THE UNIVERSITY OF TURKISH AERONAUTICAL ASSOCIATION

INSTITUE OF SCIENCE AND TECHNOLOGY

ADOPTION OF CLOUD COMPUTING IN E-GOVERNMENT FOR THE REPUBLIC OF IRAQ

MASTER THESIS

Israa AL-OGAILI

THE DEPARTMENT OF INFORMATION TECHNOLOGY

THE PROGRAM OF INFORMATION TECHNOLOGY

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Supervisor: Assist. Prof. Dr. Meltem IMAMOGLU

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Israa Jaber, having student number 1406050022, enrolled in the master program at the Institute of Science and Technology at the University of Turkish Aeronautical Association, after meeting all of the required conditions contained in the related regulation, has successfully accomplished, in front of the jury, the presentation of the thesis prepared with the title " Adoption of Cloud Computing in E-government for the Republic of Iraq ".

Supervisor: **Assist. Prof. Dr. Meltem Y. IMAMOGLU**
Türk Hava Kurumu Üniversitesi ----------

Jury Members: **Assist. Prof. Dr. Gülesin SENA DAŞ**
Kırıkkale University ----------

Assist. Prof. Dr. Shadi AL SHEHABI
Türk Hava Kurumu Üniversitesi ----------

Assist. Prof. Dr. Meltem Y. IMAMOGLU
Türk Hava Kurumu Üniversitesi ----------

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THE UNIVERSITY OF TURKISH AERONAUTICAL ASSOCIATION
INSTITUE OF SCIENCE AND TECHNOLOGY

I hereby declare that this thesis, submitted to Turk Hava Kurumu universities as the fulfillment of requirements for the degree of Master of Information Technology, entitled: Adoption of Cloud Computing in E-government for the Republic of Iraq, it has not been submitted as an exercise for a similar degree at any other university. I also certify that the work described here is entirely my own except for excerpts and summaries whose sources are appropriately cited in the references.

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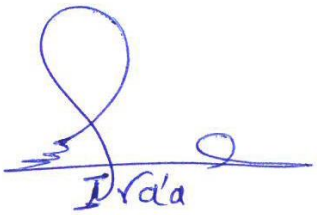

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LIST OF ABBREVIATION

E-government	Electronic Government
ICT	Personal Computer
IT	Internet Protocol
SPSS	Statistical Package for Social Sciences
G2C	Government to Citizen
G2G	Government to Government
G2B	Government to business
G2E	Government to employee
SaaS	Software as a service
PaaS	Platform as a service
IaaS	Infrastructure as a service
CPU	Central Processing Unit
CIO	Chief information officer
CSO	Central Statistics Organization
TR	Trust
CA	Compatibility
CX	Complexity
SE	Security
BU	Budget
ITI	IT Infrastructure
ITK	IT knowledge
TRE	Technology Readiness
MS	Managerial Support
RA	Relative Advantage
ACC	Adoption of Cloud Computing
A	Accept
NA	Not Accept
NS	Not Significant

ABSTRACT

ADOPTION OF CLOUD COMPUTING IN E-GOVERNMENT FOR THE REPUBLIC OF IRAQ

AL-OGAILI, Israa
Master, department of information technology
Thesis Supervisor: Assist. Prof. Dr. Meltem Y . IMAMOĞLU
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E-government uses the Internet to provide governmental services to the Government, employees, businesses and citizens electronically to reduce time cost and effort. In order to increase the efficiency and effectiveness of e-government, government applies the appropriate technologies. One of these technologies is cloud computing.

Cloud computing is defined as one of the technologies that significantly affects government tasks and electronic services provided to citizens, government organizations, businesses, and enterprises. Furthermore, cloud computing provides new technical tasks of e-government and eliminates the challenges of e-government.

The primary objective of our research is to determine the factors that to affect the adoption of cloud computing technology and to propose a cloud computing model by e-government in Iraq. For this purpose, a survey is prepared with a number of factors, such as trust, budget, compatibility,

complexity, security, IT infrastructure, IT knowledge, technological readiness, managerial support, and relative advantage, all of which can affect the adoption of cloud computing in e-government.

Data are collected from the respondents of 22 Iraqi ministries. Finally, a model of cloud computing is proposed based on the results of the analysis of applied questionnaire.

The proposed model passed through four levels in order to make our solution understandable. In the proposed model, the cloud computing provider would responsible SaaS, IaaS, and PaaS services to every Iraqi ministry in one platform that will help to sustain interoperability. Moreover, the proposed model financial benefit is calculated based on a one Ministry case and it shows that to reduce the cost of e-government Information Technology expenditures by 97.7%.

KEYWORDS: E-Government, Cloud Computing, Modeling, Statistical Analysis, Survey, Iraq.

ÖZET

IRAK CUMHURİYETİ'NDE E-DEVLET İÇİN BULUT BİLGİ İŞLEM SİSTEMİNİN UYARLANMASI

AL-OGAILI, Israa
Yüksek Lisans Tezi, bilgi teknolojileri bölümü
Tez Danışmanı: Yard. Doç. Dr. Meltem Y . IMAMOĞLU
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E-devlet harcanan zaman, butce ve çabadan tasarruf edilmesi için internet kullanılarak Hükümetlere, çalışanlara, işletmelere ve vatandaşlara elektronik ortamda devlet hizmetleri sağlamaktadır. E-devletin etkililiğinin ve veriminin artırılması için e-devlet uygun teknolojileri kullanmaktadır. Bu teknolojilerden birisi ise bulut bilişim teknolojisidir.

Bulut bilişim devletlerin kendi iclerindeki Bilgi Teknolojileri servislerini ve vatandaşlara sağlanan elektronik hizmetleri önemli oranda olumlu yonde etkileyen teknolojilerden birisi olarak tanımlanmaktadır. Bunun yanında, bulut bilişim sistemi yeni e-devlet teknik görevleri sağlamakta, birlikte calisbilir altyapilara imkan vermekte ve e-devlet üzerinden yaşanan zorlukların önüne geçmektedir.

Araştırmamızın birincil hedefi Irak' ta e-devlet uygulamalari içerisinde bulut bilişim sisteminin uyarlanmasını etkileyen faktörleri belirlemek ve bir bulut bilişim sistemi modeli ortaya koymaktır. Bu amaçla, e-devlet içerisinde bulut bilişm sisteminin uyarlanmasını etkileyen güven, bütçe, uyumluluk,

karmaşıklık, güvenlik, bilgi teknolojisi alt yapısı, bilgi teknolojisi bilgisi, teknolojiye hazır olmak, yönetimsel destek ve göreceli avantajlar gibi faktöleri içeren bir anket hazırlanmıştır.

Veriler Irak'taki 22 bakanlıkta anketi yanıtlayanlardan elde edilmiştir. Bu anketlerden elde edilen sonuçların analiz edilmesine dayanılarak bir bulut bilşim sistemi modeli önerilmiştir.

Önerilen modelin daha iyi anlaşılabilmesi için, model dört seviyede acıklanmıştır. Önerilen modelde, bulut bilişim hizmet sağlayıcı Irak'taki her bakanlığa SaaS, IaaS, ve PaaS servislerini sağlayacaktır. Bunun yanında ornek bir bakanlık ele alınarak yapılan matematiksel hesaplamalar ile önerilen modelin e-devlet Bilgi Teknolojileri harcamaları maliyetini %97.7 oranında azalttığı görülmüştür.

ANAHTAR KELİMELER: E-Devlet, Bulut Bilişim, Modelleme, Istatistiksel Analiz, Anket, Irak.

CHAPTER ONE

INTRODUCTION

1.1 Background

The concept of e-government appeared more than two decades ago, and many countries around the world have sought to apply e-government for public organizations in order to increase the efficiency of government services and serve citizens electronically [1].

The concept of e-government has been adopted by most developed and developing countries detailed in section 2.5. Citizens are able to accomplish government and commercial transactions electronically instead of following traditional routines and procedures [1].

E-government increases the efficiency and transparency of state administration. Moreover, it improves the performance of government by making it more efficient and effective [2]. E-government helps to develop the economy by relying on knowledge and modern technology. Furthermore, it provides the possibility of involving citizens and civil society in discussions of policies through direct dialogue and by supporting decision-making and policy formulation in a manner acceptable not only to citizens and citizens' requirements, but also private organizations [1] [2].

The Science and Technology Department was founded at the Ministry of Higher Education in Iraq. This new department oversaw the creation of the

e-government project in 2004. However, due to severe conditions in Iraq, the Science and Technology Department created the Iraqi portal, which is a guide to provide knowledge to citizens about the required documents in transactions. However, the Iraqi portal does not offer electronic services. In 2014, the Iraqi portal ceased operations, and the e-government program commenced. At the end of 2014, the e-government program was launched in Iraq. [3].

The application of an e-government project is one of the pillars of the country's development. Moreover, it is a major element in the fight against corruption. However, the application of this project requires cooperation between citizens and government agencies. The rate of adoption by the citizen of e-government is important for the success of the project [5].

The general problems of e-government can be defined as the absence of an efficient infrastructure for information and communication technology ICT, a lack qualified IT staff, the interaction between government and citizen still being inactive, a lack of laws support electronic signatures, and security difficulties. Moreover, other problems include the weakness of the relationship between the private and public sectors, the lack of awareness of the community regarding the acceptance of e-government services, and finally, the lack of trust between citizens and the public sector [1] [6].

1.2 Research problems

Public organizations are not able to communicate electronically with each other due to the complexity of the software and hardware are used in e-government systems.Other reasons for governmental institutions not being able to communicate electronically with each other include the lack of budget, lack of managerial support, lack of trust in the provided services via the Internet, the lack of efficiency and effectiveness of e-government, the lack of knowledge and experience of staff in Iraqi ministries, governmental data being vulnerable to theft and loss, the deterioration of the situation in Iraq and

its effect on the sustainability of the technology, and weakness of the ICT infrastructure.E-government data are continuously becoming increasingly complex; therefore, it has become necessary to adopt a suitable model for Iraqi e-government to face the challenges and problems in the electronic government more easy and make the e-government system more effective and more efficient. Cloud computing is characterized by multiple benefits can serve us to overcome the challenges of e-government [7].

Cloud computing is defined as one of the technologies significantly affects government functions and electronic services provided to citizens, businesses, and employees. Moreover, cloud computing provides new technical capabilities to e-government [8]. Cloud computing is a field of application development for a vibrant life provides solutions to e-government infrastructure development at a lower cost and fewer time requirements [9].

Organizations desire to improve and update their systems must adopt cloud computing as it has many of the flexible and necessary resources required by organizations that are available on the cloud [10]. If agencies are ready to move to the cloud, the virtual desktop and software and infrastructure as a service will be available to the organizations [11].

E-government is a path to achieving perfect government via ICT in order to improve citizen participation. The aim of e-government is to establish robust and transparent relationships among citizens, government organizations, and business organizations. Moreover, it ensures improved services, government operations and a perfect democratic environment for government operations [9].

1.3 Research Objective

The primary objectives of our research are to propose a model of cloud computing for e-government in Iraq depending on the determining factors that affect the adoption of cloud computing in e-government.

In this research, we focus on determining the techniques and services of cloud computing which are used in governmental organizations by distributing a questionnaire toIraqi government employees. Furthermore, we propose an appropriate model for cloud computing in Iraq's e-government so as to be more effective and efficient and because the level of the adoption of e-government by citizens is not satisfactory[12].

We will apply an SPSS analysis to analyze the data collected from the questionnaire. Following this, we propose a cloud computing model to carry all e-government services and to take advantage of it on one cloud computing platform. Moreover, we learn from the experiences of other countries which have adopted cloud computing in order to know about the types of clouds and services that are adopted by electronic governments. We illustrate these experiments in Chapter 2.

Cloud computing pertains to the ability to access information, services, and devices anywhere and at any time. It increases the skills of staff, and it can increase the scalability. Moreover, it reduces the costs of e-government because when these services are carried on one cloud, software, hardware, energy, networks, training employees, and so on are no longer necessary [13].

1.4 Research Contribution

Our research is important as it will provide decision-makers with a model of cloud computing for e-government in Iraq depends on determining the factors that affect the adoption of cloud computing in e-government.

Therefore, it can accelerate the development of the e-government project in Iraq.

The Iraqi government is in need of this study as it will reduce the number of years of effort in the development of e-government. Citizens can profit from the services of e-government because it will be more reliable, secure, and interactive with cloud computing. Moreover, businesses and governmental agencies may profit from our study to enhance their interactions and reduce costs by utilizing e-government services depend on cloud computing. Finally, our study may reduce the development costs of e-government by proposing an appropriate model of cloud computing for e-government. Furthermore, there has been no previous study proposing a model of cloud computing for e-government in Iraq, and this reinforces the importance of our research.

Our research was conducted with every ministry having participated in the e-government program. The participants in our study are experts and IT staff in every agency and ministry in Iraq.

1.5 The Structure of the Thesis

- Chapter 2 presents a literature review for e-government and cloud computing.
- Chapter 3 presents the current situation of Iraqi e-government services.
- Chapter 4 is a presentation of the research methodology of this thesis.
- Chapter 5 is an analysis of a survey and a discussion of the outcomes of the analysis.
- Chapter 6 introduces a proposed model for cloud computing.
- Chapter 7 contains the conclusion of our research**.**

CHAPTER TWO

LITERATURE REVIEW

2.1 E-Government Stages and Types

Depending on reading some papers, there are many definitions of E-government, it leads to a single meaningless. It is using information and communication technology in all organizations of the state to give the best services to citizens and agencies in the existence of the Internet 24/7. Such that, all the activities and services are in a single location. There is a coordination between government agencies to complete the service quickly and efficiently [4]. For E -Government, a framework involves E-government stages and e-government types [14].Governments use various levels of technology. Most of the studies identified four stages are cataloguing, transaction, vertical integration, and horizontal integration [15]. Some studies determined five stages to achieve more advanced e-government [14]. The five stages of E –government are

Information is the dissemination of accurate and available information on the organizations' sites of E-government [14].

Two-Way Communications depending on this stage, the citizen reaches to the largest number of government organizations via the official website of the government, which is a gateway links the related organizations with the agencies and other ministries [4].

Transaction at this stage, the citizen can deal electronically with the government, where transactions are conducted electronically and securely [4] [15].

Integration means the integration of all governmental services by placing one gate to all institutions, where citizens can access to services needed regardless of the institutions or departments provide service to them. The lack of integration between the institutions and agencies is one of the biggest obstacles for conducting transactions electronically [15].

Participation is the last stage in the development of E-government, at this juncture, the citizen can cooperate in the development of government services, participate in elections and communicate with governmental officials in the country using various communication [4] [15].

The types of E-government classified in the several categories which are as follows.

1- Government to Citizen (G2C)

It includes all interactions between citizens and government, where the aim of government is to facilitate citizen's access to information via the Internet in anywhere and anytime in the world. Such as the paying for traffic fines [4] [8].

2- Government to Government (G2G)

Include the exchange of information between governmental institutions to provide cooperation and communication between agencies [8] [14].

3- Government to Business (G2B)

It involves the sharing of information between the government and commercial sectors, such as the use of the electronic means for implementation of procurement and tenders governmental [14] [16].

4- Government to Employee (G2E)

Include the interaction between the government and the staff, so the opportunity is given for employees to get to the database and information needed in their business. It also includes all the records and personal information for staff [16] [17].

2.1.1 Findings

The success of E-government depends on the availability of good infrastructure and Wi-Fi without interruption, integration, cooperation and coordination between the public organizations to provide services and citizens' satisfaction. The stages of E-government are an integrated loop to provide a better system serves agencies and citizens. On the other hand, types of E-government represent all the categories profit from electronic services (citizens, government, business, and employees).

2.2 E-Government Challenges and Benefits

Several challenges classified for E-government as technical, economic and social challenges [18] [32].The technical challenges are a defect in the database, the lack of integration or communication between the institutions and a shortage of skills in the scope of information technology [18] [19].Economic challenges included a limited budget for implementation and maintenance. Social challenges represent the efficiently and readiness for the workforce and stakeholders [19] [20]. For example, India has many languages, so they will have a problem with the adopted language in the electronic services. Despite the use of the Internet by the population dramatically. There are a substantial number of citizens are not able to access and profit from online services for different reasons [21].If there are no solutions for these challenges and problems, it will lead to dissatisfaction of the citizens and the lack of financial profits [19]. Also, there are various

challenges in E-government like scalable, software license support, security, application lifecycle management and accountability [16]. The challenges of E-government reduced by adopting other technologies like cloud computing technology [19].

Despite the challenges of E-government, also there are many benefits of E-government like efficiency and effective management, saving money, easy access to data, a single portal for services, avoid mistakes of humans. As the information and communications technology continues to progress, so E-government must increase its efficiency and effectiveness by using new technology, advanced computational techniques such as using cloud computing technology [22].

2.2.1 Findings

Many countries use E-government system because of the several benefits but despite the adoption of most of the developed and developing countries for E-government system. There are many challenges which must reduce them by using other techniques. The advantage of e- government summarized as

- Efficient and effective management
- Saving costs
- Easy access to data
- A single portal for services
- Avoid mistakes of humans

The challenges of e- government is summarized as

- Scalability
- Software license support
- Security
- Application lifecycle management
- Accountability

2.3 The Concept of Cloud Computing

Cloud computing has many characteristics are as follows.

On-Demand Self-Service: This feature uses when the client needs them, where they can access easily to the server, network storage [7].

Rapid elasticity: Provided resources for the user are flexible so it can be updated and expanded quickly, according to the user's request [8].

Location-Independent Resources pooling: All physical and virtual resources are available in a single pool to all customers and re-appointed as the request of the client [17].

A Broad Network Access: Through the Internet, the client can access for resources, regardless of the used device. For example, a phone or a laptop or other device [25].

Measured Service: This characteristic gives control and monitor of the resources by appointing a weighted capacity also control the kind of duty, and quantity of utilized resources for client and supplier of the infrastructure [25].

Organizations can publish applications for one of the following four models:

Private Cloud: Operation and use of the private cloud infrastructure for the institution can administer by the same institution or another institution [7].

Community Cloud: The Infrastructure of community cloud which is shared by multiple agencies and can be administered by same institution or another institution [8].

Public Cloud: The infrastructure of public cloud is available to everyone and can be managed by a group of people, and its services may be without or with paying money for some services [16].

Hybrid Cloud: The infrastructure of hybrid cloud made up of several types of clouds, for example, it contains public and community cloud or contains private, public and community cloud. The institution relies on the hybrid cloud; its technology must be appropriate for using the cloud [19].

There are three models of services for cloud computing: software, platform, and infrastructure.

Software as a Service (SaaS): Is a model to implement operating systems by the cloud's suppliers (except some of the settings of the application). Clients via different devices can access applications, but they cannot manage or control the infrastructure of the cloud. For example, E-mail [7] [8].

Platform as a Service (PaaS): There is no possibility for customers to control the infrastructure to the cloud (networks, operating systems, and storage or servers). However, the client can deploy, and control of the infrastructure of the cloud created for consumers or applications created depending on programming languages which are supported by the cloud provider. Like, Google Engine [16] [19].

Infrastructure as a Service (IaaS): There is no possibility for customers to control the infrastructure to the cloud. However, it controls on (the established programs, storages, and the operating systems). In this model, the artificial server is at the client's disposal completely. For example,

Amazon Web Services [23] [24]. The services are managed by the client or provider for each type of three models (SaaS, PaaS, IaaS) as following Figure 2.1.

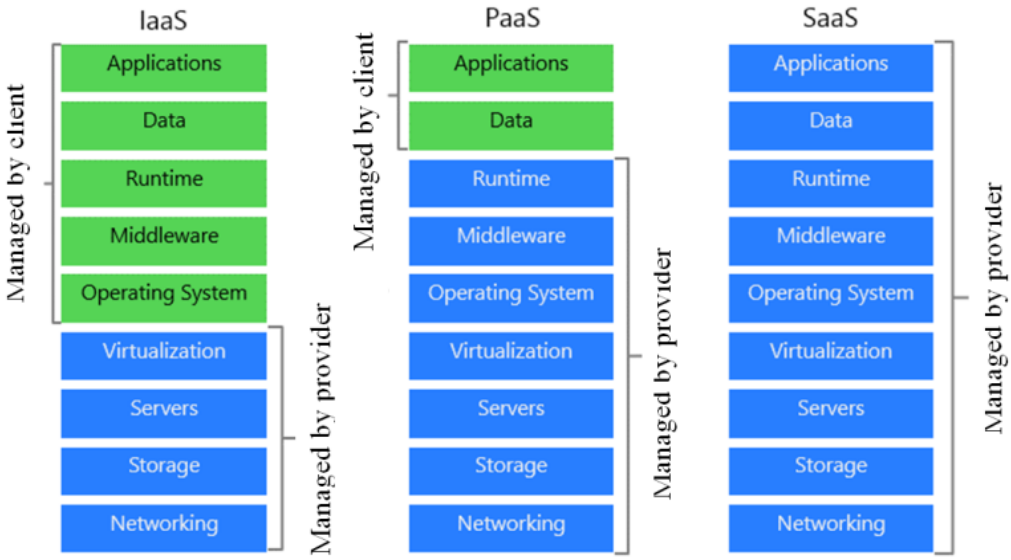

Figure 2.1: The Different Resources Provided by the Three Models [24]

Cloud computing has many benefits and challenges. The benefits are:

- **Ensure That the Service permanently:** The service works along the time, provides service with modern equipment to ensure data will not miss, and repairs any malfunction during the fast time. All these services lead to saving time and cost [26].

- **Data Protection:** The foundation is the customer and the service provider. The customer must ensure there is an Internet connection when storing the data. Service Provider must keep customer data away on the infusion [16].

- **MassiveInfrastructure:** Previously, the information is taken a complex operation on regular computers and taken a long time may be years.

When the clouds use these operations, it will be for a few minutes because the clouds contain many servers [26].

- **Virtualization:** Users can access to services and existing applications in the cloud, but users do not know the site's cloud [18].

- **Green ICT:** Cloud computing has a significant impact in making the information and communications technology to be green [16].

- **Identity Management System:** Used to check the identity of the user and the real owner of the account.

- **Large Scale:** Cloud computing has millions of servers, and this adds the power of cloud computing [26].

- **Easy To Implement:** When using cloud computing, we do not need to buy hardware and software [16].

- **Reliability:** Quality of service with a backup service [26].

- **On-Demand Service:** The user can buy any service needed [16].

- **Increased Flexibility:** Depending on a massive infrastructure, and accessing to services by low prices. All this leads to reducing the implementation time [26].

- **Latest Technology:** The user does not need to be updated because the technology is updated automatically [18] [32].

- **Access Anywhere:** The user can access the cloud to anywhere in the world via a computer or smartphones [26].

- **Low Price:** User pays to services only needed [18].

Challenges and concerns in cloud computing are audit, interoperability and data portability, data protection, security, identity and access management [16].

2.3.1 Findings

The concept of cloud computing is a new in information technology; cloud computing provides services, storage, applications and servers used by the individual, it provided according to the needs of persons. In the last few years, cloud computing entered in all areas and applications, which includes a lot of characteristics, models, types, benefits and challenges. Depending on the concept of cloud computing, we deduce technology is flexible and available to everyone when it needed; it provides many services serve a variety of institutions and individuals. In addition, it has many benefits.

2.4 Cloud Computing Based on E –Government Benefits and Challenges

Information technology is constantly evolving, so E-government must focus on use all modern information technology types to provide more efficient services to citizens and improve the organizational, electronically, and technical interfaces for government [28].

The cloud computing adopted in E-government frequently in recent times, to make E-government services more effective and efficient [17].

The challenges of cloud computing in E-government summarized as

•**Internet Dependency:** As the cloud computing depends on the availability of the Internet, so it considered the most prominent challenge of cloud computing [13].

• **Security and Privacy:** Citizen feels Permanent concerned because the data storage and processing is not within the organization when the organization uses cloud computing, the data on the cloud servers its position is unknown, so the citizens worried about their personal data [8] [22].The

security plays a fundamental role in the citizen's confidence, so the government depends on the cloud must be secure [13].

• **Open Standards and Interoperability:** There are no standards when applying cloud computing to government services. It will lead to an increase in the risks and costs, so the governments have sought to adopt open standards policies for the cloud and use information and communication technology to reduce the cost [8] [13].

•**Audit:** Cloud providers do not provide details about the cloud, where it becomes necessary scrutiny in cases where the comply with regulations or specific policies should be verified [8].

• **Service Failure:** Some services must be available to users all the time, but at some times these services may not be available, so the service fails to affect the confidence of users of cloud computing [22]. In addition to many challenges such as migration to new technologies, data scaling, disaster recovery, leadership, rules, policies, system integration and legacy software [8] [13].

The benefits of adopting cloud computing in E-government are more than its challenges; it could clarify as

• **Flexibility:** E-government applications rely on cloud computing can deal with clouds according to the needs and strategies of ICT for getting the benefits of the clouds [22].

• **Scalability:** Affinity, the citizens for E-government with increasing day by day and will increase the load on the E-government system, because of that, technology approved for E-government, must be expandable to accept the burden of the citizens [22]. The cloud computing is the technology scalable because it is possible to add hardware to be able to accommodate the

increasing number of citizens (such as hard drives, disk drives, and the CPU, and servers) [27].

- **Cost Saving:** Cloud computing reduces the cost of E -government because it will not need to purchase and install of equipment within the institution, but they pay only for the used services [8] [13].

- **Availability and Accessibility:** Applications and information for cloud computing are available all the time, when adopting cloud computing in E-government, the citizen can access for these applications at any time, but only needs the internet with computer or mobile. [13] [22].

As well as other benefits such as unlimited storage, reducing or staff redeployment, increasing the efficiency of E-government services and reducing the required time for IT developing, and easing of Implementation and deployment of cloud computing in the enterprise without needing for substantial resources [8] [27].

