoft)	9	20	13	18
9	Online Application Exchange Platform (e.g. Salesforce.com)	13	18	13	16
	All items count	159	217	118	46
	All items %	29.4%	40.2%	21.9%	8.5%

Table (5) The best description of Cloud Computing's current role for your company

The best description of Cloud Computing's current role for your company	Frequency	Percentages
We are already using some Cloud Computing services and planning to use more	28	46.7
We are planning to use some Cloud Computing services in near future	17	28.3
We are already using some Cloud Computing services and don't expect more	7	11.7
We regard Cloud Computing as a vision which won't be implemented in near future	5	8.3
Other	3	5.0
Total	60	100.0

Table (6) why Cloud Computing seems attractive to your company include

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
4	High scalability of the systemcontinuity and avilability	4.72	4.207	94.33	3.161	0.002
1	Less capital lockup	4.20	0.819	84.00	11.346	0.000
7	Quick integration into existing implementations	4.13	5.482	82.67	1.601	0.115
2	Less sunk costs and separate capex&opex	3.88	0.761	77.67	8.989	0.000
3	Less administration and maintenance costs	3.88	0.904	77.67	7.571	0.000
8	Less deployment time and complexity	3.52	1.066	70.33	3.756	0.000
6	The interoperability of Cloud Computing services	3.47	0.833	69.33	4.340	0.000
9	Better monitoring tools and accountability of services	3.37	0.920	67.33	3.087	0.003
11	Environment awareness(Green IT)	3.35	0.988	67.00	2.743	0.008
5	Less data loss or other security issues	3.18	1.242	63.67	1.144	0.257
10	Consolidation of legacy systems	3.03	1.149	60.67	0.225	0.823
	All items	3.70	0.895	74.06	6.084	0.000

Table (7) using Cloud Computing now or in near future

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
1	Technology immaturity	3.72	0.976	74.33	5.689	0.000
2	Technology complexity	3.55	1.016	71.00	4.195	0.000
3	Potential system failure due to hardware problems	3.58	0.829	71.67	5.448	0.000
4	Security issues (data loss, confidential information etc.)	3.72	1.010	74.33	5.496	0.000
5	Legacy infrastructure	3.45	0.872	69.00	3.998	0.000
6	Legal compliance	3.50	0.873	70.00	4.435	0.000
7	High deployment costs	3.27	1.177	65.33	1.755	0.084
8	Lock in problem and opportunity cost by following the wrong trend	3.23	1.047	64.67	1.725	0.090
9	Hostile software licensing regime	3.50	1.066	70.00	3.634	0.001
	All items	3.50	0.486	70.04	8.005	0.000

Appendix (D)
Table 1 Companies that participate in the study.