2.4.1 Findings

Cloud Computing has many benefits; these benefits can serve E-government and make it more efficient and effective, the benefits of cloud computing in E-government exceeds the challenges number. Our research focuses on the adoption of cloud computing in Iraqi E-government. So it is necessary to concentrate on previous studies touched to know the advantage and challenges when adopting cloud computing in E-government. We can profit from these advantages in our project, to reduce costs in particular.

2.5 The Experiences of Countries which are Adopting Cloud Computing Model in E- Government

Many countries discussed the adoption of cloud computing in its government, they focused on the advantages and challenges of cloud computing, and some of them proposed a model for the adoption of cloud

computing in E-government. Some countries which adopted cloud computing studies are expressed in below title. Detailed countries are selected based on the objective of these studies and the economic, environmental and social status of these countries.

2.5.1 Saudi Arabia

The model of cloud computing applied by the Saudi Arabia when the number of users of electronic services offered by E-government in Saudi Arabia increased, that led to increasing the cost of information technology. Also, for thinking the E-government will be expensive and inflexible in the future. They Guess the growth rate of spending on IT will be up 11.4% in 2015. It was 10.2% in 2011, the reasons for increasing the costs due to the factors (hardware, software, accommodation and human resources), the reduction of these factors leads to much time and costs, and the best solution is cloud computing to reduce these factors in an efficient manner.Such that, it suggested to enable hybrid cloud E-government system, the necessary processes and use of data in the public cloud with the central control of E-government [30]. Figure 2.2 illustrates the Hybrid Cloud model in Saudi Arabia.

Figure 2.2: Hybrid Cloud model in Saudi Arabia [30]

This model of cloud computing in Saudi Arabia to reduce the costs of information technology, the cost of accommodation and human resources costs is reduced, no need to buy hardware and software. However, there was concern about the Saudi's model because of the security challenges, the

integration of different platforms or software tools, data migration, regulatory requirements and the transition to a new cloud [30].

2.5.2 Pakistan

Pakistan considered as a developing country where E-government is in the early stages, so it must have a massive investment for the purchase of information technology equipment and carry out operations and maintenance to provide services achieve the needs of the government and the users [29]. The economic situation and the few budgets cannot afford to invest in information technology, so it was thought to adopt cloud computing in E-government in Pakistan, cloud computing has many benefits, and the most important of these benefits cost reduction [16]. Therefore, the public sector requires assessing the safety and security of cloud computing options without any new investment. Pakistan needs to consult with the stakeholders of the private sector to prepare regulations to process the challenges of cloud computing like reliability, privacy, service level, security and the establishment of a regulatory body to monitor the performance of the cloud providers and completing cloud policies [29].

Cloud computing environment model in Pakistan includes the supply and demand sides. A private cloud created for sensitive government information. It is managed by the private cloud operators and included secure data centers [13].

Public Cloud adopted to provide public services needed by government and citizens, such as the use of public sector employees of Google Apps, this leads to reducing the costs. On the demand side, the Universal Service Fund can utilize of the advantages of cloud computing to process the digital divide inside Pakistan [13] [29].

2.5.3 Egypt

Egypt suggests the hybrid cloud computing model for using it in E-government. The purpose of the cloud model in Egypt is to reduce fears (integration, communication, cooperation) [31].

The model in Egypt includes three types of clouds (inter- cloud IECC), (intra-cloud IACC), (extra cloud EXCC). Inter -cloud means a public cloud which the citizens can submit their applications and get responses or results, this cloud to deal with non-sensitive data and run the applied programs. Intra-cloud is a private cloud; the extra cloud is a community Cloud [16]. These three clouds limit the restrictions and make the integration, communication, and cooperation at the highest level. These clouds provide the services (SaaS, PaaS, IaaS) which are responsible for the formation and a large group of jobs and services. These three clouds limit the obstacles and restrictions to allow the maximum amount of integration and cooperation and communication among themselves [16] [31].

The model in Egypt has identified the recommended mission practices in the implementation of cloud computing, these practices classified into a set of categories.Such that, each category has a set of specifications and data recommended [31].These categories are

- Cloud computing application category
- Cloud computing contract category
- Cloud computing infrastructure category
- Cloud computing users category
- Cloud computing data category

2.5.4 Indonesia

E-government in Indonesia is not satisfactory because of the problems faced in the implementation, especially the meager budget. Moreover, the human resources and the ability to use information and communication technology in institutions are low. Therefore, they have been thinking of a model improves the services in E-government. Due to the technology is moving aggressively from using cloud computing in E-governments, Indonesia has suggested the adoption of computing in E-government because it will provide many benefits for infrastructure. Moreover, it suggested hybrid cloud, and the use of service models (SaaS, PaaS, IaaS, DaaS), make the investment efficiency of the government up to 45.8, savings of the general budget in Indonesia will be realized [20]. They suggested architectural cloud this architectural contains some layers.

1- Infrastructure layer: It is the base layer contains all the hardware needed by the cloud service provider.

2- Cloud Platform Layer: It contains two platforms. The first platform manages cloud services for users. The second is to manage data.

3- Cloud Services Layer: Is the layer reacts with citizens and contains the following service models

- Infrastructure as a Service
- Data as a Service
- Software as a Service
- Government as a Service

There are many of Beneficiaries from cloud environment where each beneficiary has a specified entrance in the cloud system; they are (Users, Business Partner, Regulator, and Provider).

2.5.5 Findings

Some countries suggested a cloud computing model in E-government, and others discussed the advantage and challenges of adopting cloud computing in E-government. The benefits of cloud computing are increasing the profits in their governments and trying to decrease weaknesses in E-government. Some of these countries have benefited from the feature of reducing the costs and the flexibility in cloud computing on the electronic governments. In our research, we focus to propose a suitable model of cloud computing for electronic government in Iraq and to profit from the experiences of some countries in this area. Although, the cloud computing models in these countries, were persistent for challenges to cloud computing considered in our model.

2.6 The Factors Impact on the Adoption of Cloud Computing in E-Government

Many factors impact the adoption of cloud computing in E-government. For example, Jordan presented a survey about the factors influencing on the adoption of cloud computing in its hospitals. Three primary constructs were incorporated. Namely, technological (privacy, trust, and security), organization (technology readiness and managerial support), environmental (policy, competition, and legislative). Data collected from interviewing from five information technology experts in the ministry of health in Jordan. The findings indicated all the proposed factors consist of a substantial effect on the adoption of cloud computing in Jordan's hospitals [37].

As well as Taiwan tested the factors which effect on the adoption of cloud computing in Taiwan by using the survey. Four primary constructs were incorporated. Namely, technological (Security, Complexity, Compatibility, Budget), organization (Relative advantage, Top manager support, Adequate

resources), environmental (Government policy, Perceived industry pressure), Human (CIO innovativeness, Perceived technical competence). The survey distributed to 60 respondents. Findings showed the security, perceived technical competence, budget, top manager support and complexity were the most important factors [39].

As for the factors which impact on the adoption of cloud computing in organizations of India are an organizational competency, relative advantage, complexity, compatibility, IT knowledge, competitive compression, managerial support, trading copartner support, realized usefulness and realized the ease of use. The data collected from 280 organizations in India. The findings indicated the important variables impact on the cloud computing adoption are complexity, relative advantage, managerial support, compatibility and IT knowledge. Also, competitive compression and commerce accomplice support have discovered. Such that, it affect immediately on the cloud computing adoption intentions [47].

There is also a study to adopt SaaS with the title "Understanding SaaS adoption from the perspective of organizational users: A tripod readiness model". Three constructs were incorporated. These included organizational willingness (managerial support, information technology infrastructure), technological readiness (IT knowledge, ability, simplicity, compatibility, relative advantages), and environmental readiness (partner pressure and competitive pressure). The data collected from 137 responders. The findings indicated all the factors affect significantly on the use of software as a service (SaaS) [48].

There was a study on the factors which impact on the adoption of the cloud in the E-government of Iraq. The factors were of two types: technological factors include (complexity, compatibility, trust, and security), and non-technological factors include (technology readiness, IT knowledge, relative advantage, and managerial support). The questionnaire distributed on

234 IT experts in the Ministry of Science for determining the effect of these factors on the adoption of cloud computing in E-government. The findings showed the factors (relative advantage, complexity, managerial support, compatibility, IT knowledge, and security) have a significant effect when adopting cloud computing. Also, the factors (trust and technology readiness) have no substantial effect on the adoption of cloud computing in E-government. The findings lead to the non-technological factors need to the attention more than technological factors [66].

There is also a study to adopt cloud computing in Saudi Arabia. Saudi Arabia examined 19 factors. These factors are (culture, security concerns, service quality, budget, organization size, external pressure, usefulness, IT infrastructure readiness, feasibility, organizational culture, organizational structure, government support, industry type, trust, indirect benefits, privacy risk, direct benefits, and complexity). The data is collection from 169 of people by using survey and interview. All the factors affect significantly on the adoption of cloud computing [72]. Table 2.1 shows the highest frequency of these factors which are used in our research.

Table 2.1: The Most Frequent Factors

Factors	**Frequency**	**Resource**
Managerial support	5	[37], [39], [47], [48], [66]
Security	4	[37], [39], [66], [72]
Compatibility	4	[39], [47], [48], [66]
Complexity	4	[39], [47], [66], [72]
Relative advantage	4	[39], [47], [48], [66]
Trust	3	[37], [66], [72]
IT knowledge	3	[47], [48], [66]
Technology readiness	3	[37], [48], [66]
Budget	2	[39], [72]
IT infrastructure	2	[48], [72]

2.6.1 Findings

We found the factors mentioned in section 2.6 consist of a substantial effect on the adoption of cloud computing in different areas, like education, health, and E-government. The methodology of those studies based on a questionnaire and interviews with some employees and experts in governments. We will benefit from these studies and methodologies in our research. We will select the appropriate group of these factors for the E-government in Iraq as shown in Table 2.1, structured our survey based on these factors and test the impact of these factors on the adoption of cloud computing in E-government to propose an appropriate model of cloud computing for electronic government in Iraq.

CHAPTER THREE

E- GOVERNMENT IN IRAQ

3.1 Current E –Government System in Iraq

The Iraqi government formed in 1920, made up of nine ministries, and the system was monarchy at the time. In 1958 the system changed from a monarchy to a republican and a democratic regime still so far [4].

E-government project in Iraq began at the end of 2014, and it includes a few of the organizations. However, nowadays, there are many of the organizations involved in E-government. The General Secretariat of the Council of Ministers is the agency responsible for E-government services. The function of E-government in Iraq for the reception citizens' complaints and requests for proposals and provide them with a serial number to follow up on these requests in the future. The Iraqi government includes 22 ministries, 13 Provinces.The ministries: M. of Interior. M. of Defense. M. of Industry. M. of Higher Education. M. of Trade. M. of Finance. M. of Labor and Social Affairs. M. of Oil. M. of Transportation. M. of Planing. M. of Foreign Affairs. M. of Culture. M. of Migration and Displacement. M. of Electricity. M. of Water Resources. M. of Education. M. of Agriculture. M. of Housing and Construction. M. of Health and Environment. M. of Justice. M. of Youth and Sports.Moreover, M. of Communication [33].

The provinces are Dhi Qar, Wasit, Diwaniya, Baghdad, Karbala, Basra, Muthanna, Diyala, Najaf, Kirkuk, Maysan, Anbar, and Babylon [33].

3.2 Electronic Services Provided by the Iraqi Ministries

Iraqi ministries offer many services to the citizens, business, enterprises and government. The following table contains the ministries, the electronic services they provide, the type of services, information type and carpetbagger of these services. All it showed on the table in Appendix 1**.**

3.3 Problems in Iraq

In the modern world, there are increasing to the desire to adopt ICT in the government, the economic and the social fields. Governments of developing countries invested ICT with improving strategies and government work. The Iraqi government is slow in the information and communication technology adoption and the providing of E-government services to people and enabling citizens to interact and communicate with government [35].

1- The Weakness of Infrastructure in Iraq

Infrastructure in Iraq is weak and not guaranteed to finalize. For example, the field of telecommunications works by the lowest level of contact with the adoption of information and communication technology is available, and for buildings and security services are available. However, the field of telecommunications is not at the level of the world's governments [35] [4]. In 2016 we noticed a keen interest towards the E-government and seek to increase the participation in E-government organizations. For example, in February 2016 the participating organizations in E-government are 116 foundations, and reached to 282 foundations in August 2016 [33].

2- The Lack of Budget

In recent years, Iraq exposed to an economic crisis due to the ongoing conflict and falling oil prices, that impact on allocated amounts to support ICT [36].

3- Lack of Laws and Legislations

Iraqi organizations dependent on the legislation and contain many instructions and regulations, but there are no laws to support E-government. Which considered priorities for the issuance of the law relating to infrastructure, services, and security [4] [36].

4- Security

The unstable security situation in Iraq prevents the improvement of government services. In addition to the migration of the owners of talent to other countries because of the unstable security or to improve their living circumstances. So it leads to a significant impact on the progress of E-government [35] [36].

5- The Society

Iraq characterized by geographically diversity (rural and city areas), educational, cultural level, and standard of living [35]. Despite this diversity, the Iraqi society uses the technology during the short period. The biggest problem is a lack of the citizen's trust with services are provided by the E-government. The responsible committees for E-government in Iraq endeavor for the awareness campaigns for workers in public organizations to educate them on the importance and the benefits and advantages of E-government to provide the trust between citizens and the government [36].

3.4 The Readiness of Iraq to Shift towards E-Government

Central Statistics Organization (CSO) in Iraq presented a study to assess the willingness of state organizations for E-government in 2015. The

study has been conducted comprehensively by coverage all ministries and independent agencies at an administrative formation level as well as province councils and province headquarters in two stages [34]. As showing below.

3.4.1 The First Stage

Provides a framework for a survey community

- **Indicator of Financing Sources of Information Technology**

This section focuses on governmental funding for sources to the information technology. Figure 3.1 shows the result:

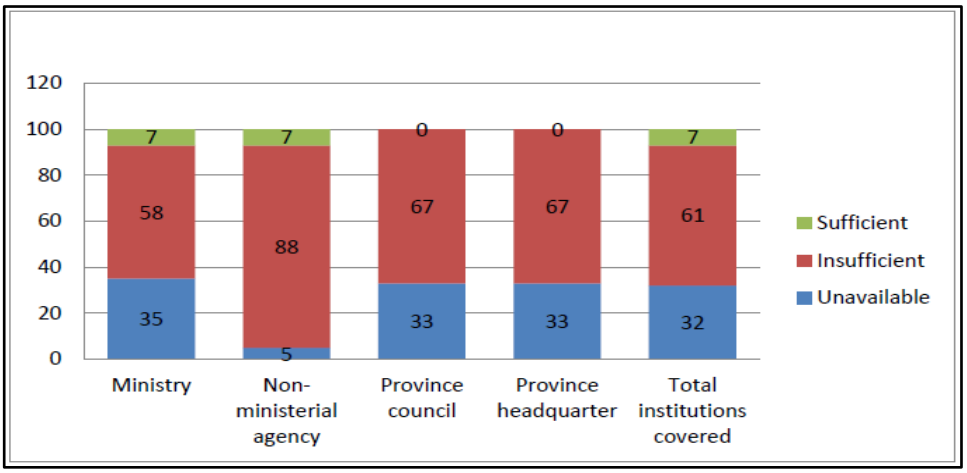

Figure 3.1: Financing Sources by Institutions Covered for 2015 [34]

The results of the Indicator of Financing Sources of Information Technology in Figure 3.1 revealed the total proportion of sources of financing at the two levels (unavailable) and (insufficient) are 93% of total institutions covered in the survey. That means the government did not provide sources for the information technology to the institutions.

- **Data Network Availability**

This part is interested with the availability of the Internet in the institutions. Figure 3.2 shows the results

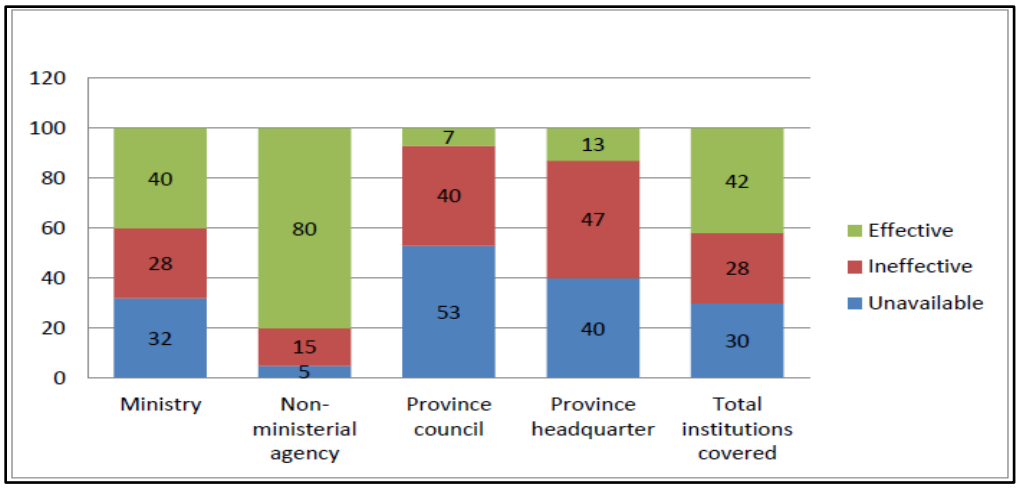

Figure 3.2: Data Network Availability by Details for Institutions Covered for 2015 [34]

The results of the Indicator of the Data Network Availability in Figure 3.2 revealed that the survey covers 42% of total institutions have an effective data network, 28% have an ineffective network, and the network is not available about 30% of total institutions. It means less than half of the institutions in Iraq are accessible on the Internet.

3.4.2 The Second Stage

This stage includes the selection of agencies characterized by applying E-government more than the other agencies

•Importance of E-Government Role in the Formation Perspective

This part is interested in asking about the significance of the role of E-government from the institutions' viewpoint. Figure 3.3 explains the outcomes

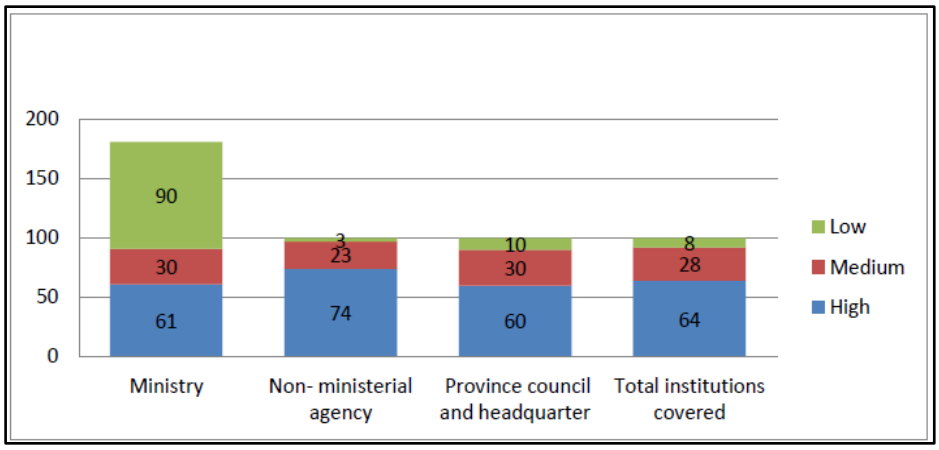

Figure 3.3: Levels of E-government Role in Administrative Formation Perspective of Institutions Covered for 2015 [34].

E-government plays a significant role with 64% of governmental agencies, a moderate role with 28% of governmental agencies, and weakened role with 8% of governmental agencies. It showed in Figure 3.3.

- **Data and Information Systems**

This part is interested in asking about the presence or absence of compatibility between the institution's systems. Figure 3.4 explains the outcomes.

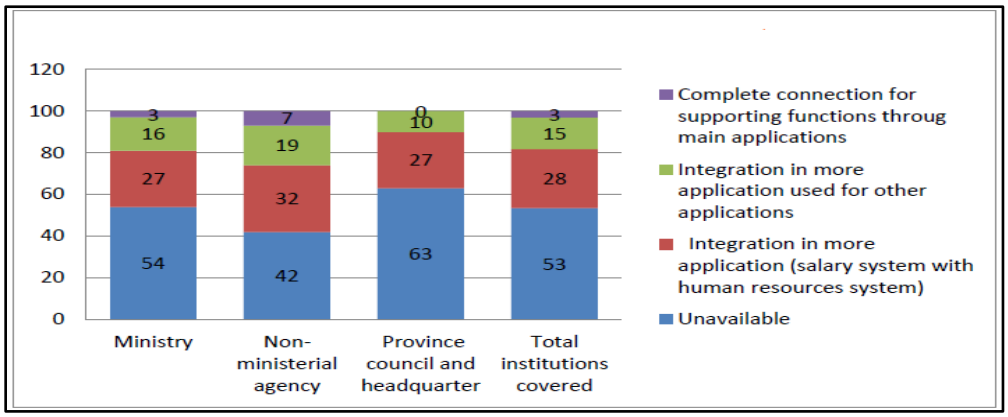

Figure 3.4: Integration of Supporting Processes and Systems for 2015 [34]

The results of the Integration of Supporting Processes and Systems in Figure 3.4 showed that 53% of total institutions covered by the survey has no integration of supporting processes or systems, which makes it difficult to use their systems and information to support other applications. It means more than half of the institutions in Iraq are not compatible with each other.

- **Management of Business Processes**

This part is interested in asking about the presence or absence of a coordinate between the institution's systems. Figure 3.5 explains the outcomes.

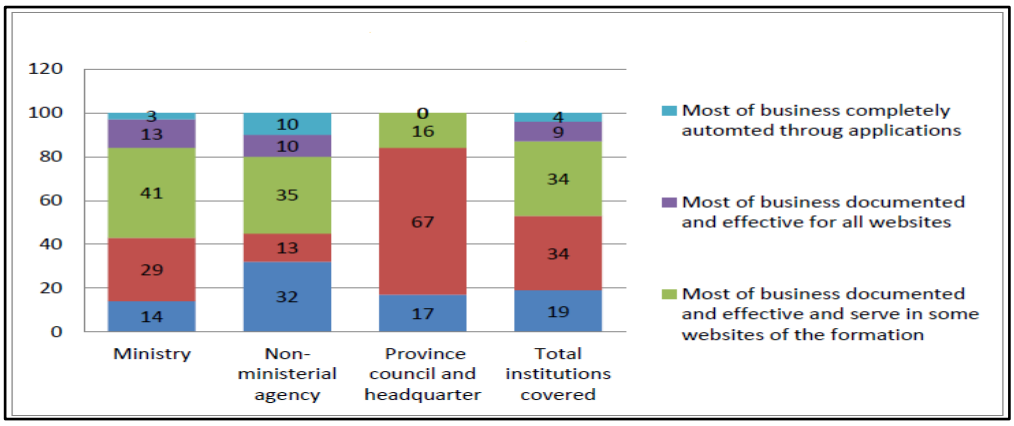

Figure 3.5: Description of Current Practices for Process Management for 2015 [34]

The description of the results of current practices for Process Management in Figure 3.5 showed that 34% of the surveyed institutions implement business with a lack of coordination between institutions

3.5 Findings

In this chapter, the General Secretariat of the Council of Ministers is responsible for E-government services. Such that, we noticed the E-government in Iraq gradually grow. Also, there is growth with electronic services, but we have noticed via statistical submitted by the Central

Statistical Organization, There is a lack of financial support for E-government, the proportion of the Internet availability in the Iraqi organizations is unsatisfactory, there is no integration and coordination between institutions in the electronic government. The adoption of E-government is necessary depending on the concept of the agencies; the Iraqi community has been accepted to keep up with information technology. However, the lack of infrastructure in Iraq and economic crisis prevent of the adoption of E-government in an Iraq Acceptable manner. To overcome these problems, we propose to adopt the cloud computing technology because of it has a lot of benefits outweigh the E-government problems.

CHAPTER FOUR

RESEARCH METHODOLOGY

Our research seeks to propose an appropriate model of cloud computing to e- government to help to raise the efficiency of E-government in Iraq and reduce the cost required for the development of E-government services. A model will propose depending on the influenced factors in previous studies detailed in Table 2.1 to adopt cloud computing in E-government and apply a survey depends on these factors. Finally, create hypotheses.

We will use the Google Form application for our survey. The distribution of questions will publish online to IT staff in Iraqi ministries to obtain accurate data. "Statistical Package for Social Sciences" (SPSS) will use for analysis data of the survey, the proposed model of cloud computing to E-government will depend on the results of the questionnaire analysis.

4.1 The Influencing Factors on Adopting Cloud Computing in E-Government

As stated in chapter two, we discussed the factors affect to adopt cloud computing in E-government. In this chapter, we will discuss the relationship in the independent variables (trust, budget, compatibility, complexity, security, IT infrastructure, IT knowledge, technological readiness, managerial

support, and relative advantage). Moreover, examine the impact of independent variables on the cloud computing adoption.

4.1.1 Dependent Variable

Improper planning and rushing to adopt technology without knowledge of the factors influence the adoption of leading to falling off the cloud computing usage [38]. In our research, the dependent variables will be the adoption of cloud computing. Based on the literature review, if required to move from non-cloud to the cloud, a set of independent factors must be identified and examined with the dependent variable.

4.1.2 Independent Variables

It includes ten factors, these factors are related directly to our survey Likert Scale questions; it detailed in Appendix 2. We will assume each factor has two hypotheses (positive hypothesis and negative hypothesis), if the positive hypothesis rejects, the negative hypothesis will be instead of it. Statistical analysis of these ten factors explained in chapter 5.