No	Company Name	Contact Name	Mobile	E-Mail	Tel.	Tel	City
1	AL-Qudwa Company	Ahmad alqudwa	599-999919	info@alqudwa.ps	972-8-2827717	972-8-2823933	Gaza
2	ALTARIQ Systems & Projects	Tarek M. Eslim	599-529295	tarek@altariq.ps, tarek@p-i-s.com	970-8-2860280	970-8-2847736	Gaza
3	Bisan Tech for Systems & Communications Ltd	Haitham AL Khateeb	599-677904	Haitham@BisanTech.ps	970-8-2888719	970-8-2888709	Gaza
4	BeOnline						
5	Castle Establishment Company	Majdy Abu Daff	594-35450	castle@castlesoft.net	970-8-2833211	970-8-2846885	Gaza
6	citynet	Majdi Almaqadma	599-417329	info@citynet.ps	970-8-2821373	970-8-2864715	Gaza
7	Computer Connect	Mohamed Abu Nahla	599-602545	m.ali@connect.ps	970-8-2843387	970-8-2882213	Gaza
8	Computer Land Center	Merwan Kehail	599-855662	info@computerland.ps	970-8-2852229	970-8-2855662	Gaza
9	Development Pioneers Company for Consultations	Wessam Suliman Al Moamer	589-763179	info@pioneer.ps	972-8-2888781	972-8-2888781	Gaza
10	Effects For Consultations and Development	Nahed Eid	599-988776	info@effects.ps	970-2-2233445	970-2-2233445	Gaza
11	Fusion for Internet services and TeleCommunication systems	Khaled Abu Hasna	599-626323	info@fusion.ps	970-2-2977439	970-8-2880158	Gaza
12	Future Information Systems	Jihad Kaloub	594-07724	jihad@fis.ps	972-8-2820207	972-8-2820065	Gaza
13	Future Tech	Mohamad El-Alami	594-1234	alamim@futuretech-pal.com	970-8-2835655	970-8-2847355	Gaza
14	Impact Consulting, Inc.	Rami A. Wihaidi	599-224084	rami.wihaidi@impact.ps	970-8-2827777	970-8-2827777	Gaza
15	Jamal Sons Telecom Computer Systems Ltd.	Mohammed Jamal Salem Haboush	595-00600	jamal@jamalsons.com	970-8-2833507	970-8-2867199	Gaza
16	jerusalem information technology	ayman h. bakroun	599-424141	ayman@jit-co.ps	970-8-2824446	970-8-2824445	Gaza
17	johatoon for cartoon	Omima Joha	599-865227	info@johatoon.ps	970-8-2843197	970-8-2843197	Gaza
18	Link Information Technolojy	Hazem Zyad Al Asaly	598-295031	hazem@linkit.ps	970-8-2825520	970-8-2825530	Gaza
19	Mdar Co. for management and software	Munis Ahmed	599-064276	info@mdar.ps	972-8-2862338	972-8-2862338	Gaza
20	Modern Tech Corporation (MTC)	Rassem Fayez Mushtaha	599-408843	mtcg@mtcgaza.com	970-8-2820929	970-8-2824099	Gaza
21	Nepras for Media and IT	Fady Issawi	599-494971	fady.issawi@nepras.com	970-8-2835933	970-8-2820332	Gaza
22	netstream	Ziad Elshikhdeeb	599-479195	ziad.deeb@netstream.ps	972-8-2883900	972-8-2883900	Gaza
23	P A L I N V E S T® - Development and Business Services	Ahmed F. ElFarra	598-182222	aelfarra@palinvest.ps	970-8-2889777	970-8-2889776	Gaza
24	Palestine For Communication & IT	Dr. Mahir B. Sabra	599-600043	msabra@pcit.ps	972-8-2889129	972-8-2889129	Gaza

25	PC WORLD COMPANY LTD	AHMED-RAMI Y ABU ELOUN	594-07670	rami@pcworld-co.com	970-8-2825968	970-8-2824229	Gaza
26	SADAF Technology Development	Mohammed Alafranji	599465222	info@sadaf.ps	970-8-2843388	970-8-2888821	Gaza
27	Sidata Information and Communication Systems Ltd.	Fawaz Khaled El-Alami	599716106	info@sidata.ps	970-8-2824665	970-8-2825131	Gaza
28	Speed Click for IT & Tele Communications Ltd.	Wael Mohammed Hamdy Nabhan	599-601602	wael@speedclick.ps	970-8-2886004	970-8-2886004	Gaza
29	TATWEER Business Services	Haitham Abu Shaaban	599-479209	haitham.abushaaban@tatweer.ps	970-8-2882700	970-8-2882600	Gaza
30	Teletalk Telecom Co.Ltd	Talal T. Khalil	598-280028	Info@teletalk.ps	970-2-2977445	970-8-2881123	Gaza
31	Unit One ICT	Saady S. Lozon	599-750531	info@unitone.ps	972-8-2843130	972-8-2883607	Gaza
32	VISION PLUS	Ashraf Elyazouri	599-526119	info@visionplus.ps	970-8-2888776	970-8-2884888	Gaza
33	Ziyad Mourtaga & Bros. Co.	ashraf demaidi	599-600666	info@z-mourtaga.ps	970-8-2867593	970-8-2866562	Gaza

Appendix (E)
Referees Who Judge the Reliability of the questionnaire

No.	Name	Position
1	Prof. Dr. Yousef Ashour	Professor at Commerce College - IUG
2	Prof. Dr. Faris Abu Mouamar	Professor at Commerce College - IUG
3	Dr. Wassim Al Habil	Associate Professor at Commerce College - IUG
4	Dr. Sami Abou-Al-Ross	Assistant Professor at Commerce College – IUG
	Dr. Nafez Barakat	Assistant Professor at Commerce College – IUG
5	Dr. Ayman Abu Samra	Assistant Professor at Engineering College – IUG
6	Dr. Mohamed Al Hanjouri	Assistant Professor at Engineering College – IUG