4.1.2.1 Trust (TR)

It can define as the confidence to rely on Specific destination. This Specific destination vulnerable to attack, citizen data will be risky [41]. The trust in cloud computing divided into two parts [42]. First, trusting the services itself. Second, trusting the services providers to provide the highest level of data confidentiality and preservation. This concept is similar to the confidence in E-government where researchers pointed out trust divided into trust in both the government and the Internet [43]. Trust is a primary condition for people depend on E-government relies on cloud computing [44]. The lack of confidence by the citizens will not lead to use the E-government services [45]. However, the present study focuses on trust in the cloud computing dominates the technical problems in E-government, citizen contacts in E-

government and completing transactions online. So, the hypotheses in our research are:

H_{0a}: Trust affects positively on the movement of E-government to cloud computing.

H_{1a}: Trust affects negatively on the movement of E-government to cloud computing.

4.1.2.2 Budget (BU)

The cloud computing is a solution to overcome the budget problems hinders the success of implementation E-government globally. E-government projects used mainly the Internet to deliver the e-services to citizens. Hence, when creating E-government by cloud computing, the best service, the lowest cost, and the least amount of hardware will be provided [66] [67]. Cloud computing is the most cost effective compared to grid desktops or other technologies, and it enabled smart distributions of resources [52]. Cost is considered an important factor in adopting cloud computing. Like, health institutions in Taiwan have reduced the cost and increased the profits, so the interest in cost factor is too necessary [39].However, in the present study, the cost variable focuses on reducing the number of staff, the customers demand services when needed reduces storage costs, as well as interrelated work environments. Also, cost reduction for E-government equipment (software, hardware, operations) when adopting cloud computing. So, the hypotheses in our research are:

H_{0b}: Budget affects positively on the movement of E-government to cloud computing.

H_{1b}: Budget affects negatively on the movement of E-government to cloud computing.

4.1.2.3 Compatibility (CA)

Compatibility is the extent of coordination between the information systems and internal regulations environments [46]. Moreover, we must focus on compatibility when adoption cloud computing in the other systems [42]. The related compatibility issues with cloud computing are technical aspects in organizations and customizing the existing applications to cloud systems. They urged organizations to understand and check the compatibility of cloud computing with the existing architecture of technology [47].

Compatibility represents one of the important factors which effect on the cloud computing adoption, or any new technology [48]. The compatibility with company policy is the primary concern of IT managers in Taiwan [49]. Compatibility found as one important factor in the qualitative study [40]. The compatibility incorporated to locate the use and performance of cloud computing among European organizations [50]. Based on the above, the compatibility has a significant influence of compatibility of existing infrastructure, system, structures, and so on, on the adoption of cloud. Thus, in our research, we expect the compatibility affects positively to adopt cloud computing in E-government in Iraq. So, the hypotheses in our research are:

H_{0c}: Compatibility affects positively on the movement of E-government to cloud computing.

H_{1c}: Compatibility affects negatively on the movement of E-government to cloud computing.

4.1.2.4 Complexity (CX)

Complexity is the extent of the use of innovation, one of the difficulties, and an important factor. Researchers believe a complex innovation or technology, which requires substantial physical, mental efforts, and skills [51]. This belief can apply to the adoption of the cloud computing

technology. The complexity of the applications and procedures of cloud could discourage potential adopters to use technology [52].

The complex nature of cloud computing measured regarding proficiency in data transfer, the time of the completion of tasks, interfaces, and functions of the system, and application integration with the infrastructure of cloud computing [47]. However, the present study focuses on the integration of the current work with cloud computing platforms and interacts with E-government. So, the hypotheses in our research are:

H_{0d}: Complexity affects positively on the movement of E-government to cloud computing.

H_{1d}: Complexity affects negatively on the movement of E-government to cloud computing.

4.1.2.5 Security (SE)

Security is the level of data protection or the systems from unauthorized access or attacks [42]. Many institutions are too worried about moving to cloud computing technology because of lack of security [53]. Recent studies in Taiwan and Europe have tested the influence of security empirically to adopt cloud computing services in private, public, health care organizations, and on a separate level.

1-The main factor effects to adopt cloud computing in Taiwan hospitals is security [39].

2-In Taiwan, the information technology associations would not adopt the cloud computing unless the issues and concerns over security reduced.

3-The public sector organizations in Europe have a great desire to overcome on safety issues of the adoption of cloud computing [40].

In our research, we expect the effect of security on decision makers to develop the E-government services by using the cloud computing is

significant. A high security would encourage the decision makers to move to the cloud. So, the hypotheses in our research are:

H_{0e}: Security affects positively on the movement of E-government to cloud computing.

H_{1e}: Security affects negatively on the movement of E-government to cloud computing.

4.1.2.6 IT Infrastructure (ITI)

IT infrastructure includes and support each of IT Services, IT Hardware, IT components, IT management, IT integration, IT operation, IT maintenance, and IT documentation. The barriers to E-government are represented by the infrastructure in its initiatives to reach the potential of the developed countries. Infrastructure generates many benefits for the government and citizens to improve social and economic conditions in developing countries [69]. Governments spend a significant proportion of monetary amounts on the infrastructure of information technology but use 10% of this infrastructure, and this leads to increase expenses could avoid by the adoption of cloud computing in electronic government [66]. The emergence of cloud computing led to access for data storage sites at anywhere and anytime. So, it leads to lower cost of the infrastructure of information technology is scalable with increasing request [68]. Infrastructure can operate and implement of information systems, where it considered as an important element in organizational competitiveness [66]. The public organizations can outsource the infrastructure (e.g. Storage and backup) on a structure of infrastructure such as information technology platforms (e.g. Database) or in the structure of the platform as a service (PaaS) or infrastructure as a service (IaaS) [48]. Thus, in this research, IT infrastructure is expected to affect positively on the move of E-government to the cloud computing in Iraq. So, the hypotheses in our research are:

H_{0f}: IT infrastructure affects positively on the movement of E-government to cloud computing.

H_{1f}: IT infrastructure affects negatively on the movement of E-government to cloud computing.

4.1.2.7 IT Knowledge (ITK)

IT Knowledge is the conscious level of staff for cloud computing technology and its benefits to the organization. Cloud computing represents a new technology, and it needs to train and teach many employees in this area. Cloud computing will be depended If the staff has the sufficient experience for cloud computing [39]. In addition, IT staff experience is a source of competitive advantage; experts can use the technology on a foundation benefits the institution, plug the gaps, increases productivity, reduces time and cost [55] [56].

Also, the IT knowledge effects on the performance and usage of cloud computing [50]. In this research, IT knowledge relates to the awareness of the government employees regarding the cloud computing and its benefits. It expected the IT knowledge would affect positively on the development of E-government via cloud computing. So, the hypotheses in our research are:

H_{0g}: IT knowledge affects positively on the movement of E-government to cloud computing.

H_{1g}: IT knowledge affects negatively on the movement of E-government to cloud computing.

4.1.2.8 Technology Readiness (TRE)

Technological readiness considered like the willingness of the organization to adopt the technology. Readiness depends on the availability of technical resources, awareness of staff, and managers to cloud computing technology [57]. Broadly, it described with two dimensions; financial

readiness (financial resources for cloud computing implementation and ongoing expenses during usage), and technological readiness (human resources and infrastructure for cloud computing usage and management) [58].

Also, the technological readiness represented by the infrastructure, finance, and IT human resources affects significantly to adopt new technology. The technical infrastructure is as the installed systems, and network technologies give the basis for developing cloud computing applications. Also, they referred to IT human resources as the technical skills require the implementation of IT applications [59].

Technological readiness represents a significant factor in adopting of cloud computing. Organizational competence is the term used to refer to technological readiness, and it considered as an essential factor to adopt of cloud [47]. In the present study, the technological readiness is expected to affect positively to adopt of cloud computing. So, the hypotheses in our research are:

H_{0h}: Technological readiness affects positively on the movement of E-government to cloud computing.

H_{1h}: Technological readiness affects negatively on the movement of E-government to cloud computing.

4.1.2.9 Managerial Support (MS)

The definition of the managerial support is the attention of officials and managers in the institutions to support the development of technology and enterprise in technological innovation [60]. Top management ensures reinforcement of values, long-term vision, optimal management of resources, the commitment of resources, cultivation of favorable organizational climate, and higher assessments of individual self-efficacy, support to overcome the

barriers and resist any changing [59]. The role of management is critical to the success of the adoption of technology because the manager is responsible for supporting the initiative and assigning the required resources for the adoption [59]. The manager can implement the cloud computing or drop it in Institute [42].

The role of managerial in public sector adoption of cloud computing is to reduce the bureaucracy and encourages transparency [40]. Thus, it expected the top officials are responsible for the E-government project would affect positively on the adoption of cloud computing. So, the hypotheses in our research are:

H_{0i}: Managerial support affects positively on the movement of E-government to cloud computing.

H_{1i}: Managerial support affects negatively on the movement of E-government to cloud computing.

4.1.2.10 Relative Advantage (RA)

Relative advantage is a measure to use the innovation, the organizations depending on the innovation based on the results of the relative advantage. The main elements of relative advantage are the flexibility, reducing the costs, ease of use, capacity, speed and agility of implementation which increase the efficiency and the effectiveness [51] [52]. Cloud computing is the most cost effective compared to grid desktops or other technologies, and it enables the appropriate distributions of resources [61] [62].

Although the companies pay many finances on IT infrastructure, indeed they use about 10% of servers, which leads for avoiding expenses by using cloud computing [63]. Thus, cloud computing reduces the cost of information technology. Cloud computing provides services depending on the needs of the organization [64]. It will offer the mobility for users, the facility

of accessing and working on their documents from anywhere in the world; they have provided a computer and an Internet connection [65].

The relative advantage is a major factor for adoption the cloud by the hospital in Taiwan. The findings of interviews with IT professional in business and IT engineering found a relative advantage is a factor affects the cloud computing adoption [39] [49]. So, it expected relative advantage affects positively on the development of E-government via cloud computing. So, the hypotheses in our research are:

H_{0j}: Relative advantage affects positively on the movement of E-government to cloud computing.

H_{1j}: Relative advantage affects negatively on the movement of E-government to cloud computing.

4.2 Model Evaluation

The previous section determines the selected factors and created hypothesis. In this section, these factors will be tested based on population, study's instrument, pilot study, and data collection will be discussed.

4.2.1 Research Population

In our research, the population is the entire IT experts in the ministries and organizations affiliates of the Iraqi ministries to apply our survey. The ministries and agencies have knowledge about the E-government project in Iraq have selected. Therefore, IT staff has knowledge of the government project in Iraq has chosen.

4.2.2 Instrument of the Study

There are three primary instruments in the field of social science include a questionnaire, observation, and interview [70]. The questionnaire is favored among the others because it provides an easy way to collect data without the need of the presence of the researcher [71]. Thus, our research

uses a survey as a tool to collect data. The questionnaire adapted from previous studies as in Table 4.1. The original version of the questionnaire in English, it will be in Appendix 2. It will translate into the Arabic language because the respondents' mother language is Arabic. The questionnaire consists of three main sections.

4.2.2.1 Demographic Questions

This section is interested in the information background on employees and some of the technical information in their organizations, like age, gender, the degree of education, and experience in the fields of (information technology, E-government, and cloud computing) and some questions about external resources and structures used in their organizations.

4.2.2.2 The Cloud Utilization

This section seeks to know whether the ministry adopts cloud computing, which stage is reached by the ministry using cloud computing**.**

4.2.2.3 The Factors of E-Government Development Using Cloud Computing

This section consists of eleven subsections to cover all the dependent and independent variables of the study. The questions about this section seek to survey the perception of the respondents regarding the factors affect the movement to cloud computing and these factors connected with our research problems. The survey questions are from sources were used these factors as in Table 4.1. This section uses a five-point Likert Scales such that "1" refers to strongly disagree and "5" refers to strongly agree.

Table 4.1: The Survey Questions for each Factor

Factor	Questions
Adoption of cloud computing (ACC)	• Cloud computing is not difficult for using [66] • Cloud computing reduces time of transactions completion[39] • Cloud computing reduces the cost [47] • Cloud computing is safe [66] • Cloud computing is reliable [69]
Trust (TR)	• Cloud computing will be controlled on technology difficulties Existing in E-government [50] • Cloud computing provides an environment of confidence to connect citizens with the E-government [69] • Adoption of cloud computing in E-government can be trusted with the implementation of online transactions quickly and reliably and faithfully [72] • Cloud computing service providers are trustworthy [66] • Overall, E-government can be trusted when adopting cloud computing [45]
Budget (BU)	• Cloud computing reduces the budget by redeploying Information Technology staff in public organizations [39] • Cloud computing reduces the number of the used devices in E-government, which leads to cost reduction [72] • Cloud computing helps to build interconnected environments work which contributes to improving the performance and reducing the costs [69] • Cloud computing reduces the costs of (software, operations, hardware) in E-government [73]

Factor	Questions
Compatibility (CA)	• Changes introduced by cloud computing are compatible with E-government [47] • In the case of any problem of incompatibility, the cloud service provider will provide integrated services [47] [66]. • Cloud computing is compatible with current information technology infrastructure [50]
Complexity (CX)	• When adopting cloud computing, the current work will be integrated easily with platforms and cloud computing services [47] [66] • Cloud computing has flexible interaction with E-government [74]
Security (SE)	• When adopting cloud computing in E-government, there is no loss or manipulated in government data [66] • The sharing of government information with cloud computing suppliers does not endanger ministry [66] • There are enough regulations in ministry to protect the government's data from the cloud computing dangers[72] • Overall, cloud computing provides security for data of E-government [66] [69]
IT Infrastructure (ITI)	• Information technology infrastructure at the ministry is ready to adopt cloud computing technology [72] • The use of cloud computing will reduce the load of infrastructure management for information technology [66] • Based on cloud computing, it is not necessary to remain the infrastructure for information technology [47] • The creation of Infrastructure depending on the basic needs of the organization reduces the storage costs.[69]

Factor	Questions
IT Knowledge (ITK)	• The staff knows a lot about cloud computing services [74] • Staff has knowledge about the benefits and disadvantages of cloud computing [66] • Staff has enough experience for adopting the cloud computing in E-government [74]
Technology Readiness (TRE)	• The ministry can implement cloud computing technology – unlimited access to the computer, due to it has enough technology recourses [66] • The ministry allocates a part of the total profit to contribute to cloud computing implementation in the ministry [66].
Managerial Support (MS)	• The manager is ready to bear the risks occur in the ministry when adopting cloud computing [47] [66] • The manager supports the development of cloud computing technology in the ministry [39] • The managers have knowledge about the cloud computing benefits in the ministry [39] • The managers provide the necessary resources to adopt cloud computing technology[47] [39]
Relative Advantage (RA)	• Cloud computing provides information to users in any era and any area [66] • when adopting cloud computing, The Ministry pays only for the services have used [47] • The performance level of cloud computing services will not weaken when increasing the number of users[66] • Cloud computing can improve the efficiency of communication among public organizations [39]

4.2.3 Pilot Study

A pilot study was done to a group of 15 respondents to evaluate the understanding and the clarity of the survey questions. Participants in the pilot study are Iraqi students have a master degree in the IT department at our university because the most of them are employees in the Iraqi ministries and organizations. The opportunity was given to respondents to comment and provide their feedback. There was no change in the original set of the questions. Questions were clear and understandable.

4.2.4 Data Collection

In our research, we have used a survey as a data collection tool. The questionnaire created by the Google form application, and it distributed online. A link sent to the government employees in the Ministries and public organizations in Iraq. The questionnaire sent to respondents via email and social media. The questionnaire was translated and posted in Arabic languages, as shown in Appendix 3. One month period was given to respondents to answer the survey. Data collected from 338 respondents of employees, in 22 ministries and organizations in Iraq.

After collecting the data, we analyzed the data by (SPSS) analysis and depending on the result of the analysis; we will propose an appropriate cloud computing model for Iraqi E-government.

4.3 Findings

In this chapter, ten independent factors identified which effect on the adoption of cloud computing in the Iraqi electronic government (trust, budget, compatibility, complexity, security, IT infrastructure, IT knowledge, technological readiness, managerial support, and relative advantage). Such that, each factor has two hypotheses, positive hypothesis and negative hypothesis. If the positive hypothesis rejects, the negative hypothesis will be instead of it. The dependent factor in our research is the adoption of cloud

computing. The questionnaire was distributed online to IT staff in the Iraqi organizations and ministries. Data collected from 338 responders. The data will be analyzed by SPSS version 23, depending on the results of the analysis; we will propose an appropriate cloud computing model for electronic government in Iraq. The results of the analysis and the proposed model were discussed in chapter 5.

CHAPTER FIVE

ANALYSIS AND DISCUSSIONS

This chapter presents the analysis and the discussion of our study. It consists of eight main sections. The first section provides a description of the background of the respondents such as their age, gender, occupation, education, and usage of cloud computing services to inform the audience about the respondents of the study. In the second section, the reliability of the survey presented. The third section presents a test of normality.The fourth section focuses on Correlation Analysis among factors. The fifth section provides the Level of independent and dependent variables. The sixth section focuses on the factors which effect on the adoption of cloud computing by using regression analysis. Also, the study presents both of the result and the discussion of the hypotheses of the factors.The seventh section illustrates the study of cloud-based E-government factors. Lastly, the findings in chapter five.

5.1 Descriptive Information for the Respondents

The descriptive information of the respondents presented in tables and figures show the distributions of the respondents about gender, age, scientific qualification, ministries, The techniques used in ministries, and usage of cloud computing services.

5.1.1 Gender

The first question in the survey is the gender of the respondents in the Iraqi organizations and ministries, the results of answers for males and females are shown in the Table and Figure 5.1, respectively.

Table 5.1: Gender of the Respondents

Gender	Label	Frequency	Percent %
	Male	235	69.53
	Female	103	30.47
	Total	338	100.0

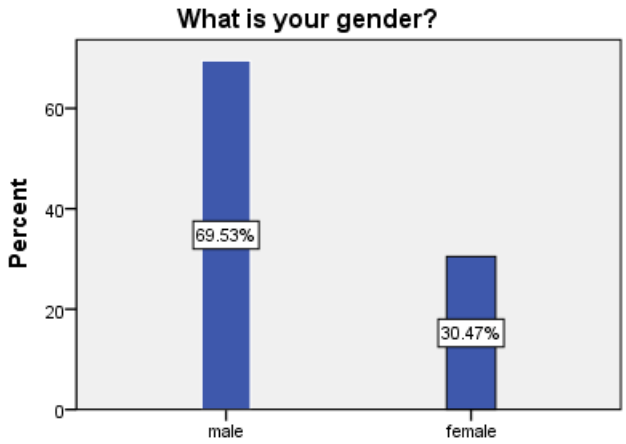

Figure 5.1: Gender of the Respondents

The Table and Figure 5.1 explain that 69.53% of the respondents are males and 30.47% are females. It means more than half of the respondents were men.

5.1.2 Age

The second question in the survey is the age of the respondents in the Iraqi organizations and ministries, the results of answers for the respondents are shown in the Table and Figure 5.2, respectively.

Table 5.2: Age of the Respondents

Age	Label	Frequency	Percent %
	< 30 years	56	16.57
	30-40 years	232	68.64
	41-50 years	46	13.61
	> 50 years	4	1.18
	Total	338	100.0

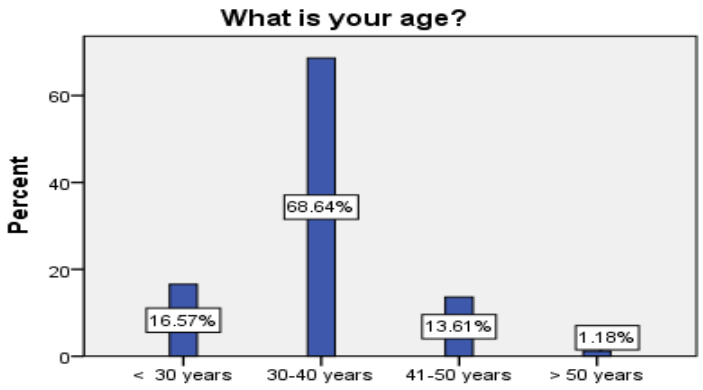

Figure 5.2: Age of the Respondents

The Table and Figure 5.2 show that 16.57% of the respondents are less than 30 years, followed by 68.64% in the age group of 30 to 40. 13.61% in the age group of 41 to 50 years and 1.18% of the respondents are more than 50 years. It means the ages which strongly available in the Iraqi ministries and organizations are the younger age groups a fairly, which have the ability for adaptation and compatibility with the use of new technologies.

5.1.3 What is your Scientific Qualification?

The third question in the survey is about the scientific qualification of the respondents in the Iraqi organizations and ministries, the results of answers for the respondents are shown in the Table and Figure 5.3, respectively.

Table 5.3: Scientific Qualification of the Respondents

Scientific qualification	Label	Frequency	Percent %
	Diploma	3	0.89
	Bachelor	146	43.20
	Higher Diploma	14	4.14
	Master	141	41.72
	PhD	34	10.06
	Total	338	100.0

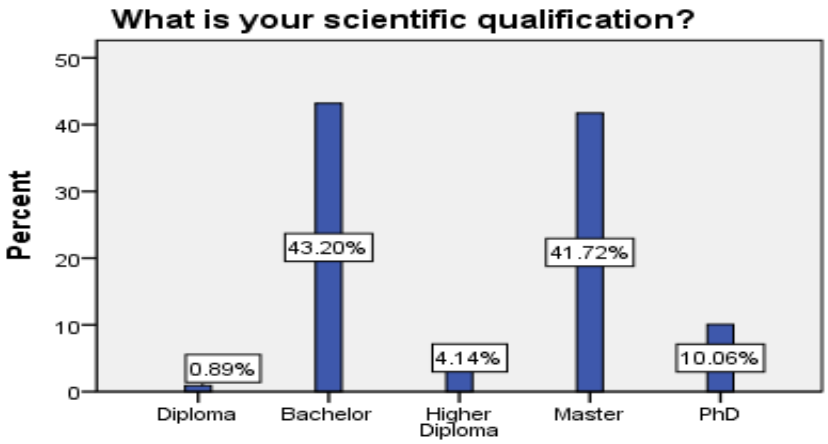

Figure 5.3: Scientific Qualification of the Respondents

The Table and Figure 5.3 show that 0.89% of the respondents have diploma degree. 43.20% of the respondents have a bachelor degree. 4.14% of the respondents have a higher diploma degree. 41.72% of the respondents have a master's degree. 10.06% of the respondents have a PhD. Degree.It means the education levels of staff in the Iraqi ministries and organizations, ranging widely between bachelor and master. The result ensures the answers were via people with a high degree of education.

5.1.4 Which Ministry You are Working?

The fourth question in the survey is about the ministries for the respondents in the Iraqi government, the results of answers for the respondents are shown in the Table and Figure 5.4, respectively.

Table 5.4: The Ministry of the Respondents

Name of Ministries	Frequency	Percent %
Ministry of Higher Education	61	18.0
Ministry of Education	44	13.0
Ministry of Electricity	25	7.4
Ministry of Transportation	16	4.7
Ministry of Communication	14	4.1
Ministry of Health and Environment	14	4.1
Ministry of Defense	12	3.6
Ministry of Labor and Social Affairs	12	3.6
Ministry of Oil	12	3.6
Other	12	3.6
Ministry of Agriculture	11	3.3
Ministry of Finance	10	3.0
Ministry of Housing and Construction	10	3.0
Ministry of Justice	10	3.0
Ministry of Planning	10	3.0
Ministry of Water Resources	10	3.0
Ministry of Foreign Affairs	9	2.7
Ministry of Culture	8	2.4
Ministry of Interior	8	2.4
Ministry of Migration and Displacement	8	2.4
Ministry of Youth and Sports	8	2.4
Ministry of Industry	7	2.1
Ministry of Trade	7	2.1
Total	338	100.0

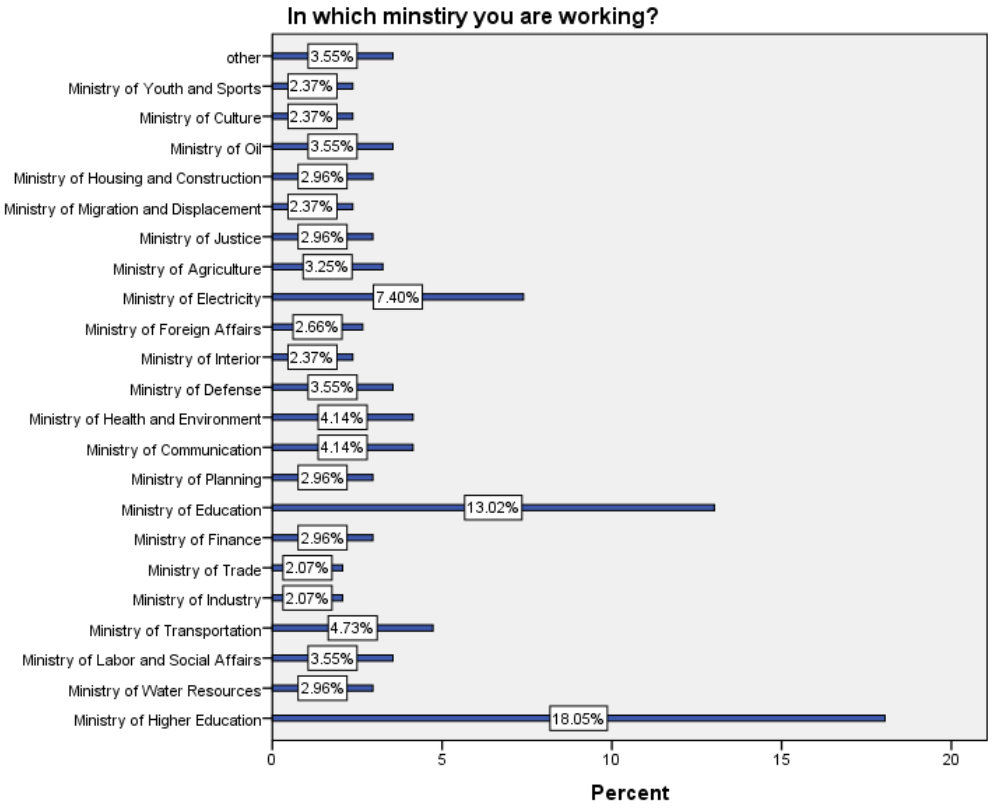

Figure 5.4: The Ministry of the Respondents

The Table and Figure 5.4 show that 18.0% of the respondents work in the Ministry of Higher Education.3.0% of the respondents work in the Ministry of Water Resources. 3.6% of the respondents work in the Ministry of Labour and Social Affairs. 4.7% of the respondents work in the Ministry of Transportation. 2.1% of the respondents work in the Ministry of Industry. 2.1% of the respondents work in the Ministry of Trade. 3.0% of the respondents work in the Ministry of Finance. 13.0% of the respondents work in the Ministry of Education. 3.0% of the respondents work in the Ministry of Planning. 4.1% of the respondents work in the Ministry of Communication. 4.1% of the respondents work in the Ministry of Health and Environment. 3.6% of the respondents work in the Ministry of Defence. 2.4% of the respondents work in the Ministry of Interior. 2.7% of the respondents work in

the Ministry of Foreign Affairs. 7.4% of the respondents work in the Ministry of Electricity. 3.3% of the respondents work in the Ministry of Agriculture. 3.0% of the respondents work in the Ministry of Justice. 2.4% of the respondents work in the Ministry of Migration and Displacement. 3.0% of the respondents work in the Ministry of Housing and Construction. 3.6% of the respondents work in the Ministry of Oil. 2.4% of the respondents work in the Ministry of Culture. 2.4% of the respondents work in the Ministry of Youth and Sports. 3.6% of the respondents work in other organizations. It means the most responses were from the Ministry of Higher Education, education, and electricity. These ministries are the largest ministries in Iraq have many employees and organizations.

5.1.5 Had Ever Been Worked in Another Ministry?

The fifth question in the survey is about if the respondents had been collaborated in the other ministry before, to find out whether there were any similarity in the used systems in the ministries. The results of answers for the respondents are shown in the Table and Figure 5.5, respectively.

Table 5.5: The Work in another Ministry of the Respondents

Another ministry	**Label**	**Frequency**	**Percent %**
	Yes	131	38.76
	No	207	61.24
	Total	338	100.0

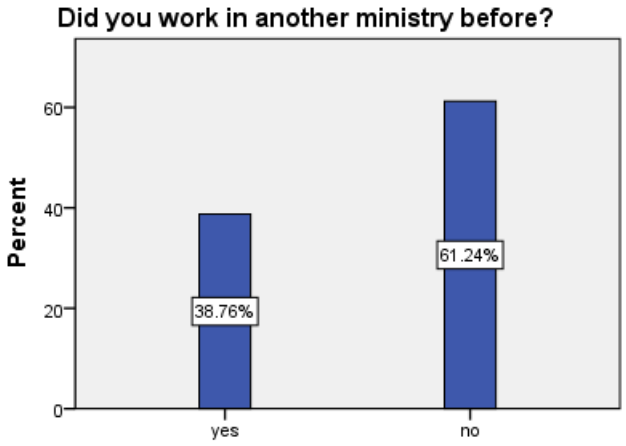

Figure 5.5: The Work in another Ministry of the Respondents

The Table and Figure 5.5 show that 38.76% of the respondents answered yes, and 61.24% of the respondents answered no. It means more than half-staff is not worked in any previous ministry**.**

5.1.6 If Answered YES to the Previous Question, Is There Any Systems Used Similarly to Each Other in Those Ministries?

The sixth question in the survey is about if the respondents answer yes about working in the other ministries before, to see if there were any similarity in the used systems in the ministries or not. The results of answers for the respondents are shown in the Table and Figure 5.6, respectively.

Table 5.6: The Similar Systems Used in Different Ministries

The similar systems	**Label**	**Frequency**	**Percent %**
	Yes	56	42.75
	No	75	57.25
	Total	131	38.8

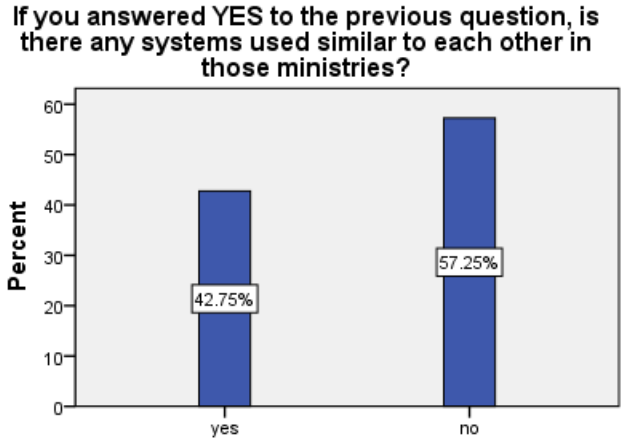

Figure 5.6: The Similar Systems Used in Different Ministries

The Table and Figure 5.6 show that 42.75% of the respondents answered yes, and 57.25% of the respondents answered no. This question is not required, so the total number of respondents is 131, and the missing value is 207. It means the systems dissimilar somewhat in the Iraqi ministries.

5.1.7 How Many Years Has Experience in Your Current Job?

The seventh question in the survey is about work experience for the respondents in the Iraqi organizations and ministries, the results of answers of the respondents are shown in the Table and Figure 5.7, respectively.

Table 5.7: The Job Experience of the Respondents

Job experience	**Label**	**Frequency**	**Percent %**
	< 2 years	26	7.69
	2-6 years	81	23.96
	7-10 years	117	34.62
	> 10 years	114	33.73
	Total	338	100.0

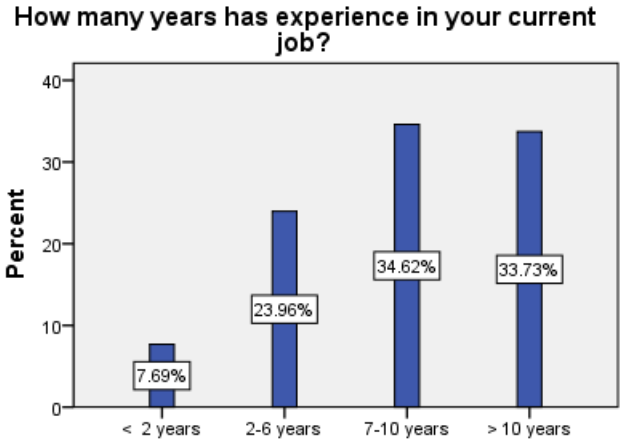

Figure 5.7: The Job Experience of the Respondents

The Table and Figure 7.5 indicate that 7.69% of respondents has experienced less than 2 years. 23.96% in the experience group of 2 to 6. 34.62% in the experience group of 7 to 10 years. 33.73% of respondents have experience more than ten years. It means the owners of the experience of more than 7 years are strongly present in the Iraqi ministries and organizations. Due to the owners have enough experience in work, they may have a clear vision as to whether the adoption of modern technologies in the Iraqi ministries and organizations will be useful and efficient.

5.1.8 What Is Your Title in Your Department?

The eighth question in the survey is about the title, to know the position of the respondents in the Iraqi organizations and ministries, the results of answers of the respondents are shown in the Table and Figure 5.8, respectively.

Table 5.8: The Title of the Respondents

The title	Label	Frequency	Percent %
	Director of information technology department	31	9.17
	Assistant director of IT department	29	8.58
	Team leader in information technology department	81	23.96
	Employee in information technology department	197	58.28
	Total	338	100.0

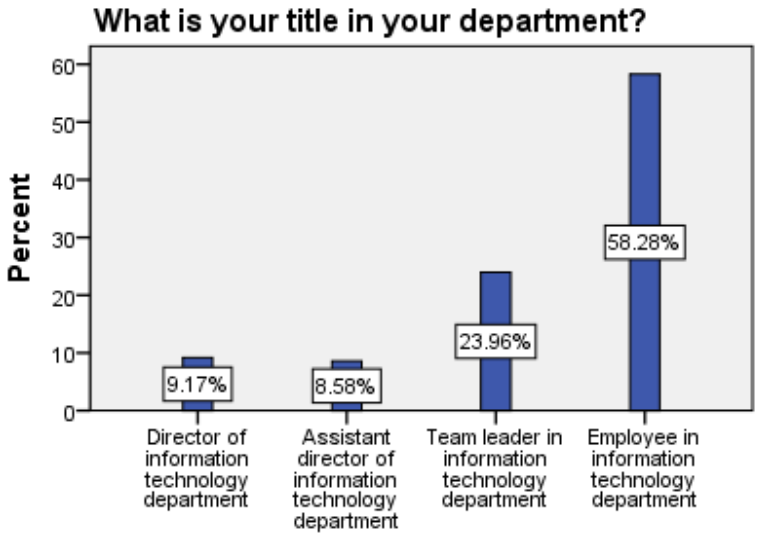

Figure 5.8: The Title of the Respondents

The Table and Figure 5.8 indicate that 9.17% of the respondents are director of information technology department. 8.58% of the respondents are assistant director of information technology department. 23.96% of the respondents are the team leader in information technology departments, and 58.28% of the respondents are an employee in an information technology

department.It means more than half of the respondents are employees in the information technology department.

5.1.9 How Long Have You Been Worked in the Information Technology (IT) Department?

The ninth question in the survey is about the years of the work in the IT department, to find out how much staff experienced in the field of information technology overall, the results of answers of the respondents are shown in the Table and Figure 5.9, respectively.

Table 5.9: The Working in (IT) Department of the Respondents

The working in an information technology department	Label	Frequency	Percent %
	< 5 years	82	24.26
	5-10 years	156	46.15
	11-15 years	74	21.89
	> 15 years	26	7.69
	Total	338	100.0

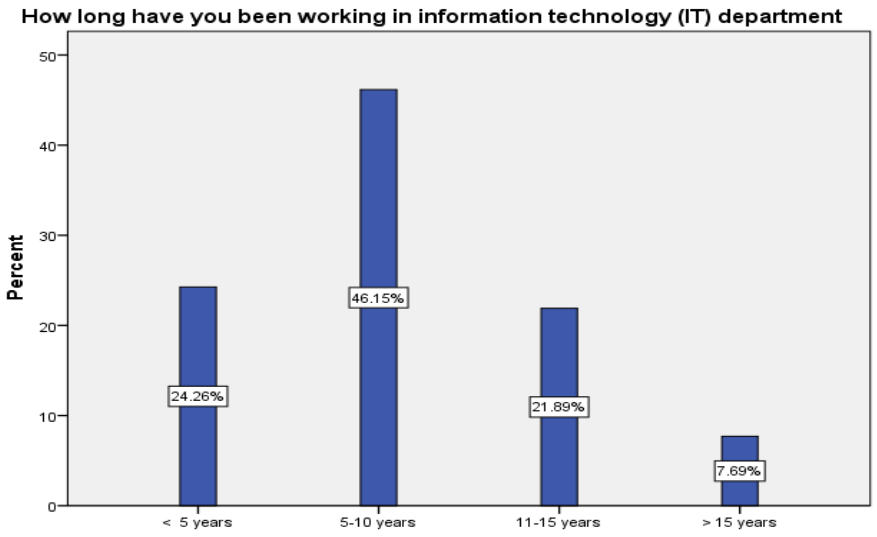

Figure 5.9: The Working in (IT) Department of the Respondents

The Table and Figure 5.9 show that 24.26% of the respondents work less than 5 years. 46.15% in the work group of 5 to 10 years. 21.89% in the work group of 11 to 15 years.Moreover, 7.69% of the respondents they work more than 15 years.It means approximately half of the respondents have experience in the field of information technology for a period ranging between 5-10 years.

5.1.10 Do You Have Any Experience With the Electronic Government Project?

The tenth question in the survey is about the experience in an electronic government project, to find out whether the staff experience in E-government project, the results of answers of the respondents are shown in the Table and Figure 5.10, respectively.

Table 5.10: The Experience in the Electronic Government of the Respondents

The experience in the electronic government	Label	Frequency	Percent%
	Yes	144	42.60
	No	194	57.40
	Total	338	100.0

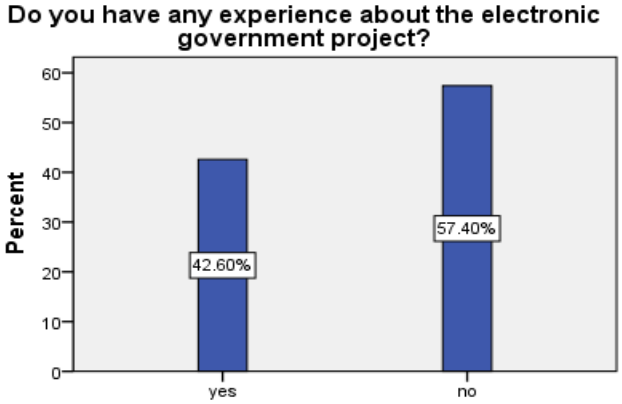

Figure 5.10: The Experience in the Electronic Government of the Respondents

The Table and Figure 5.10 show that 42.60% of the respondents answered yes, 57.40% of the respondents answered no. It means more than half of the respondents have no experience in E-government project.

5.1.11 If Your Answer to the Previous Question Is "YES", Please Explain Your Experience Briefly

The eleventh question in the survey is about if the respondents answer yes about the experience in the electronic government, the results of answers for the respondents are shown in the Table and Figure 5.11, respectively.

Table 5.11: The Brief Experience in the Electronic Government of the Respondents

The brief experience in the electronic government	Label	Frequency	Percent %
	Graduation project about E-government	23	23.47
	Participation in seminars and training sessions about E-government	16	16.33
	Receiving mail from employees and citizens and send it to other organizations	27	27.55
	Management and development of E-government software	22	22.45
	Work on connecting servers and E-government networks	10	10.20
	Total	98	29.0

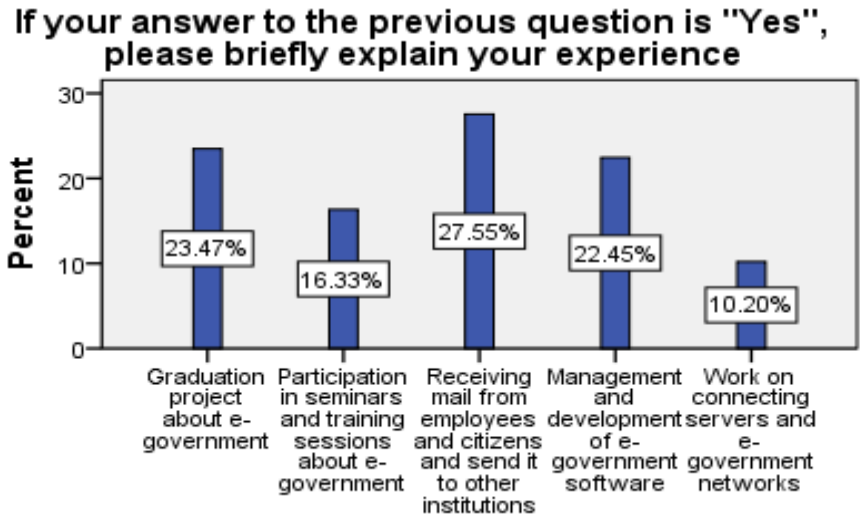

Figure 5.11: The Experience in the Electronic Government of the Respondents

The Table and Figure 5.11 show that 23.47% of the respondents have Graduation project about E-government. 16.33% of the respondents have a Participation in seminars and training sessions about E-government. 27.55% of the respondents receive mail from employees and citizens and send it to other organizations. 22.45% of the respondents have experience in management and development of E-government software. 10.20% of the respondentsWork on connecting servers and E-government networks. This question is not required, so the total number of respondents is 98, and the missing value is 240. It means the highest percentage of staff expertise in E-government project works on the E-government system and communicates with other ministries and organizations, employees and citizens

5.1.12 Which Kind of Internet Connection is Used in YourMinistry?

The twelfth question in the survey is the kind of internet connection in the Iraqi government ministries and organizations, the results of answers of the respondents are shown in the Table and Figure 5.12, respectively.

Table 5.12: The Kind of Internet Connection of the Respondents

The kind of internet connection	Label	Frequency	Percent%
	Dial up	51	15.09
	Satellite	107	31.66
	Fiber optics	99	29.29
	Dial-up, satellite	8	2.37
	Dial-up, fiber optics	4	1.18
	Satellite, fiber optics	22	6.51
	Dial-up, satellite, fiber optics	4	1.18
	Other connection	43	12.72
	Total	338	100.0

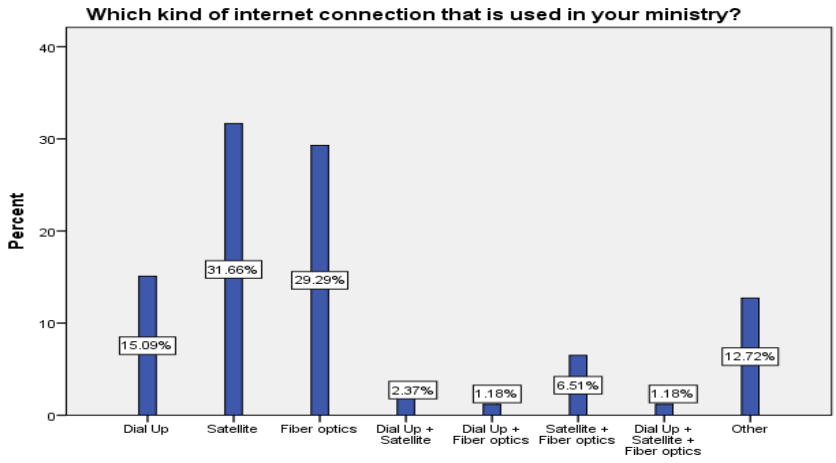

Figure 5.12: The Kind of Internet Connection of the Respondents

The Table and Figure 5.12 show that 15.09% of the respondents use dial up. 31.66% of the respondents use satellite. 29.29% of the respondents use fiber optics. 2.37% of the respondents use (dial-up, satellite). 1.18% of the respondents use (dial-up, fiber optics). 6.51% of the respondents use (satellite, fiber optics). 1.18% of the respondents use (dial-up, satellite, fiber optics). Moreover, 12.72% of the respondents use another connection. It means the

most of the ministries are used Internet connection by satellite and fiber optics.

5.1.13 what are the External Sources which Your Ministry Supports?

The thirteenth question in the survey is the type of the external source supports in Iraqi government ministries and organizations, the results of answers of the respondents are shown in the Table and Figure 5.13, respectively.

Table 5.13: The External Sources of the Respondents

The external sources	Label	Frequency	Percent %
	Network	74	21.9
	Software	40	11.8
	Hardware	20	5.9
	Network, Software	32	9.5
	Network, Hardware	12	3.6
	Software, Hardware	26	7.7
	Network, Hardware, Software	36	10.7
	Unavailable	98	29.0
	Total	338	100.0

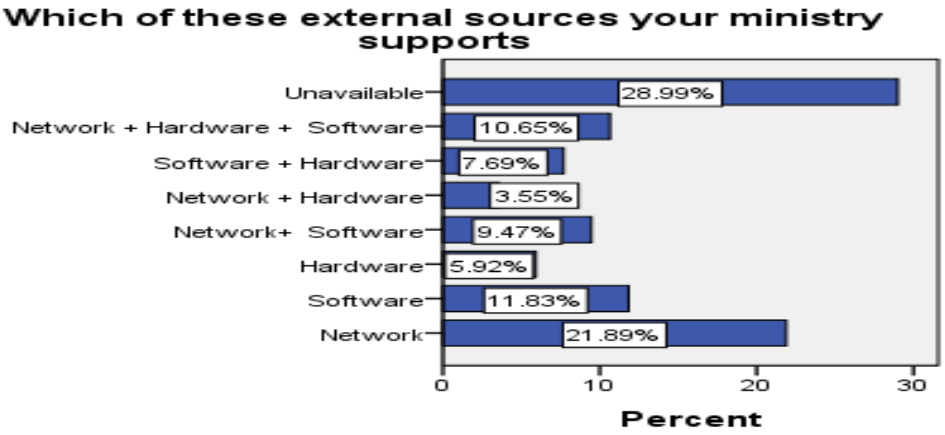

Figure 5.13: The External Sources of the Respondents

The Table and Figure 5.13 show that 21.9% of the respondents support network. 11.8% of the respondents support software. 5.9% of the respondents support hardware. 9.5% of the respondent's ministries support (network, software). 3.6% of the respondent's ministries support (network, hardware). 7.7% of the respondent's ministries support (software, hardware). 10.7% of the respondent's ministries support (network, hardware, software). 29.0% of respondents said there is no support from their ministries to these external sources.It means networks are the highest percentage of the sources supported by theIraqi government ministries and organizations, despite the fact a lot of agencies and ministries do not support any outsourcing.

5.1.14 Do You Have Any Idea About Cloud Computing?

The fourteenth question in the survey is the idea of staff of cloud computing, the results of answers of the respondents are shown in the Table and Figure 5.14, respectively.

Table 5.14: The Idea about Cloud Computing of the Respondents

The idea of cloud computing	Label	Frequency	Percent %
	Yes	256	75.74
	No	82	24.26
	Total	338	100.0

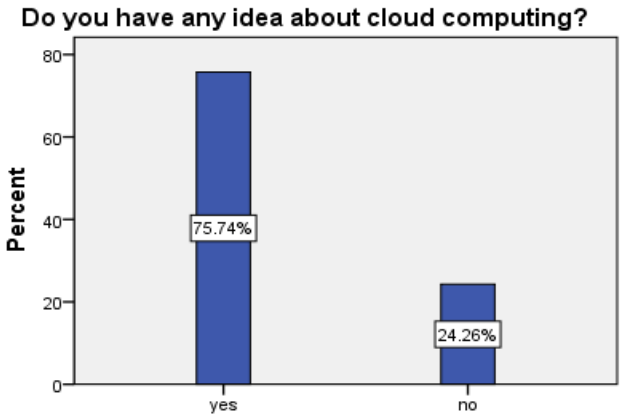

Figure 5.14: The Idea about Cloud Computing of the Respondents

The concept of cloud computing of respondents presented in Table 5.14. The Table and Figure 5.14 show that 75.74% of the respondents answered yes, 24.26% of the respondents answered no. That means, most of the employees in the Iraqi organizations and ministries have an idea about cloud computing.

5.1.15 Is Your Ministry Adopting Cloud Computing?

The fifteenth question in the survey is interested in asking whether the organizations or ministry relies on cloud computing, the results of answers of the respondents are shown in the Table and Figure 5.15, respectively.

Table 5.15: The Adopting of Cloud Computing in the Ministries of the Respondents

The adopting of cloud computing in ministries	Label	Frequency	Percent %
	Yes	73	21.60
	No	265	78.40
	Total	338	100.0

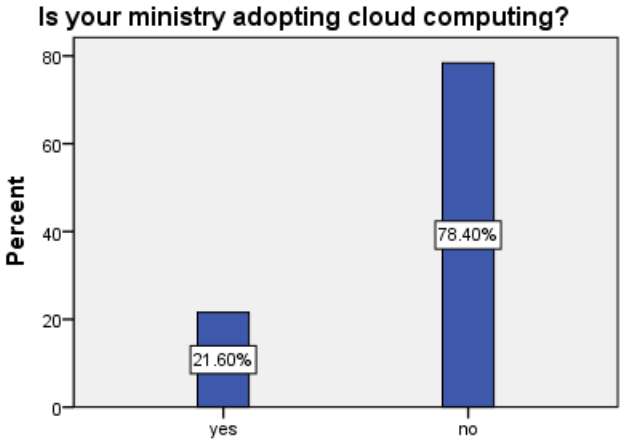

Figure 5.15: The Adopting of the Cloud Computing in the Ministries of the Respondents

The adopting of cloud computing in ministries of respondents presented in Table 5.15. The Table and Figure 5.15 show that 21.60% of the

respondents answered yes, 78.40% of the respondents answered no. That means the vast majority of organizations and ministries do not depend on cloud computing.

5.1.16 If Your Answer to The Previous Question Is "Yes", Explain Which Part Your Ministry Adopts Cloud Computing?

The sixteenth question in the survey is about cloud computing services adopted by the organizations and ministries of respondents, the results of answers of the respondents are shown in the Table and Figure 5.16, respectively.

Table 5.16: The Usage of Cloud Computing of the Respondents

The usage of cloud computing of respondents	Label	Frequency	Percent %
	Email	25	43.10
	Google Apps	8	13.79
	Electronic Archive	7	12.07
	Servers	7	12.07
	Storage	6	10.34
	Social Media	5	8.62
	Total	58	17.2

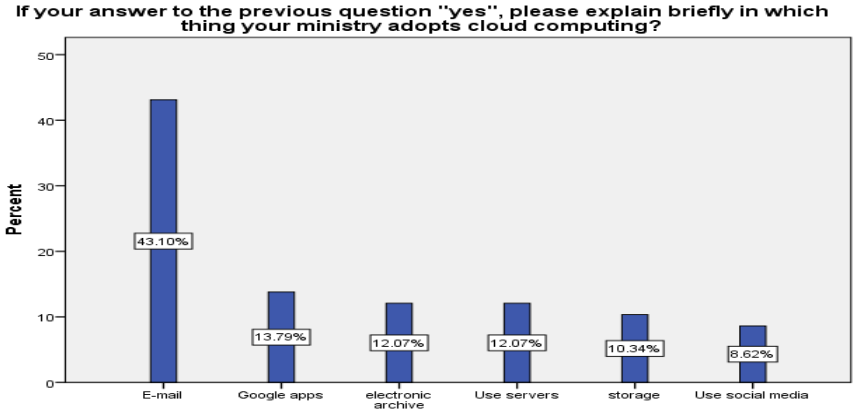

Figure 5.16: The Usage of Cloud Computing of the Respondents

The Table and Figure 5.16 show that 43.10% of the respondents use e-mail. 13.79% of the respondents use Google apps, 12.07% of the respondents use the electronic archive, 12.07% of the respondents use servers, 10.34% of the respondents use storage, 8.62% of the respondents use social media. This question was not required, so the total number of respondents is 58, and the missing value is 280. Depending on the results, we conclude the Iraqi ministries and organizations use email dramatically.

5.1.17 If Answer to the Previous Question is "No" Please Explain Briefly, Why Your Ministry Did Not Adopt the Cloud Computing?

The seventeenth question in the survey is Interested in asking the respondents about the reasons for not adopting cloud computing in their organizations or ministries, the results of answers of the respondents are shown in the Table and Figure 5.17, respectively.

Table 5.17: The Reasons for Non-Use of Cloud Computing of the Respondents

The reasons for non-use of cloud computing	Label	Frequency	Percent %
	Lack of knowledge	16	6.06
	The organizations does not want to change	14	5.30
	Lack of experience	32	12.12
	Lack of trust	20	7.58
	Lack of financial support	24	9.09
	The weakness of the infrastructure	18	6.82
	The weakness of the internet	8	3.03
	The lack of supporting the ministry	120	45.45
	Cloud computing not safe	12	4.55
	Total	264	78.1

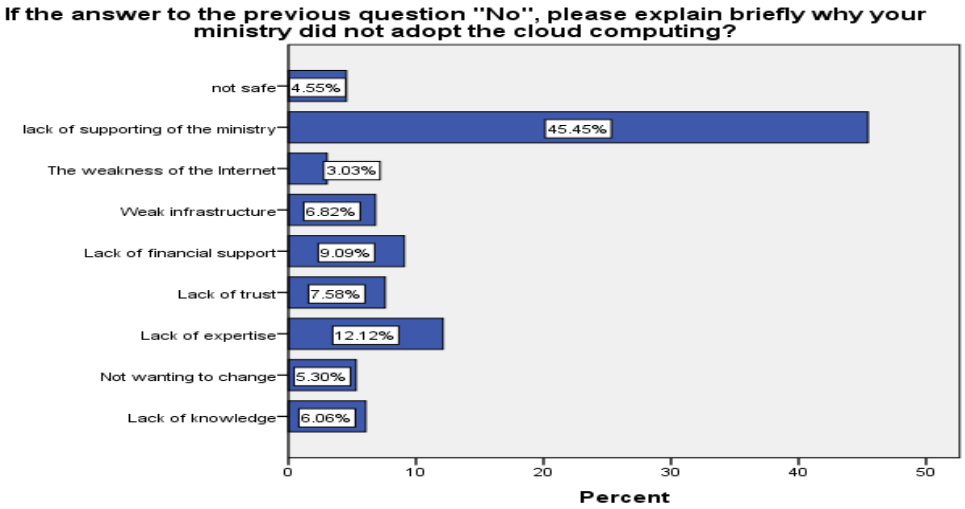

Figure 5.17: The Reasons for Non-Use of Cloud Computing of the Respondents

The Table and Figure 5.17 show that 6.06% of the respondents answered, because of the lack of knowledge. 5.30% of the respondents answered the organization does not want to change. 12.12% of the respondents answered the lack of experience. 7.58% of the respondents answered the lack of trust. 9.09% of the respondents answered the lack of financial support. 6.82% of the respondents answered the weakness of the infrastructure. 3.03% of the respondents answered the weakness of the internet. 45.45% of the respondents answered because of the lack of supporting of the ministry. 4.55% of the respondents answered cloud computing is not safe. This question is not required, so the total number of respondents is 264, and the missing value is 74. Depending on the results, we conclude the ministries do not provide supporting dramatically for the adoption of cloud computing technology.

5.1.18 what is the Reached Stage by Your Ministry Using Cloud Computing?

The eighteen questions in the survey are about the reached stage for Iraqi government ministries and organizations into the adoption of cloud computing, the results of answers of the respondents are shown in the Table and Figure 5.18, respectively.

Table 5.18: The Stage of Cloud Computing of the Respondents

The stage of cloud computing in the ministries	**Label**	**Frequency**	**Percent %**
	Not involved	184	54.44
	Discussing	81	23.96
	Trial	33	9.76
	Implemented	40	11.83
	Total	338	100.0

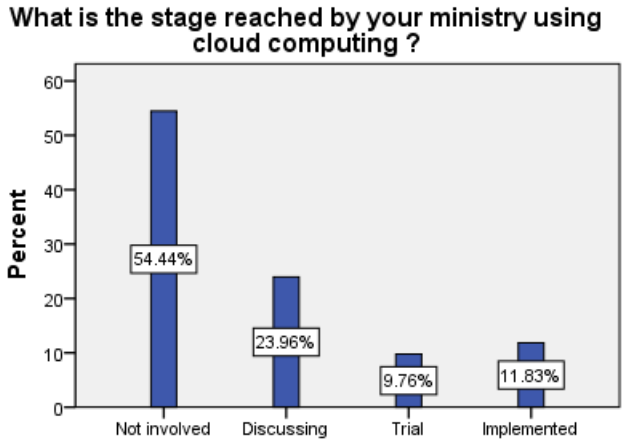

Figure 5.18: The Stage of Cloud Computing of the Respondents

The Table and Figure 5.18 show that 54.44% of the respondents are not involved, 23.96% of the respondents are with discussing stage, 9.76% of the respondents are with Trial stage, and 11.83% of the respondents are the Implementation stage. It means more than half of Iraq's organizations and ministries have not participated until now in the adoption of cloud computing.

5.1.19 What Is the Most Kind of Structures Available For Your Ministry?

The nineteenth question in the survey is the kind of structures are available in the Iraqi government ministries and organizations, the results of answers of the respondents are shown in the Table and Figure 5.19, respectively.

Table 5.19: The Kind of Structure of Cloud Computing of the Respondents

The kind of structure	Label	Frequency	Percent %
	Infrastructure as a Service (IaaS)	37	10.95
	Software as a Service (SaaS)	69	20.41
	Platform as a Service (PaaS)	80	23.67
	Infrastructure as a Service (IaaS), Software as a Service (SaaS)	7	2.07
	Infrastructure as a Service (IaaS), Platform as a Service (PaaS)	22	6.51
	Software as a Service (SaaS), Platform as a Service (PaaS)	41	12.13
	Infrastructure as a Service (IaaS), Software as a Service (SaaS), Platform as a Service (PaaS)	82	24.26
	Total	338	100.0

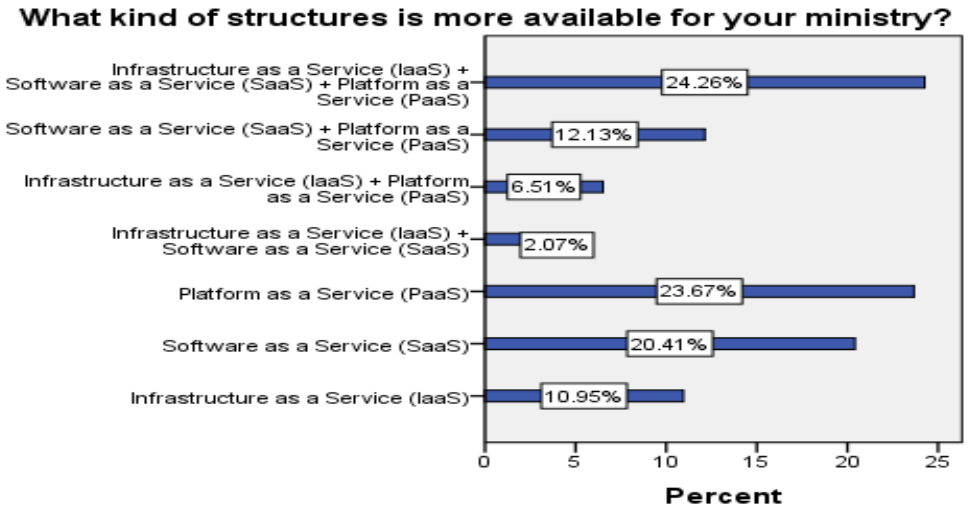

Figure 5.19: The Kind of Structure of Cloud Computing of the Respondents

The Table and Figure 5.19 show that 10.95% of the respondents are Infrastructure as a Service (IaaS). 20.41% of the respondents are Software as a Service (SaaS). 23.67% of the respondents are Platform as a Service (PaaS). 2.07% of the respondents are Infrastructure as a Service (IaaS) andSoftware as a Service (SaaS). 6.51% of the respondents are Infrastructure as a Service (IaaS), Platform as a Service (PaaS). 12.13% of the respondents are Infrastructure as a Service (SaaS), Platform as a Service (PaaS). 24.26% of the respondents are Infrastructure as a Service (IaaS), Software as a Service (SaaS), Platform as a Service (PaaS). Depends on the results, we conclude all kinds of structures (SaaS, PaaS, IaaS) are available in the Iraqi ministries and organizations.

5.2 Reliability Analysis

One of the widely used indicators for assessing the reliability of the measurement is Cranach's Alpha. The value of Cronbach's Alpha ranges from zero to one [79], as showing in the Table 5.20.

Table 5.20: The Range of the Reliability Values

Cronbach's Alpha	**Internal Consistency**
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$\alpha < 0.5$	Unacceptable

The value of our data is greater than 0.8 considers as the good value, so our data reliability is good. As showing in Table 5.21.

Table 5.21: Reliability Analysis

Reliability Statistics	
Cronbach's Alpha	**No. of items**
0.825	40

Table 5.21 presents the Cronbach's Alpha for all variables. The table shows that the Cronbach's Alpha for all variables is 0.825. The value is greater than 0.7, which indicated all the measurements are reliable.

5.3 Test of Normality

In statistics, this test is needed to assess the normality of a given set of data. For many statistical processes, it is a prerequisite for making the assessment of the normality of the data, since it is an important assumption in parametric testing. Various normality tests are available for the determination of normality of data. The normality tests used to determine whether a given set of data is well-defined by a normal distribution. The theoretical normal distribution can determine by each mean value and standard deviation combination. There are several methods of assessing whether data normally distributed or not. It falls into two broad categories: graphical and statistical. One of the common techniques is Cumulative frequency (P-P) plots [66] [72].

5.3.1 Histogram and P-P plot

The histogram is a plot, we can find, and show, the shape of the underlying recurrence distribution of a set of continuous data depending on it. It permits the examination of the data for its underlying distribution, e.g. normal distribution, outliers.

P-P Plots a variable's cumulative proportions against the cumulative proportions of any of some test distributions. Probability plots are used to determine whether the distribution of a variable matches a given distribution.

If the selected variable matches the test distribution, the points cluster will be around a straight line [72].

The normal distribution is the form of a curved, the mean of the normal distribution of the data will be in the center of the curve, the vertical axis represents the frequency of data, and the horizontal axis represents the periods will fall including the value of the data rate.

Trust histogram which shows a normal curve shown a Figure 5.20. P-P plot showed in Figure 5.21 consecutively

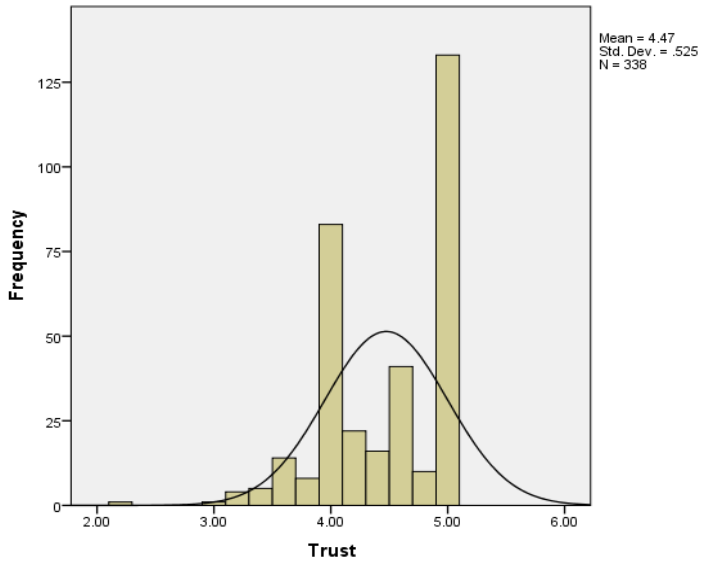

Figure 5.20: Histogram of Trust

In Figure 5.20 each axis represents Likert Scale response among 1 to 5, in Figure 5.20 the axis above 125 represents a response rate with mean= 4.74. The height for each axis represents the percentage of the respondent answered about trust in cloud computing.

The shape tilted in the center. Thus, the standard distribution model contains the best normal curve.

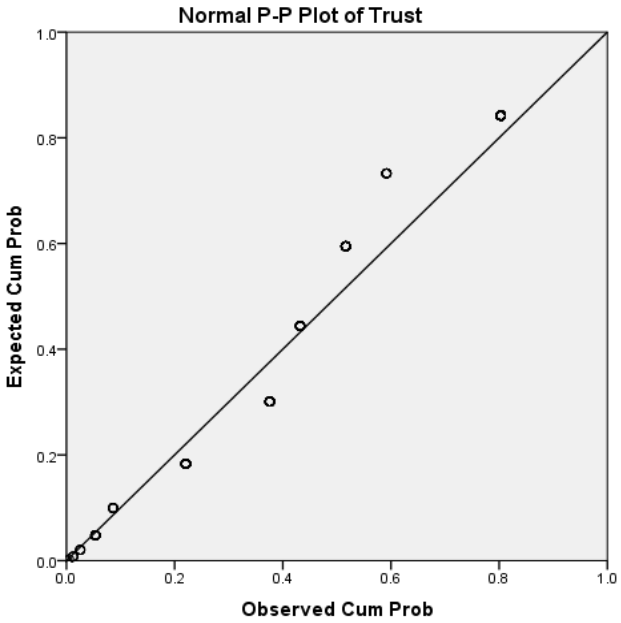

Figure 5.21: P-Plot of Trust

The budget histogram shows a normal curve in Figure 5.22. P-P plot showed in Figure 5.23 consecutively

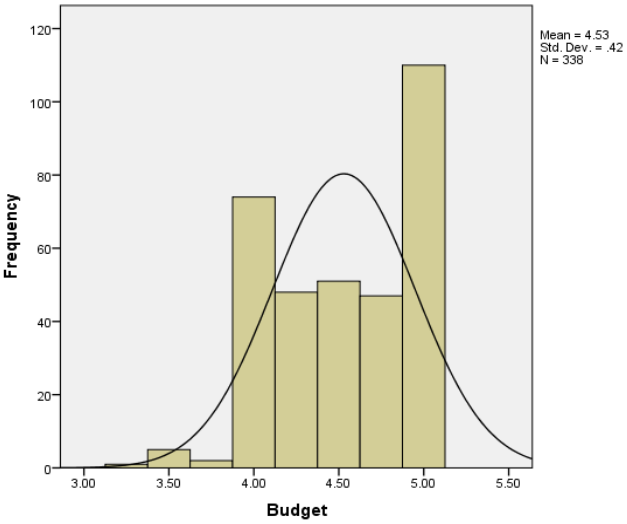

Figure 5.22: Histogram of Budget

In Figure 5.22 each axis represents Likert Scale response among 1 to 5, in Figure 5.22 the axis above 100 represents a response rate with mean=

4.53. The height for each axis represents the percentage of the respondent answered about the budget in cloud computing.

The shape tilted in the center. Thus, the normal distribution model contains the best normal curve.

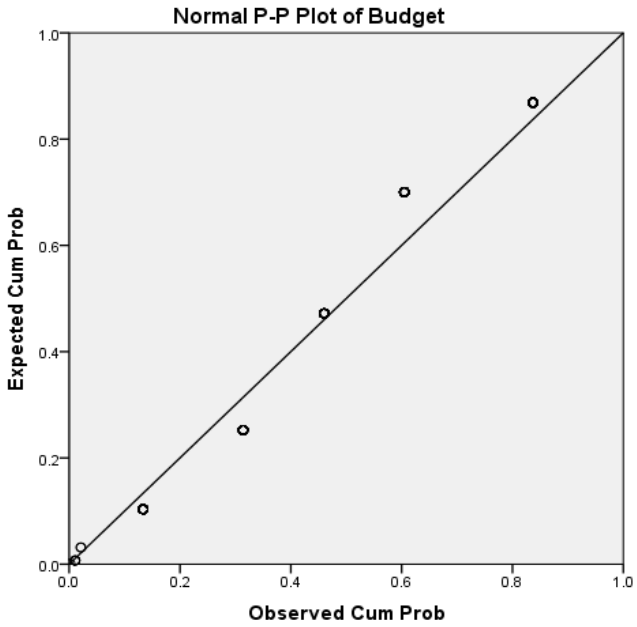

Figure 5.23: P-Plot of Budget

Compatibility histogram shows a normal curve in Figure 5.24. P-P plot showed in Figure 5.25 consecutively

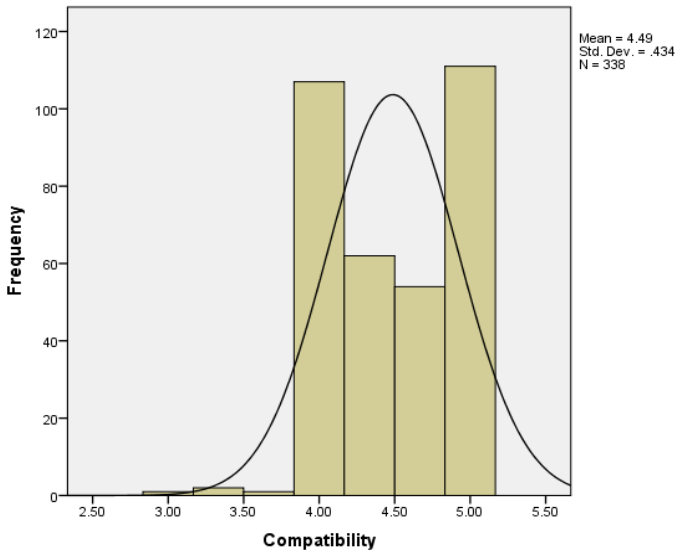

Figure 5.24: Histogram of Compatibility

In Figure 5.24 each axis represents Likert Scale response among 1 to 5, in Figure 5.24 the axis above 100 represents a response rate with mean= 4.49. The height of each axis represents the percentage of the respondent answered about compatibility with cloud computing.

The shape tilted in the center. Thus, the normal distribution model contains the best normal curve.

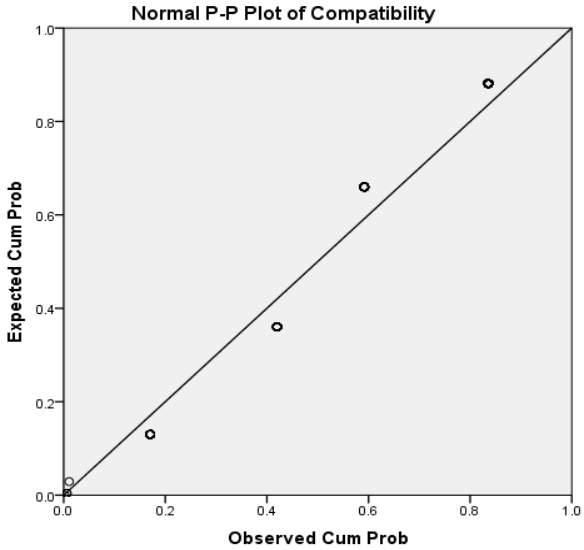

Figure 5.25: P-Plot of Compatibility

Complexity histogram shows a normal curve in figure 5.26. P-P plot showed in Figure 5.27 consecutively

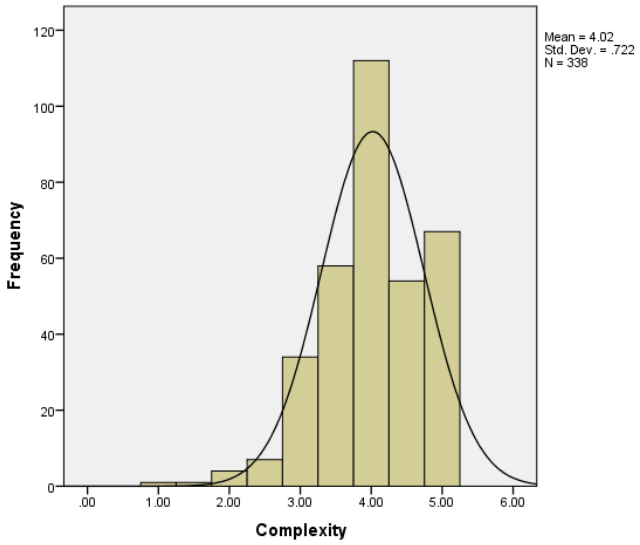

Figure 5.26: Histogram of Complexity

In Figure 5.26 each axis represents Likert Scale response among 1 to 5, in Figure 5.26 the axis above 100 represents response rate with mean= 4.02. The height for each axis represents the percentage of the respondent answered about complexity in cloud computing.

The shape tilted in the center. Thus, the normal distribution model contains the best normal curve.

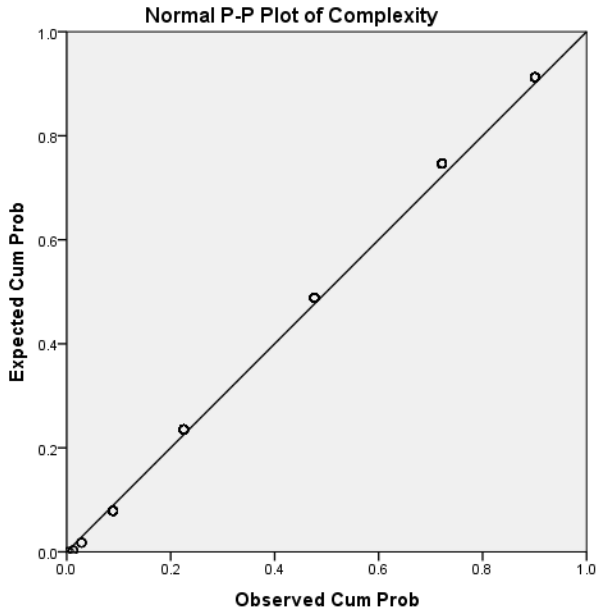

Figure 5.27: P-Plot of Complexity

Security histogram shows a normal curve in Figure 5.28. P-P plot showed in Figure 5.29 consecutively

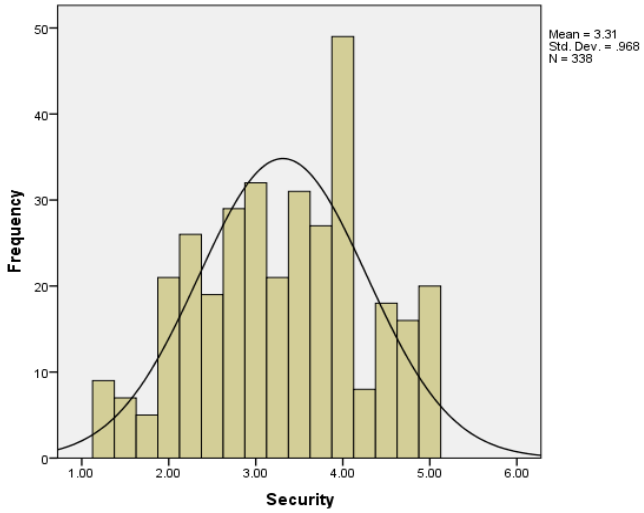

Figure 5.28: Histogram of Security

In Figure 5.28 each axis represents Likert Scale response among 1 to 5, in Figure 5.28 the axis above 40 represents a response rate with mean= 3.31. The height for each axis represents the percentage of the respondent answered about security in cloud computing.

The shape tilted in the center. Thus, the normal distribution model contains the best normal curve.

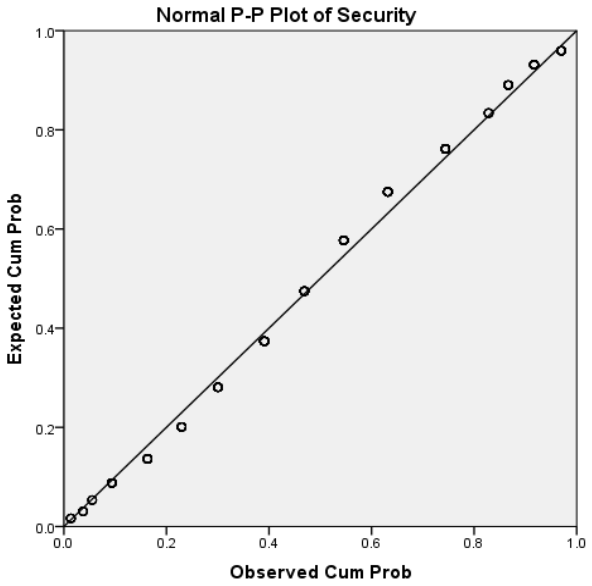

Figure 5.29: P-Plot of Security

IT knowledge histogram shows a normal curve in Figure 5. 30. P-P plot showed in Figure 5.31 consecutively

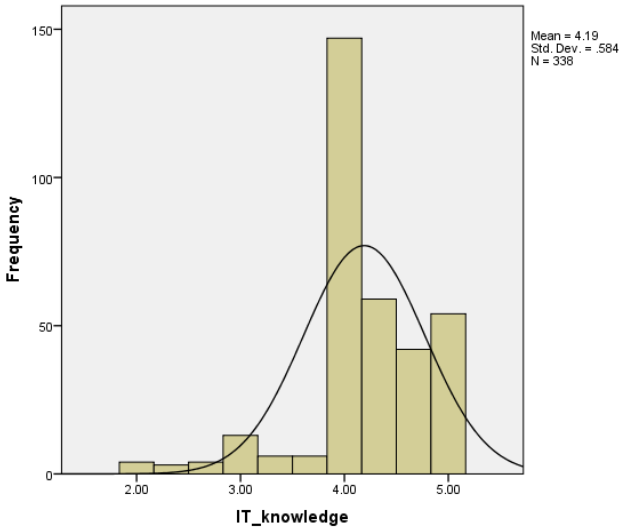

Figure 5.30: Histogram of IT knowledge

In Figure 5.30 each axis represents Likert Scale response among 1 to 5, in Figure 5.30 the axis above 100 represents a response rate with mean= 4.19. The height for each axis represents the percentage of the respondent answered about IT knowledge in cloud computing.

The shape tilted in the center. Thus, the normal distribution model contains the best normal curve.

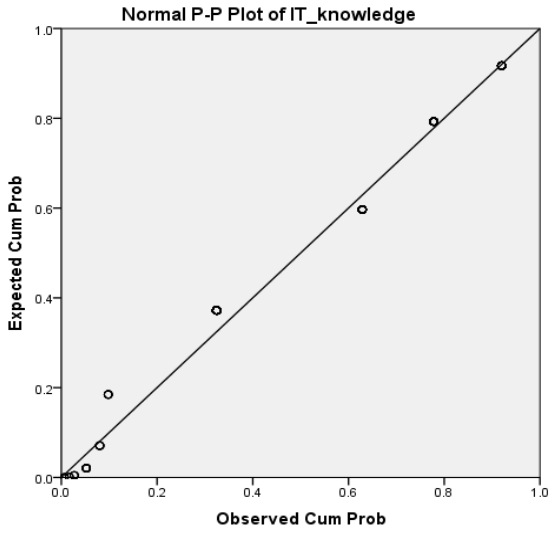

Figure 5.31: P-Plot of IT knowledge

IT infrastructure histogram shows a normal curve in Figure 5.32. P-P plot showed in Figure 5.33 consecutively

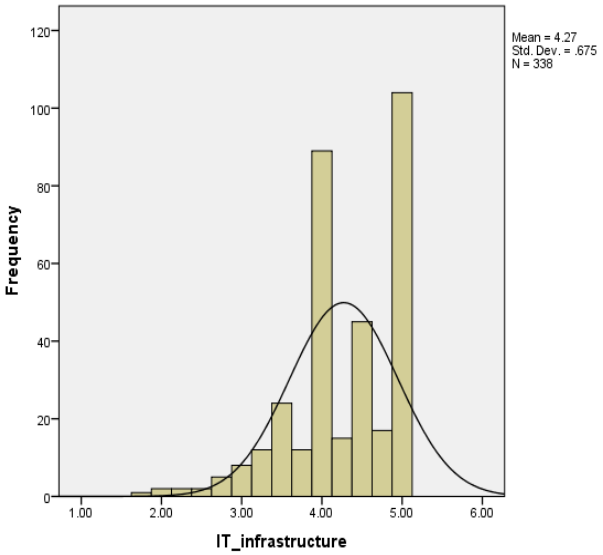

Figure 5.32: Histogram of IT Infrastructure

In Figure 5.32 each axis represents Likert Scale responses among 1 to 5, in Figure 5.32 the axis above 100 represents a response rate with mean= 4.27. The height for each axis represents the percentage of the respondent answered about IT infrastructure in cloud computing.

The shape tilted in the center. Thus, the normal distribution model contains the best normal curve.

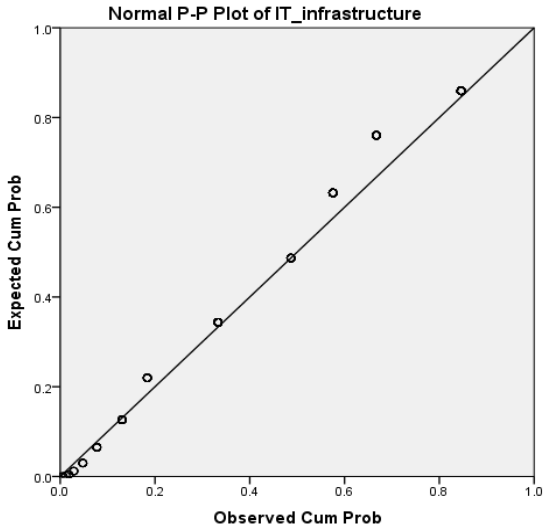

Figure 5.33: P-Plot of IT Infrastructure

Technology readiness histogram shows a normal curve in Figure 5.34. P-P plot showed in Figure 5.35 consecutively

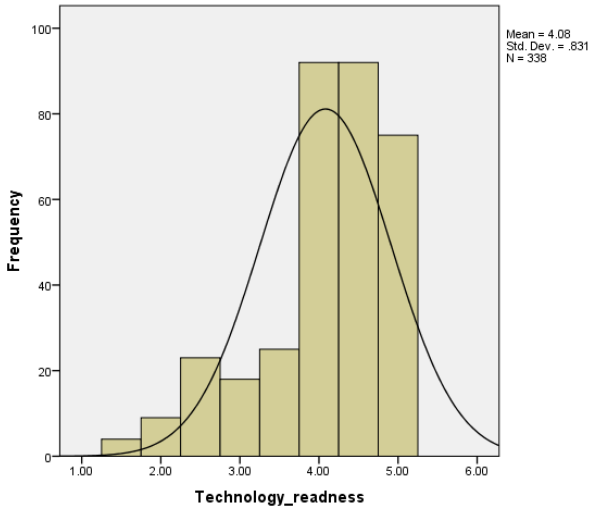

Figure 5.34: Histogram of Technology Readiness

In Figure 5.34 each axis represents Likert Scale responses among 1 to 5, in Figure 5.34 the axis above 80 represents a response rate with mean= 4.08. The height for each axis represents the percentage of the respondent answered about technology readiness.

The shape tilted in the center. Thus, the normal distribution model contains the best normal curve.

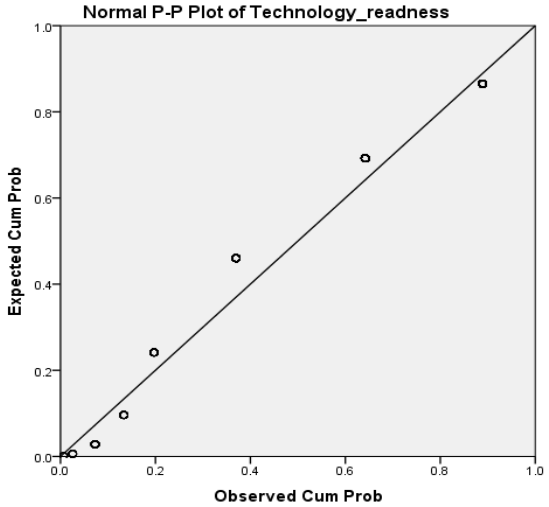

Figure 5.35: P-Plot of Technology Readiness

Managerial Support histogram shows a normal curve in Figure 5.36. P-P plot showed in Figure 5.37 consecutively

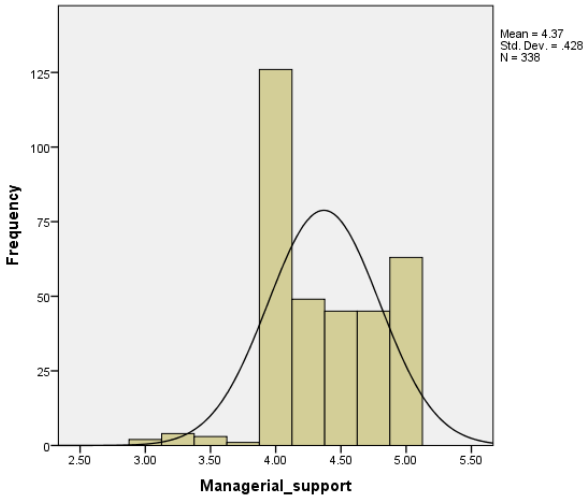

Figure 5.36: Histogram of Managerial Support

In Figure 5.36 each axis represents Likert Scale responses among 1 to 5, in Figure 5.36 the axis 125 represents a response rate with mean= 4.37. The height for each axis represents the percentage of the respondent answered about managerial support.

The shape tilted in the center. Thus, the normal distribution model contains the best normal curve.

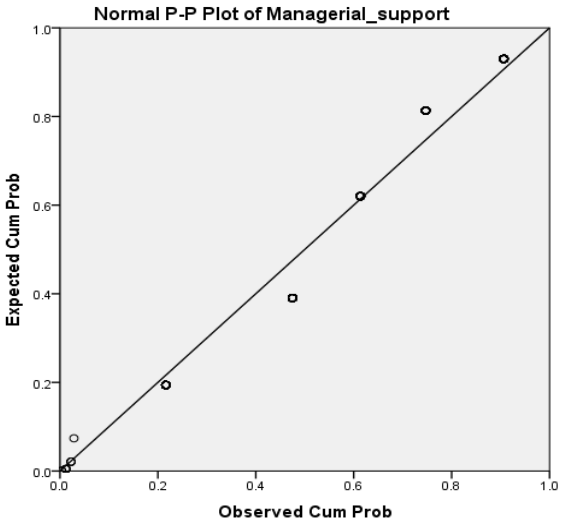

Figure 5.37: P-Plot of Managerial Support

Relative Advantage histogram shows a normal curve in Figure 5.38. P-P plot showed in Figure 5.39 consecutively

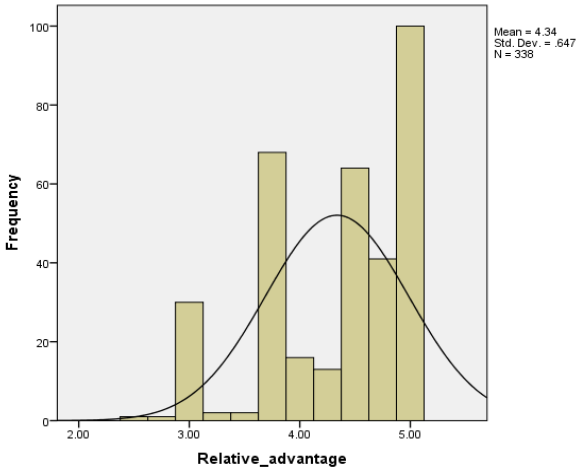

Figure 5.38: Histogram of Relative Advantage

In Figure 5.38 each axis represents Likert Scale responses among 1 to 5, in Figure 5.38 the axis 100 represents a response rate with mean= 4.34. The height for each axis represents the percentage of the respondent answered about Relative Advantage.

The shape tilted in the center. Thus, the normal distribution model contains the best normal curve.

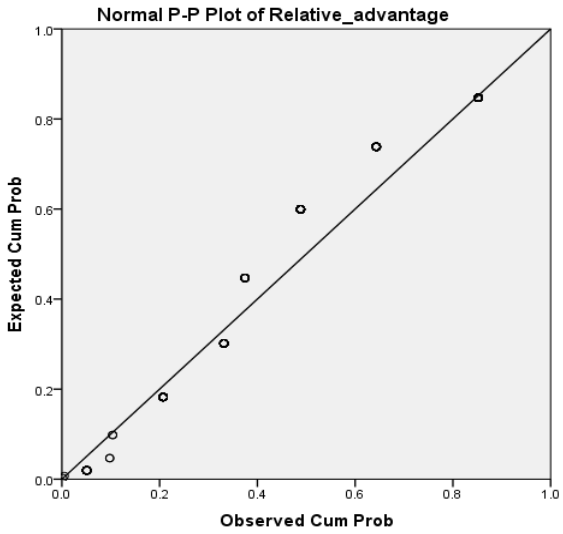

Figure 5.39: P-Plot of Relative Advantage

5.4 Correlation Analysis

Correlation is a method to measure the correlation between variables. As the correlation output is a statistical value (r), this value shows the strength and direction of the relationship between variables, and this value is known as the correlation coefficient [47].

As an assumption for conducting a regression analysis, the correlation between variables must be examined. The value of the Pearson correlation ranges from -1 to +1. Value is closer to +1 indicates the correlation is positive. Whereas a value is closers to -1 indicates the correlation is negative [72]. Table 5.22 explains the Pearson correlation coefficient between dependent and independent variables to find the relationship (r) between all variables.

Table 5.22: Pearson Correlation

Cor.	TR	BU	CA	CX	SE	ITI	ITK	TRE	MS	RA	CCA
TR	**1.000**										
BU	**-.007**	**1.000**									
CA	**.032**	**.179**	**1.000**								
CX	**-.053**	**.229**	**.021**	**1.000**							
SE	**.034**	**.164**	**.033**	**.246**	**1.000**						
ITI	**-.086**	**.135**	**.081**	**.165**	**.132**	**1.000**					
ITK	**.063**	**.050**	**.083**	**-.049**	**-.017**	**.031**	**1.000**				
TRE	**-.015**	**.026**	**.008**	**.123**	**.114**	**.203**	**.070**	**1.000**			
MS	**.114**	**.015**	**.030**	**-.038**	**-.014**	**.025**	**-.033**	**.009**	**1.000**		
RA	**.014**	**.018**	**.129**	**.093**	**.025**	**.053**	**.079**	**.007**	**.105**	**1.000**	
ACC	**.120**	**-.010**	**.141**	**.196**	**.169**	**.064**	**.089**	**-.061**	**.096**	**-.065**	**1.000**

Notes: TR=Trust BU=Budget CA=Compatibility CX=Complexity SE=Security ITI=IT Infrastructure ITK=IT knowledge TRE=Technology Readiness MS=Managerial Support RA=Relative Advantage ACC= Adoption of Cloud Computing

In Table 5.22 (r- value) for all variables are between +1 to -1.Trust ($r=0.120$, $P<0.05$), Compatibility ($r=0.141$, $P<0.05$), Complexity ($r=0.196$,

P<0.05), Security (r=0.169, P<0.05) were positive and significant correlating with cloud computing adoption.

But Budget (r=-0.010, NS), IT Infrastructure (r=0.064, NS), IT Knowledge (r=0.089, NS), Technology Readiness (r=-0.061, NS), Managerial Support (r=0.096, NS), Relative Advantage (r=-0.065, NS) were not correlated with cloud computing adoption. All details in Appendix 4. We apply correlation analysis in order to find the relationship between the dependent factor and independent factors. As shown in Table 5.22 the correlation is weak, but it is **significant**.

The weak of the correlation is due to several reasons:

✓ The heterogeneity of the ministries.

✓ The employees who answered the questions have a lack of experience in cloud computing, as shown in the Table 5.17.

✓ This result is biased according to the IT staff members who do not agree to integrate cloud computing as shown in the Table 5.17 the answer to (the lack of ministry supporting) has 120 respondents because they think if the ministries adopt cloud computing, they will get off a lot of employees.

Correlation factors are related completely with our hypothesis which detailed in chapter four.

5.5 Level of Independent and Dependent Variables

This section provides descriptive information on the dependent variable and the independent variables. The purpose of the descriptive information about the variables is to know the respondent's agreement levels for each item in all factors. It is also to find out the willingness of respondents to profit of the benefits when using the cloud computing services, and it helps to create a model by selecting questions have the highest mean [75]. The

perception of the respondents is assessed based on the value showed in Table 5.23.

Table 5.23: Interpretation of the Mean Score Value [75]

Range of Mean Score Value	Interpretation of the Result
1 – 1.80	Strongly Disagree
1.81- 2.60	Disagree
2.61 – 3.40	Natural
3.41-4.20	Agree
4.21-5	Strongly Agree

5.5.1 Adoption of Cloud Computing (Dependent Variable)

The mean score value of the adoption of cloud computing variable and its items presented in Table 5.24. The table shows the degree of respondent's agreement on each item in the factor.

Table 5.24: Mean Score Value of the Adoption of the Cloud Computing

Items	Mean	Interpretation
Cloud computing is not difficult for using	4.3609	Strongly Agree
Cloud computing reduces time of transactions completion	4.4083	Strongly Agree
Cloud computing reduces the cost	4.5266	Strongly Agree
Cloud computing is safe	4.5533	Strongly Agree
Cloud computing is reliable	4.4882	Strongly Agree

The table shows that the highest mean score value of 4.55 relates to the safe of cloud computing. A lowest mean score value of 4.36 is related to the easy with the use of cloud computing.

5.5.2 Trust

The mean score value of the Trust variable and its items presented in Table 5.25. The table shows the degree of respondent's agreement on each item in the factor**.**

Table 5.25: Mean Score Value of the Trust

Items	Mean	Interpretation
Cloud computing will be controlled on technology difficulties Existing in E-government	4.1923	Agree
Cloud computing provides an environment of confidence to connect citizens with the E-government	4.4822	Strongly Agree
Adoption of cloud computing in E-government can be trusted with the implementation of online transactions quickly and reliably and faithfully	4.5799	Strongly Agree
Cloud computing service providers are trustworthy	4.6113	Strongly Agree
Overall, E-government can be trusted when adopting cloud computing	4.5059	Strongly Agree

The table shows that the highest mean score value of 4.61 is related to the trust in cloud computing service providers. A lowest mean score value of 4.19 is related to control of cloud computing on the E-government challenges.

5.5.3 Budget

The mean score value of the Budget variable and its items presented in Table 5.26. The table shows the degree of respondent's agreement on each item in the factor**.**

Table 5.26: Mean Score Value of the Budget

Items	Mean	Interpretation
Cloud computing reduces the budget by redeploying Information Technology staff in public organizations	4.4556	Strongly Agree
Cloud computing reduces the number of the used devices in E-government, which leads to cost reduction	4.4970	Strongly Agree
Cloud computing helps to build interconnected environments work which contributes to improving the performance and reducing the costs	4.4970	Strongly Agree
Cloud computing reduces the costs of (software, operations, hardware) in E-government	4.6686	Strongly Agree

The table shows that the highest mean score value of 4.66 is related to the cloud computing reduces the cost of (software, operations, hardware) in E-government. A lowest mean score value of 4.45 relates to cloud computing reduces the budget by redeploying Information Technology staff in public organizations.

5.5.4 Compatibility

The mean score value of the Compatibility variable and its items presented in Table 5.27. The table shows the degree of respondent's agreement on each item in the factor**.**

Table 5.27: Mean Score Value of the Compatibility

Items	Mean	Interpretation
Changes introduced by cloud computing are compatible with E-government	4.4467	Strongly Agree
In the case of any problem of incompatibility, the cloud service provider will provide integrated services	4.4704	Strongly Agree
Cloud computing is compatible with current information technology infrastructure	4.5473	Strongly Agree

The table shows that the highest mean score value of 4.54 is related to the compatibility of cloud computing with current information technology infrastructure. A lowest mean score value of 4.44 is related to changing are given by cloud computing will be compatible with E-government.

5.5.5 Complexity

The mean score value of the Complexity variable and its items presented in Table 5.28. The table shows the degree of respondent's agreement on each item in the factor**.**

Table 5.28: Mean Score Value of the Complexity

Items	Mean	Interpretation
When adopting cloud computing, the current work will be integrated easily with platforms and cloud computing services	4.0355	Agree
Cloud computing has flexible interaction with E-government	4.0059	Agree

The table shows that the highest mean score value of 4.03 is related to the adopting cloud computing will be easy to integrate the current work with

platforms and cloud computing services. A lowest mean score value of 4.00 tied to the cloud computing has flexible interaction with E-government.

5.5.6 Security

The mean score value of the security variable and its items presented in Table 5.29. The table shows the degree of respondent's agreement on each item in the factor**.**

Table 5.29: Mean Score Value of the Security

Items	**Mean**	**Interpretation**
When adopting cloud computing in E-government, there is no loss or manipulated in government data	3.5414	Agree
The sharing of government information with cloud computing suppliers does not endanger ministry	3.3314	Natural
There are enough regulations in ministry to protect the government's data from the cloud computing dangers	3.3580	Natural
Overall, cloud computing provides security for data of E-government	3.0148	Natural

The table shows that the highest mean score value of 3.54 is related to the loss or manipulated in government data when adopting cloud computing in E-government. A lowest mean score value of 3.01 tied to the cloud computing provides security for data of E-government.

5.5.7 IT Infrastructure

The mean score value of the IT Infrastructure variable and its items presented in Table 5.30. The table shows the degree of respondent's agreement on each item in the factor**.**

Table 5.30: Mean Score Value of the IT Infrastructure

Items	Mean	Interpretation
Information technology infrastructure at your ministry is ready to adopt cloud computing technology	4.0118	Agree
The use of cloud computing will reduce the load of infrastructure management for information technology	4.2219	Strongly Agree
Based on cloud computing, it is not necessary to remain the infrastructure for information technology	4.3817	Strongly Agree
The creation of Infrastructure depending on the basic needs of the organization reduces the storage costs	4.4734	Strongly Agree

The table shows that the highest mean score value of 4.47 is related to reducing the storage cost when creation the Infrastructure depends on the basic needs of the organization. A lowest mean score value of 4.01 tied to the IT infrastructure in ministry is ready for adoption cloud computing technology.

5.5.8 IT Knowledge

The mean score value of the IT Knowledge variables and its items presented in Table 5.31. The table shows the degree of respondent's agreement on each item in the factor**.**

Table 5.31: Mean Score Value of the IT Knowledge

Items	Mean	Interpretation
The staff knows a lot about cloud computing services	4.1686	Agree
Staff has knowledge about the benefits and disadvantages of cloud computing	4.2101	Strongly Agree
Staff has enough experience for adopting the cloud computing in E-government	4.1923	Agree

The table shows that the highest mean score value of 4.21 is related to the knowledge of Staff about the advantages and disadvantages of cloud computing. A lowest mean score value of 4.16 is related to knowledge of Staff about cloud computing services.

5.5.9 Technology Readiness

The mean score value of the Technology Readiness variable and its items presented in Table 5.32. The table shows the degree of respondent's agreement on each item in the factor**.**

Table 5.32: Mean Score Value of the Technology Readiness

Items	Mean	Interpretation
The ministry can implement cloud computing technology – unlimited access to the computer, due to it has enough technology recourses	4.2012	Agree
The ministry allocates a part of the total profit to contribute to cloud computing implementation in the ministry	3.9644	Agree

The table shows that the highest mean score value of 4.20 is related to the ability of the ministry to implement cloud computing technology.A lowest mean score value of 3.96 tied to the ministry allocates a part of the total profit to contribute to cloud computing implementation in the ministry.

5.5. 10 Managerial Support

The mean score value of the Managerial Support variable and its items presented in Table 5.33. The table shows the degree of respondent's agreement on each item in the factor**.**

Table 5.33: Mean Score Value of the Managerial Support

Items	Mean	Interpretation
The manager is ready to bear the risks occur in the ministry when adopting cloud computing	4.5414	Strongly Agree
The manager supports the development of cloud computing technology in the ministry	4.3136	Strongly Agree
The managers have knowledge about the cloud computing benefits in the ministry	4.4112	Strongly Agree
The managers provide the necessary resources to adopt cloud computing technology	4.2101	Strongly Agree

The table shows that the highest mean score value of 4.54 is related to the managers in the Ministry are ready to take risks occur when adopting cloud computing. A lowest mean score value of 4.21 tied to the managers provide the resources to adopt cloud computing technology**.**

5.5.11 Relative Advantage

The mean score value of the Relative Advantage variable and its items presented in Table 5.34. The table shows the degree of respondent's agreement on each item in the factor**.**

Table 5.34: Mean Score Value of the Relative Advantage

Items	Mean	Interpretation
Cloud computing provides information to users in any era and any area	4.5059	Strongly Agree
When adopting cloud computing, The Ministry pays only for the services have used	4.6361	Strongly Agree
The performance level of cloud computing services will not weaken when increasing the number of users	4.0858	Agree
Cloud computing can improve the efficiency of communication among public organizations	4.6677	Strongly Agree

The table shows that the highest mean score value of 4.66 is related to the cloud computing can improve the efficiency of communication between public organizations. A lowest mean score value of 4.08 tied to the performance level of cloud computing services will not be weak when the number of users in growing**.**

Table 5.35 shows the mean for all factors, (12 independent variables, one dependent variable).

Table 5.35: Mean Score Value for All the Factors

Factors	Minimum	Maximum	Mean	Interpretation
Adoption cloud computing	3.20	5.00	4.4675	Strongly Agree
Trust	2.20	5.00	4.4740	Strongly Agree
Budget	3.25	5.00	4.5296	Strongly Agree
Compatibility	3.00	5.00	4.4882	Strongly Agree
Complexity	1.00	5.00	4.0207	Agree
Security	1.25	5.00	3.3114	Natural
IT infrastructure	1.75	5.00	4.2722	Strongly Agree
IT Knowledge	2.00	5.00	4.1903	Agree
Technology Readiness	1.50	5.00	4.0828	Agree
Managerial Support	3.00	5.00	4.3691	Strongly Agree
Relative Advantage	2.50	5.00	4.3365	Strongly Agree

5.6 Hypothesis Testing

Our research has developed ten hypotheses. Correlation analysis is conducted to find the relationship between the variables. The hypotheses tested by using regression analysis.

5.6.1 Regression Analysis

It is a statistical tool creates a statistical model to assess the relations between the independent variables and the dependent variable, so that produces a statistical equation describes the relationship between the variables [72].

Table 5.36: Coefficient of the Regression Analysis

Model	Unstandardized Coefficients		T	Sig.
	B	Std. Error		
CA	0.161	0.056	2.872	0.004 < 0.05
CX	0.140	0.035	3.993	0.000 < 0.05
BU	-0.127	0.059	-2.618	0.032 < 0.05
MS	0.116	0.056	2.083	0.038 < 0.05
TR	0.091	0.046	2.005	0.046 < 0.05
RA	-0.090	0.037	-2.409	0.017 < 0.05
ITk	0.086	0.041	2.098	0.037 < 0.05
SE	0.067	0.025	2.618	0.009 < 0.05
TRE	-0.065	0.029	-2.225	0.027 < 0.05
ITI	0.023	0.037	0.635	0.526 (NS)

Table 5.36 presents the result of hypotheses testing using regression analysis. The table shows that the regression coefficient refers to the effect size of the independent variables and the dependent variable. It denoted as B. The highest predictors of the variables in the regression line equation explained in (B). Compatibility 0.161 followed by Complexity 0.140, Budget -0.127, Managerial Support 0.116, Trust 0.091, Relative Advantage -0.090, IT Knowledge 0.086, Security 0.067, Technology Readiness -0.065. These factors have an important influence on the adoption of cloud computing. On the other hand, IT Infrastructure 0.023 has no important influence on the adoption of cloud computing (Not Support). Sig refers to the P-value, and it must be less than 0.05 to consider the hypothesis as significant. The T statistic is the result of (B/ Std. Error).

Table 5.37 explains the model summary of the regression analysis. The table shows the R-square value of the model. The R-square value represents

the predictive power of the model. It indicates the ten variables linked for adopting cloud computing can explain 0.140% of the variation in the dependent variable (adoption of cloud computing).

Table 5.37: Model Summary

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Err. of the Estimate**
1	0.374	.140	.113	.43181

5.6.2 Result and Discussion

In our research, we want to find the factors influence the adoption of cloud computing in E-government in Iraq. We assumed ten hypotheses to examine the relationship between the variables. In the following sections, the hypotheses testing and discussion will present. The criterion to accept the hypothesis is the Sig (P-value) of the relation between the dependent and independent variables. Such that, the Sig (P-value) for the relation between the dependent and independent variables must be less than 0.05.

If Sig (P-value) more than 0.05, this hypothesis will be rejected and its factor will not affect to the adoption of cloud computing.

5.6.2.1 Trust

The finding of the study presented in Table 5.36, showed that the effect of trust on cloud computing adoption is positive (B=0.091, P-value<0.05). Thus, the first hypothesis is accepted.

H_{0a}: Trust affects positively on the movement of E-government to cloud computing.

It indicates trust is one of the factors influence directly on the adoption of cloud computing in Iraq.

In the previous studies mentioned in Chapter 2 Section 2.6. This finding is in agreement with the findings of the Jordan and Saudi Arabia studies but is not agreeing with the findings of an empirical study in Iraq.

Trust is essential for any transactions. The lack of it might lead to giving up on the cloud services. The government must trust the provider. The users must trust the government will do everything possible to be sure there is no mistake or data breach. The findings show that employees in government have concerns over the trustworthy and integrity of the cloud as showed in the Table 5.17.

5.6.2.2 Budget

The finding of the study presented in Table 5.36 showed that the effect of the budget on cloud computing adoption is negative (B=-0.127, P-value<0.05). Thus, the hypothesis is accepted.

H_{1b}: Budget affects negatively on the movement of E-government to cloud computing.

It indicates the budget is considered one of the influencing factors on the adoption of cloud computing. In the previous studies mentioned in Chapter 2 Section 2.6. This finding is agreement with the findings of the Taiwan and Saudi Arabia studies.

The budget is Important when adopting technologies reduce the cost of IT; it will lessen the burden on the government. Where the Iraq In these current circumstances and conflicts facing an economic crisis. The adoption of cloud computing technology in Iraq will help in reducing the waste of the financial fee on hardware, software, and maintenance of IT. Also, employees in IT departments are encouraged to adopt cloud computing in the Iraqi organizations to reduce the budget. When the reliance on cloud computing increased, the budget will be reduced.

5.6.2.3 Compatibility

The finding of the study presented in Table 5.36 showed that the effect of compatibility on cloud computing adoption is positive (B=0.161, P-value<0.05). Thus, this hypothesis is accepted.

H_{0c}: Compatibility affects positively on the movement of E-government to cloud computing.

It indicates the compatibility is considered one of the influencing factors on the adoption of cloud computing. In the previous studies mentioned in Chapter 2 Section 2.6. This finding is agreement with the findings of the Jordon, India, and Iraq studies, but it is not agreement with the findings of Taiwan study.

The compatibility of E-government with the applications of cloud computing is an important to encourage the governments are hesitating to move to the cloud.

5.6.2.4 Complexity

The finding of the study presented in Table 5.36 showed that the effect of complexity on cloud computing adoption is positive (B=0.140, P-value<0.05). Thus, this hypothesis is accepted.

H_{0d}: Complexity affects positively on the movement of E-government to cloud computing.

It indicates the complexity is considered one of the influencing factors on the adoption of cloud computing. In the previous studies mentioned in Chapter 2 Section 2.6. This finding is agreement with the findings of the Taiwan, India, Iraq and Saudi Arabia studies.

The complexity is a major factor for cloud computing adoption. Such that, cloud computing will no adopt the complicated systems which take a long time.

5.6.2.5 Security

The finding of the study presented in Table 5.36 showed that the effect of security on cloud computing adoption is positive (B=0. 067, P-value<0.05). Thus, this hypothesis is accepted.

H_{0e}: Security affects positively on the movement of E-government to cloud computing.

It indicates the security is considered one of the influencing factors on the adoption of cloud computing. In the previous studies mentioned in Chapter 2 Section 2.6. This finding is agreement with the findings of the Taiwan, Jordon, Iraq and Saudi Arabia studies.

The security is a major factor for cloud computing adoption. When lifting the personal data and financial information for users on the electronic sites, the data will be at risk, whether security measures are not strict. The employees in the Iraqi government have concern over the governmental information when the cloud computing adopted in e- government, as showed in the Table 5.17.

5.6.2.6 IT Infrastructure

The finding of the study presented in Table 5.36 showed that the IT infrastructure does not effect on adoption cloud computing (B=0.023, P-value>0.05). Thus, this hypothesis is rejected.

Infrastructure for IT has no influence on the adoption of cloud computing in Iraq. In the current survey, this factor appeared as unimportant and ineffective. However, in the surveys of the other studies, the infrastructure factor is considered as the important factors which affect on the adoption of cloud computing as reported in Chapter Two.

The IT infrastructure factor has a significant Influence in both the adoption of SaaS and Saudi Arabia studies. However, in our research, IT

infrastructure has not effect when adopting cloud computing in Iraqi E-government.

5.6.2.7 IT Knowledge

The finding of the study presented in Table 5.36 showed that the effect of IT Knowledge on cloud computing adoption is positive (B=0.086, P-value<0.05). Thus, this hypothesis is accepted.

H_{0g}: IT knowledge affects positively on the movement of E-government to cloud computing.

It indicates the IT Knowledge is considered one of the influencing factors on the adoption of cloud computing. In the previous studies mentioned in Chapter 2 Section 2.6. This finding is in agreement with the findings of the Iraq, India, adopts SaaS studies.

The employees have weak knowledge of the technology and its application as in the Table 5.17. IT knowledge is a major factor for adopting cloud computing and could contribute significantly to the adoption of cloud computing in Iraq.

5.6.2.8 Technology Readiness

The finding of the study presented in Table 5.36 showed that the effect of Technology Readiness on cloud computing adoption is negative (B=-0.065, P-value<0.05). Thus, this hypothesis is accepted.

H_{1h}: Technological readiness affects negatively on the movement of E-government to cloud computing.

It indicates the Technology Readiness is considered one of the influencing factors on the adoption of cloud computing. In the previous studies mentioned in Chapter 2 Section 2.6, this finding is in agreement with the findings of the Jordon and adopts SaaS studies, but is not in agreement

with the findings of Iraqi study. Technology readiness is an essential factor for the adoption of the technology.

5.6.2.9 Managerial Support

The finding of the study presented in Table 5.36 showed that the effect of Managerial Support on cloud computing adoption is positive (B=0.116, P-value<0.05). Thus, this hypothesis is accepted.

H_{0i}: Managerial support affects positively on the movement of E-government to cloud computing.

It indicates the Managerial Support is considered one of the influencing factors on the adoption of cloud computing. In the previous studies mentioned in Chapter 2 Section 2.6. This finding is in agreement with the findings of the Jordon, Taiwan, India, adopt SaaS and Iraq studies.

The Managerial Support is a major factor for cloud computing adoption, The IT staff in the Iraqi organizations mentioned there is no strong support for the ministry as in the Table 5.17.

5.6.2.10 Relative Advantage

The finding of the study presented in Table 5.36 showed that the effect of the Relative advantage of cloud computing adoption is negative (B=-0.090, P-value<0.05). Thus, this hypothesis is accepted.

H_{1j}: Relative advantage affects negatively on the movement of E-government to cloud computing.

It indicates the Relative advantage is considered one of the influencing factors on the adoption of cloud computing. In the previous studies mentioned in Chapter 2 Section 2.6. This finding is in agreement with the findings of the India, adopt SaaS and Iraq studies, but is not in agreement with the findings of Taiwan study.

The relative advantage factor is important to the adoption of cloud computing technology by E-government. The respondents believed the benefits of cloud computing could have a significant effect on the decision to move E-government to cloud computing technology.

5.6.3 Summary of Hypothesis Testing

Table 5.38 explains the summary of the hypothesis testing. The table shows the P-value (Sig) of the factors. It also illustrates the status of the hypotheses based on the P-value (Sig) which supposed to be less than 0.05 for the hypothesis to be accepted.

Table 5.38: Summary of the Hypothesis Testing

Hypothesis	**Sig.**	**Status**
H_{0a}: Trust affects positively on the movement of E-government for cloud computing	.046	A
H1b: budget affects negatively on the movement of E-government to cloud computing	.032	A
H_{0c}: Compatibility affects positively on the movement of E-government to cloud computing	.004	A
H_{0d}: Complexity affects positively on the movement of E-government to cloud computing	.000	A
H_{0e}: Security affects positively on the movement of E-government to cloud computing	.009	A
H_{0f}: IT infrastructure affects positively on the movement of E-government to cloud computing H_{1f}: IT infrastructure affects negatively on the movement of E-government to cloud computing	.526	N.A
H_{0g}: IT knowledge affects positively on the movement of E-government to cloud computing	.037	A
H_{1h}: Technological readiness affects negatively on the movement of E-government to cloud computing	.027	A
H_{0i}: Managerial support affects positively on the movement of E-government to cloud computing	.038	A
H_{1j}: Relative advantage affects negatively on the movement of E-government to cloud computing	.017	A

Notes: A= Accepted, N. A= Not Accepted

5.6.3.1 Hypothesis Model for the Factors Influencing on the Adoption of Cloud Computing in E-Government in Iraq

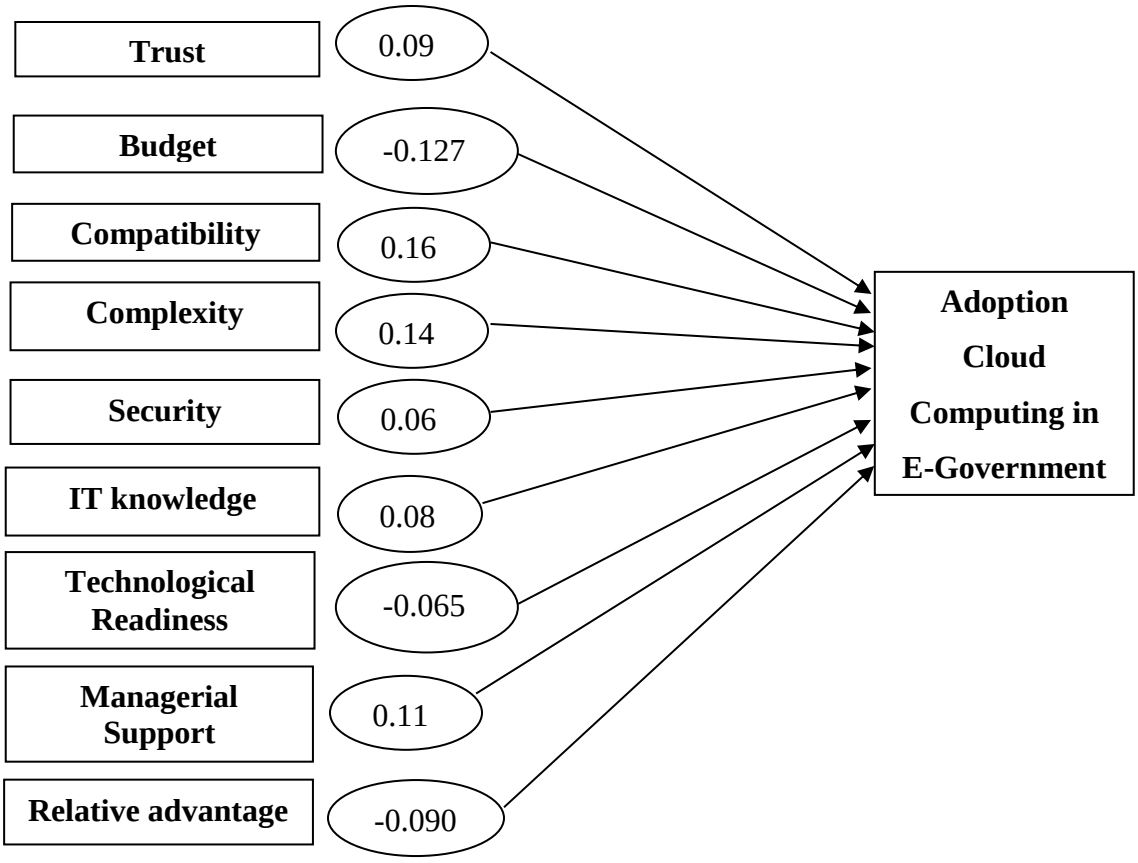

Figure 5.40: Hypothesis Model for the Factors Influencing on the Adoption of Cloud Computing in E-Government

5.7 Cloud Based on E-Government Factors

Our research aims to propose cloud computing model for E-government in Iraq; this model created on the basis of the analysis of respondents, in addition to knowing the factors will contribute strongly to the construction of this model [80]. The Table 5.39 shows the factors with a mean value and standard deviation of each factor.

Table 5.39: Cloud-Based E-Government Factors

Factors	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
TR	2.80	2.20	5.00	4.4740	.52485	.275
BU	1.75	3.25	5.00	4.5296	.41958	.176
CA	2.00	3.00	5.00	4.4882	.43354	.188
CX	4.00	1.00	5.00	4.0207	.72237	.522
SU	3.75	1.25	5.00	3.3114	.96802	.937
ITK	3.00	2.00	5.00	4.1903	.58354	.341
TRE	3.50	1.50	5.00	4.0828	.83093	.690
MS	2.00	3.00	5.00	4.3691	.42769	.183
RA	2.50	2.50	5.00	4.3365	.64748	.419

Table 5.39 shows that the Budget factor has highest mean value 4.5296, followed by Compatibility with a mean value 4.4882, Trust with a mean value 4.4740, Managerial support with a mean value 4.3691, and Relative advantage with a mean value 4.3365. Depending on the Table 5.23 in section 5.5, these mean values refer to these factors the answers of respondents strongly agree in Likert scale. Also IT knowledge factor has a high mean value 4.1903, followed by Technology readiness with a mean value 4.0828, and Complexity with a mean value 4.0207. Depending on the Table 5.23 in section 5.5, these mean values refer to these factors the answers of respondents agree in Likert scale. Security factor has less mean value 3.3114. Depending on the Table 5.23 in section 5.5, the mean value refers to this factor the answers of respondents are natural in Likert scale.

5.8 Findings

In this chapter, the results of the analysis discussed and proposed a model of cloud computing. The answers which have high repetitions are male

235 responses. 232 of respondents between the ages 30-40 years. 146 responders have a bachelor's degree. 61 responders considered as the largest number of respondents from the Ministry of Higher Education and Scientific Research. 156 of the employees have experience in the field of information technology ranging from 5-10 years. 194 employees have no experience in the E-government system. 107 of the respondents answered the type of internet connection in their organizations is the satellite. 74 respondent answered the networks are the external sources supported by their organizations. 256 employees have an idea of cloud computing. 265 of responses the ministries do not adopt cloud computing. 184 of responses the organizations still not involve in the adoption of cloud computing. 82 responses answered that organizations depend on SaaS, PaaS, IaaS. By using regression analysis, we can identify the factors affect the adoption of cloud computing. These factors are trust, budget, compatibility, complexity, security, IT knowledge, technological readiness, managerial support, and relative advantage. However, IT infrastructure is the influential factor for the adoption of cloud computing in E-government. Also, the most important factor effects on the adoption of cloud computing in E-government is a budget factor. The less important factor is the security factor.

CHAPTER SIX

THE PROPOSED MODEL

6.1 Model of Cloud Computing Adoption for Iraqi E-government

The proposed model of cloud computing for E-government bases on the accepted factors in the questionnaire defines by four Levels 0 - 3. Figure 6.1 shows a context framework of cloud computing in E-government.

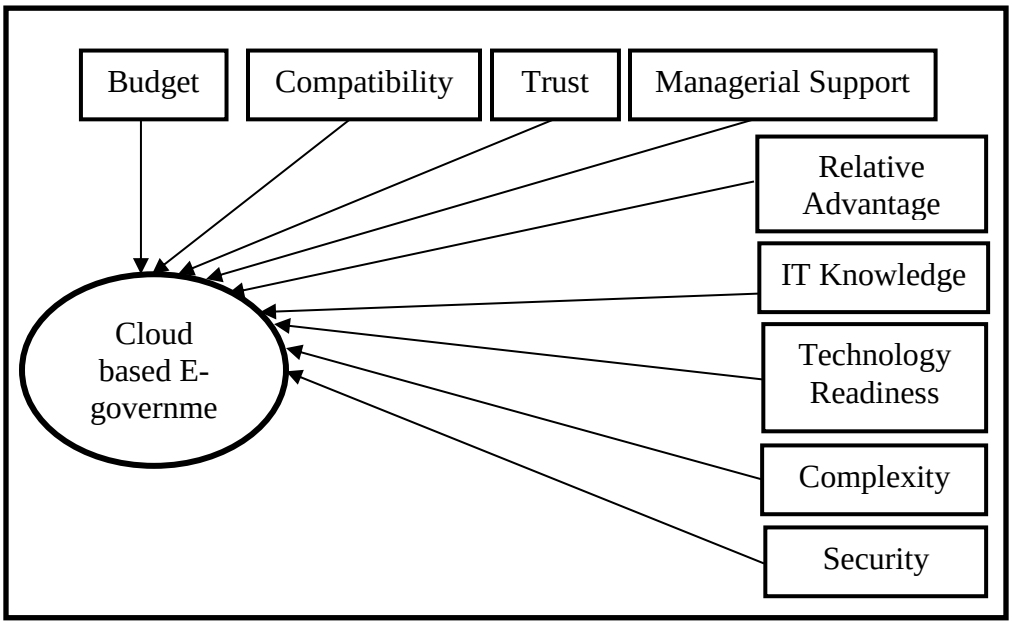

Figure 6.1: Context Framework of Cloud Computing in E-Government

Level 0 is a context framework which consists of the accepted factors with the results of the survey.It begins with the most important factor is the budget, followed by compatibility, trust, managerial support, relative

advantage, IT knowledge, technological readiness, complexity, and finally security, sequentially regarding importance as shown in Figure 6.1.

Level 1 based on the literature review. The factors will be categorized as technological and non-technological [66]. As shown in Figure 6.2

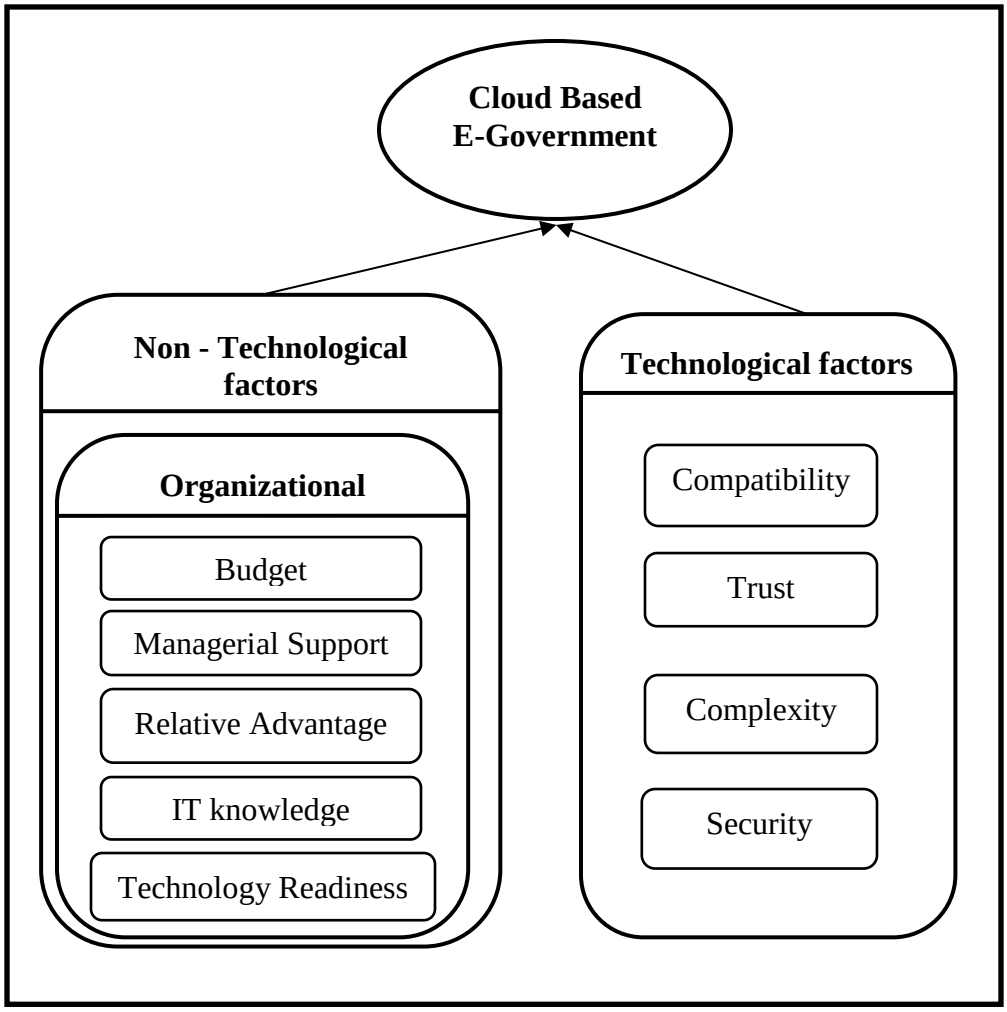

Figure 6.2: Cloud Computing Framework

Figure 6.2 indicates the Level 1 includes: technological dimension consists of variables have been identified by researchers as technology oriented. These include trust, compatibility, complexity, and security. The other dimension is non-technological. It consists of factors categorized as

organizational factors. However, this research labeled them as non-technological. The factors include budget, IT knowledge, technological readiness, top management support, and relative advantage [66] [67].

The previous studies stopped at creating a model of the factors affects the adoption of cloud computing. However, in our research, we will expand the model by classifying the framework of technological factors to provide a solution of these factors on the adoption of cloud computing in E-government in Iraq, as shown in the Level 2**.**

Technological and non-technological factors are important in the adoption of cloud computing in Iraqi E-government, but to create a model for the adoption of cloud computing technology in the E-government, we have to focus on technological factors in the Level 2. Therefore, it is essential to take into account the technological factors during framework designing. Figure 6.3 illustrates how could utilize the cloud computing facilities to satisfy requirements in a targeted environment which is Iraqi E-government project.

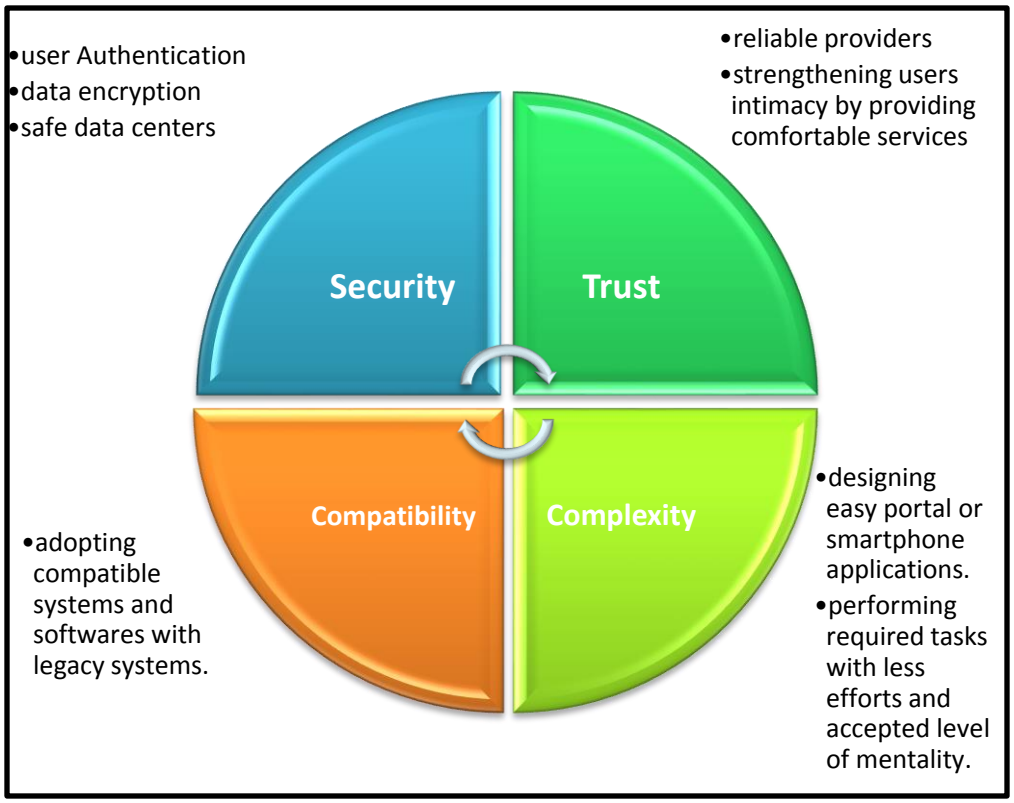

Figure 6.3: Framework for Classification of the Technological Factors

For interpreting Figure 6.3, it is essential to define the factors security, trust, compatibility, and complexity to enlighten the significant aspects of each factor in the proposed framework.

Security is the Level of data protection or the systems from unauthorized access or attacks [42]. The framework must include secure ways for users' login in systems and database; this approach includes employees and citizens. Also, it is better to use a strong algorithm for encryption transmitted data among different ministries and governmental organizations. Moreover, data centers and storage units must be saved in secure places under appropriate circumstances to keep data from losing and manipulating.

The second factor is trust; it defines as the confidence to rely on a specific destination. This Specific destination vulnerable to attack, citizen data will be risky [41].

Trust is an important to adopt cloud computing. Therefore, there must be trust between the government and providers, as well as government and citizens. Also, the adopting of cloud computing from reliable providers could strengthen the trust among different stakeholders to achieve the benefit of cloud computing. For promoting confidence in government services and government data protection, it is better to adopt a private cloud because the Iraqi government manages it, but private cloud is too expensive. To avoid the high cost, we suggest the services provided from the hybrid cloud combines between the public cloud and private cloud.

Compatibility is the extent of coordination between the information systems and internal systems environments [46]. Compatibility between both adopted and exist systems, DBMS, software, and so on.Is vital to make sure the adoption of cloud computing is successful. The difference between adopted and legacy systems can cause fatal danger of the entire project because it will be important to change or upgrade existing systems which might cost a high budget and long time.

Lastly, Complexity is the extent of the use of innovation, one of the difficult, and an important factor. Researchers believe a complex innovation or technology, which requires substantial physical, mental efforts, and skills [51]. To ensure the advantage of cloud computing will achieve completely, complexity in systems, interfaces, tasks and so on, must be avoided. Therefore, websites, Smartphone applications, and any connections between services and stakeholders must be easy to use. Complex and challenging use which requires efforts and a great mentality to use cloud services can cause aversion of cloud computing adoption and lead to failure.

Compared with the previous study in Saudi Arabia. Saudi Arabia proposed model help decision-makers to adopt cloud computing in the public sector, where the model divided into business architecture requirements and technical architecture requirements. Business architecture requirements contain 17 factors; technical architecture requirements contain 6 factors. Saudi Arabia model has been proposed based on the predicted impact of the 23 factors on the adoption of cloud computing in E-government, without any testing of factors will effect or not effect on adopting cloud computing in the public sector (without the use of analytical software) [25]. In our research, we have identified factors will influence the adoption of cloud computing in Iraq (depending on SPSS analytical) and has been proposed framework based on the technological factors and identified how to reduce the impact of these factors when adopting cloud computing in E-government in Iraq. As shown in Figure 6.3.

The last Level is 3 Level will contain a framework of cloud-based E-government. This framework includes cloud computing services (SaaS, PaaS, IaaS) profit the Iraqi government ministries. As shown in Figure 6.4.

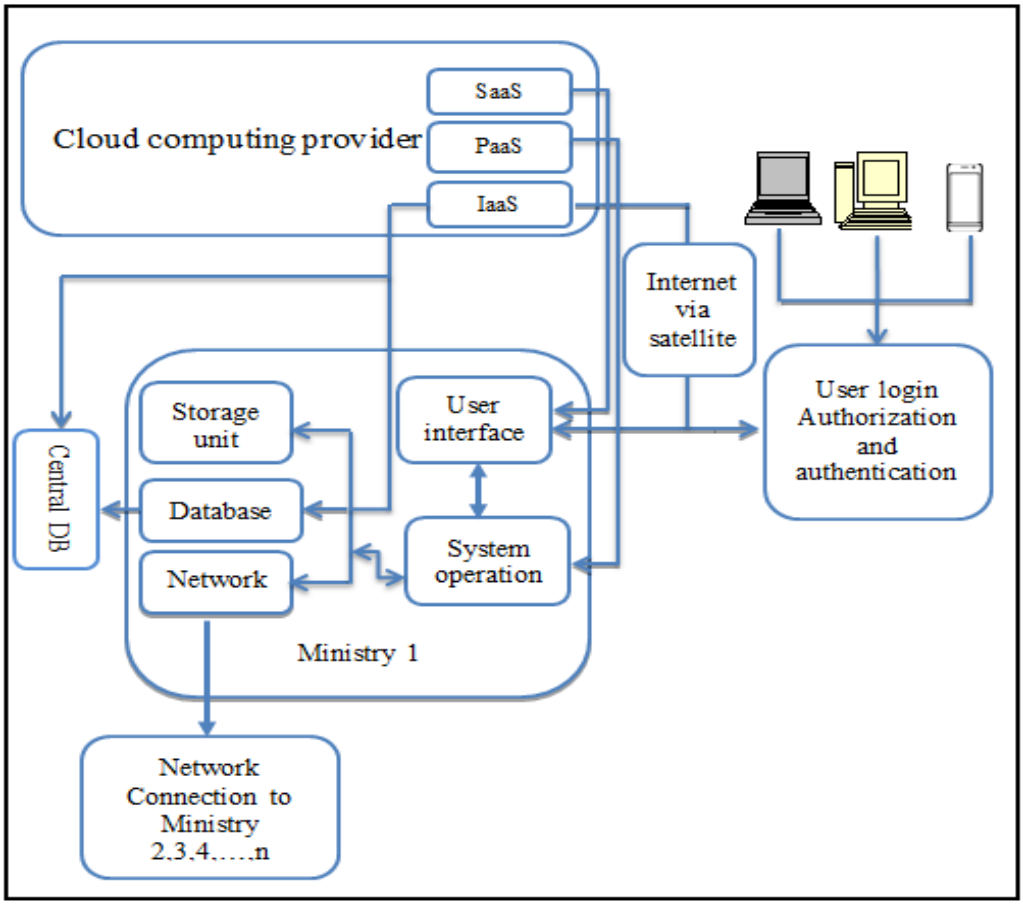

Figure 6.4: Proposed Framework for Cloud Computing Based E-Government in Iraq

Figure 6.4 indicates the cloud computing provider provides three types of services which are: Platform as a service (PaaS), Infrastructure as a service (IaaS), and Software as a service (SaaS) for each ministry in Iraq.

- ✓ **Software as a service SaaS**: Will provide the Website; this Website will be as an interface for users. The provider of cloud computing will be fully responsible for the interface where the necessary resources, technical support, and update applications. Also, the ministries can benefit from the email service provided by SaaS, because the ministries use email dramatically as in the Table 5.16 in chapter five which concerns the analysis and discussion of results.

- ✓ **Infrastructure as a service IaaS:** Will provide the internet for the user interface in the ministries, the type of Internet connection will be via (satellite) depending on the results of the survey. Also, IaaS provides a storage unit for each ministry in the E-government to store information separately for each ministry, a database for each ministry, and a network to connect all the ministries with each other. Also, it provides a central database for all ministries to be all data for Iraqi ministries in a single database. Central database location will be in the General Secretariat of the Council of Ministers which is responsible for the E-government services in Iraq. Furthermore, each Iraqi ministry will connect with the others via network service.
- ✓ **Platform as a service PaaS**: Will provide a system operation is responsible for ministry operations processing. Also, system operation considered as an intermediate service among user interface and database, storage unit services such that it will transfer data from the storage unit, database services to the user interface and vice versa. In Chapter five, Table 5.16, the respondents said they were using Google application and social media to communicate with citizens and publish achievements and news of ministries so that the ministries will benefit from Google apps and social media offered by the platform as a service.

User login will be done via PC, smartphone, where each user has an account to be able to login to the user interface in the ministry also to secure all data inside the ministry.

The description above shows the mechanism for providing cloud computing services to one ministry, which is the same mechanism to deliver services to all ministries. Figure 6.5 demonstrates the provision of cloud computing services by a cloud computing provider to all ministries in Iraq.

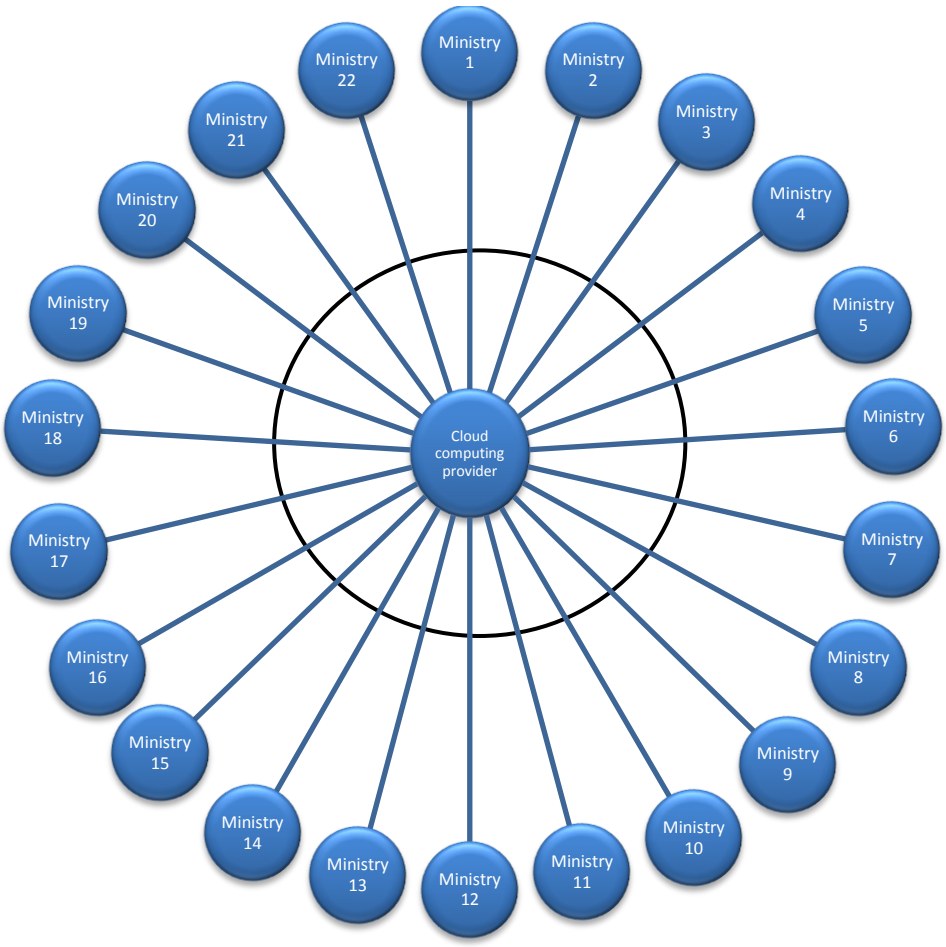

Figure 6.5: Connecting 22 Ministries by Cloud Computing Provider

Figure 6.5 indicates the provider of cloud computing provides services to all ministries. The black circle means each ministry linked to other ministries.

Moreover, it has been chosen as starburst structure, to represent the cloud-based E-government model. The reason for using the starburst structure to avoid the risk of disrepair or penetration. If there is any malfunction or break in one of the links between cloud computing providers and ministries, this leads to egress the ministry is connected to the broken link from the model and avoid disruption of the whole model.

The technological factors are affecting on the adoption of cloud computing in E-government in Iraq, taken into consideration when proposing the model. To protect Government data, the user cannot access to the ministry's website if they do not have account or ID. For promoting trust with providing services, the government has to rent cloud services from trusted providers. For achieving the principle of compatibility, the government has to rent systems of the cloud compatible with existing systems in the Iraqi ministries, which in turn will reduce the cost. If they rent non-compatible systems with existing systems, this will lead to the rental of other systems. That will increase the cost, so the government will not profit from the adoption of cloud computing. For limiting complexity, the user interface must be intuitive and straightforward. Also, the non-complex framework helps to implement many of the tasks during the little time. We can conclude the proposed model reduces the cost and makes the E-government system more flexible and efficient.

When a cloud computing model designs, the project of E-government will be more effective and efficient. It will not require complex operations. It reduces the cost of both information technology and maintenance of equipment. It will spend a little time. There is no need to build a private place for storage and central databases. There is no reason to train large numbers of employees, also the development and modernization of systems automatically. In addition to many features encourage the adoption of cloud computing technology in the E-government, because all of the services are available and the government just buy or rent the appropriate service, this, in turn, will reduce the time, effort and cost.

The value of our research is to propose a model of cloud computing for Iraqi E-government, the proposed model contributes to reducing the cost required for the development of E-government by using available cloud

computing services. Also, there is no previous study propose a cloud computing model for Iraqi E-Government.

6.2 Case Study

The level of E-government in Iraq is not satisfied, so we must develop E-government system, and that means developing information and communication technology which requires cost and it is hard nowadays due to the current economic and political conditions in Iraq. So we proposed to adopt cloud computing because of its various benefits, we focused on the advantages of reducing the cost of developing information and communication technology for increasing the effectiveness of E-government in Iraq.

We will concentrate on the cost of hardware, software, staff, maintenance, and so on.In one Iraqi Ministry as a case study, then generalize it to all Iraqi ministries. The case study will be from the Ministry of Interior. This ministry provides 11 electronic services to the citizens, government, business, and employees. The ministry of interior requires to software, hardware, network, storage, servers, maintenance, and staff to provide these services. Requirements and its cost had imposed depending on the connection with the employee in the information technology department at the Ministry of the Interior. Also, these costs are almost similar to the cost provided by the previous study to analyze the costs of E-government in Romania [77]. The requirements are

1-Staff, which includes planning staff, technical staff, and external contractors/consultants.

2- Network, which includes a router, switch, load-balancing system, firewall

backup system and other security expenses.

3- Servers, which include a web server, application servers, database servers, backup server, laptops and desktops, and development servers.

4- Storage.

5- Software.

6- Hardware and software maintenance.

7- Hardware and software upgrades.

The cost of electronic services requirements in the ministry of interior shown in the following table.

Table 6.1: E-governmentRequirements Cost for One Ministry

E-government requirements	**Cost**
Staff training and external consultants	39,000$
Network	80,000$
Servers	38,500$
Storage	12,000$
Software	100,000$
Software upgrades	3000$
Software maintenance	500$
Hardware upgrades	1,600$
Hardware maintenance	500$
Total	**275,100$**

In Table 6.1 the required cost for electronic services in a single ministry is 275,100$, the number of Iraqi ministries is 22, we multiply the cost of one ministry with 22 in order to get the total cost of E-government 275,100$*22= 6,052,200$. So the total cost of electronic services requirements in all ministries is 6,052,200$.

The increased demand for E-government services requires buying many computers, storage systems, and many resources. It leads to increase the total cost of E-government services.

A cloud computing model for E-government seeks to profit off the cost reduction, so cloud computing providers provide only the services needed by E-government. When adoption the cloud computing in electronic government, the ministry focuses on highly qualified personnel without hiring, training and paying salaries to new employees, and the ministries do not need to software and hardware maintenance because the cloud computing provider will be responsible for everything will lead to reducing the costs. The cloud computing provider offers the services the E-government needed at low cost, as in the following table.

Table 6.2: Cloud Computing Cost for One Ministry

Cloud computing services	**Cost/annually**
Staff training	1,068$
Network infrastructure and management	540$
Server infrastructure hardware, maintenance, facilities etc.	1,332$
Storage infrastructure hardware, maintenance, facilities etc.	540$
Software application and infrastructure	2,808$
Total	**6,288$**

In Table 6.2, we imposed costs depending on the previous study which provides the monthly services costs for public and private cloud [78], but we multiply the cost for each service with 12 months to get the annual cost for service. So the cost of services provided by the cloud computing provider to one of the ministries 6,288$. We multiply the cost for one ministry with 22 ministries in order to get the total cost of the services provided by cloud computing for all ministries 6,288*22= 138,336$. Finally, the total cost of the services provided by cloud computing for 22 ministries is 138,336$. We calculated the percentage of the reducing the cloud computing cost for E-government as follow: we subtracted (E-government cost from cloud computing cost) and (divided the result by E-government cost).

Reduction percent= (E-government cost – cloud computing cost) / E-government cost

= 6,052,200$ - 138,336$ / 6,052,200$

= 0.977

The above result shows that cloud computing reduces the cost of E-government to 97.7%. Finally, we can realise the proposed model in cloud computing reduces the cost of E-government by 97.7%.

6.3 Findings

The model proposed via four Levels 0-3, where the Level 0 contains all the factors are found to influence the adoption of cloud computing in E-government. In Level 1, the factors divided into technological factors (trust, compatibility, complexity, and security) and non-technological factors (budget, IT knowledge, technological readiness, top management support, and relative advantage). Level 2 contains a framework includes technological factors; it illustrates how could be utilizing the cloud computing facilities to satisfy requirements in a targeted environment which is Iraqi E-government project. In Level 3, framework contains the services offered by cloud computing (SaaS, PaaS, IaaS), where the cloud computing provider provides services for each ministry, and also each ministry linked with the other ministries. The proposed model contributes to making an e - government system more flexible and helps to reduce the cost required for the development of E-government by using cloud computing services. In comparison with previous studies, it has proposed cloud computing models based on the factors influencing the adoption of cloud computing in E-government, or the services provided by cloud computing, steps or layers. The proposed model in our research bases on the factors influencing the adoption of cloud computing and services provided by cloud computing to profit from the benefits of cloud computing; the most considerable advantages are reducing the cost required for the development of E-government. Also, the

proposed model is secure, its services are trustworthy, its systems compatible with current systems used by the government, and user interface and its internal processes are not complex. Our research problems connected with these factors, so Table 6.3 shows how the proposed model solved research problems.

Table 6.3: The Connection between Research Problems, Factors, Our Model

Research Problems	**Factors**	**Our Model Solutions**
Difficulty of integration between ministries	Compatibility	• Use central database. • The use of cloud systems are compatible with current government systems
The complexity of the software and hardware used in E-government system	Complexity	• The unified work system in the cloud. • Provide an easy connection between the service and stakeholders. • Easy user interfaces.
Lack of budget	Budget	• SaaS, PaaS, IaaS provide services when needed, which in turn will reduce the cost
Lack of Managerial Support used for developing E-government project	Managerial Support	• Cloud computing provider is responsible for the development of E-government system without the intervention of the top management

Research Problems	Factors	Our Model Solutions
Lack of trust with the provided services via internet	Trust	• Adopting of cloud computing is from reliable providers. • Adopt Hybrid or private cloud
E-government ineffective and inefficient	Relative Advantage	• The profit from the benefit of cloud computing to increase efficient and effective the E-government
Lack of knowledge and experiences of the staff in Iraqi ministries	IT Knowledge	• Staff redeployment and focusing only on the experts in the IT department
Governmental data vulnerable to theft and loss	Security	• ways for users' login in systems and database is Secure. • Use a strong algorithm for encryption transmitted data among different ministries and governmental organizations. • Provide a secure network by (IaaS) to link ministries. • The use of starburst structure to link ministries

Research Problems	Factors	Our Model Solutions
The deterioration of the situation in Iraq may affect on the sustainability of the technology	Technology Readiness	• When adopting cloud services, degradation of the situation in Iraq will not affect the sustainability of the technology because all the services, applications and data will be in virtual places • The ongoing modernization of systems ensures the sustainability.

Table 6.4 shows a comparison between the proposed model in our research with previous studies models related to the number of Levels, the use of factors or layers, and components for each model.

Table 6.4: The Comparison between the Proposed Models in Our Research with Previous Studies

Source	No. of levels	No. of Factors	No. of Layers	Components
[76]	3	X	X	Conceptual, logical, physical levels
[25]	2	23	X	(Initial level, Final level) for business architecture requirements and technical architecture requirements
[20]	1	X	6	User, access, service, management, virtualization, infrastructure layers
[28]	1	4	X	Challenges to E-government, benefits to E-government
[67]	1	7	X	Technological and organizational factors
Our model	4	9	X	Context, Technological and non-technological, technological classification, and proposed model levels. Cloud computing services (SaaS, PaaS, IaaS.)

One of the previous studies has suggested a model for digital preservation; it based on cloud computing. The goal of the model is to make the digital preservation of the public sector long-term. The model represented as a centrist warehouse contains three levels of digital preservation (conceptual level, logical level, and physical level), the models in the previous study contains all levels together as in Figure 6.6 [76]. However, in our

research, each level is shown separately (each level described in a separate figure for each other) to accommodate and comprehend the proposed model.

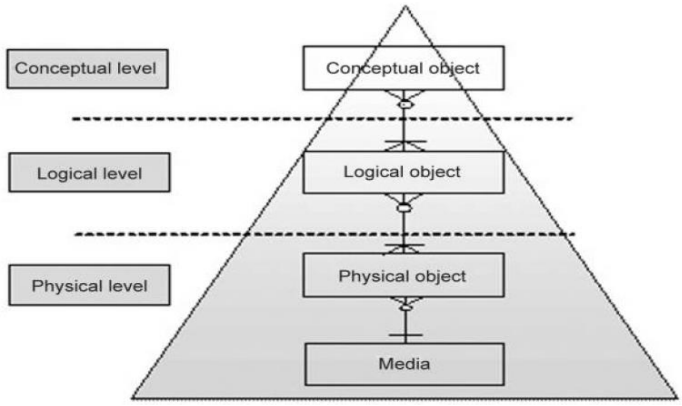

Figure 6.6: Digital Preservation Model [76]

Saudi Arabia has a model of cloud computing for the public sector to assist the decision-makers as to whether it is possible to invest in cloud computing or not applied it. The model contains two levels; the initial level consists of business architecture requirements and technical architecture requirements, the final level contains factors for the technical architecture requirements and factors for the business architecture requirements. As in Figure 6.7, 6.8 Consecutively.

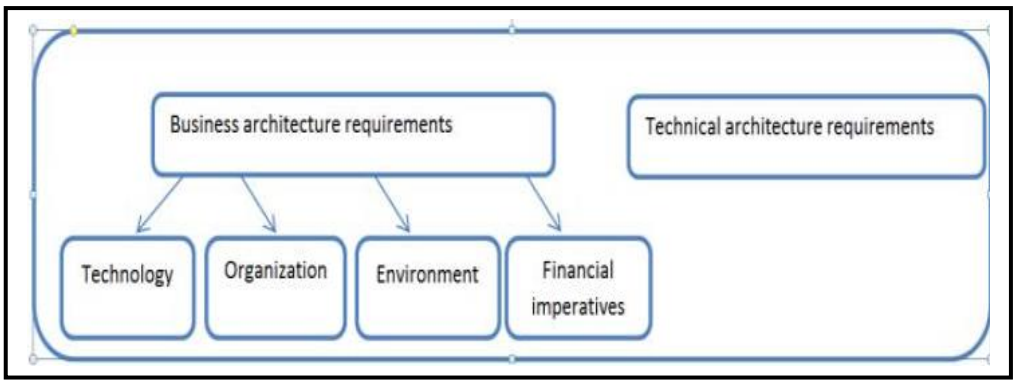

Figure 6.7: Initial Framework for Saudi Arabia [25]

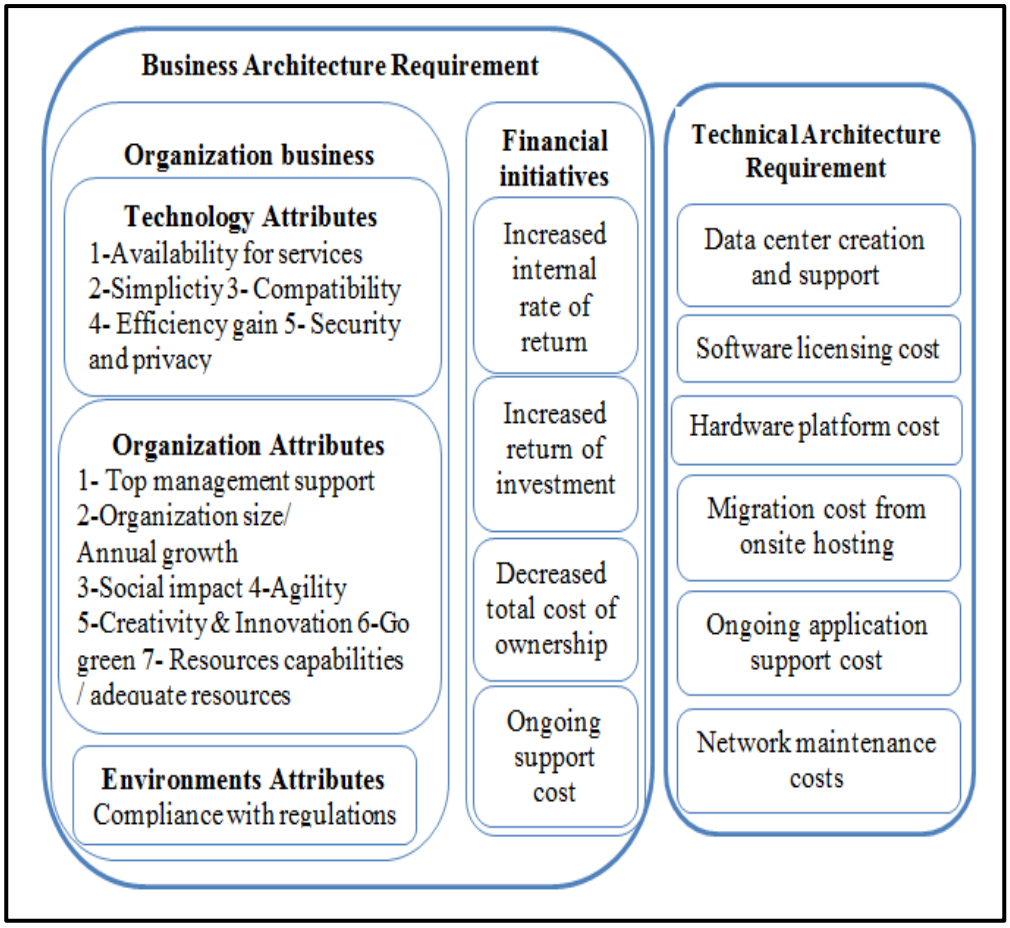

Figure 6.8: The Framework for Saudi Arabia [25]

The model in Indonesia is to reduce the investment in information and communications technology costs; IT consists of 6 layers as in Figure 6.9. However, this model does not take into account the factors influence the adoption of cloud computing in E-government [20]. The proposed model in our research contains some components of these layers in addition to factors affecting on adoption of cloud computing in E-government.

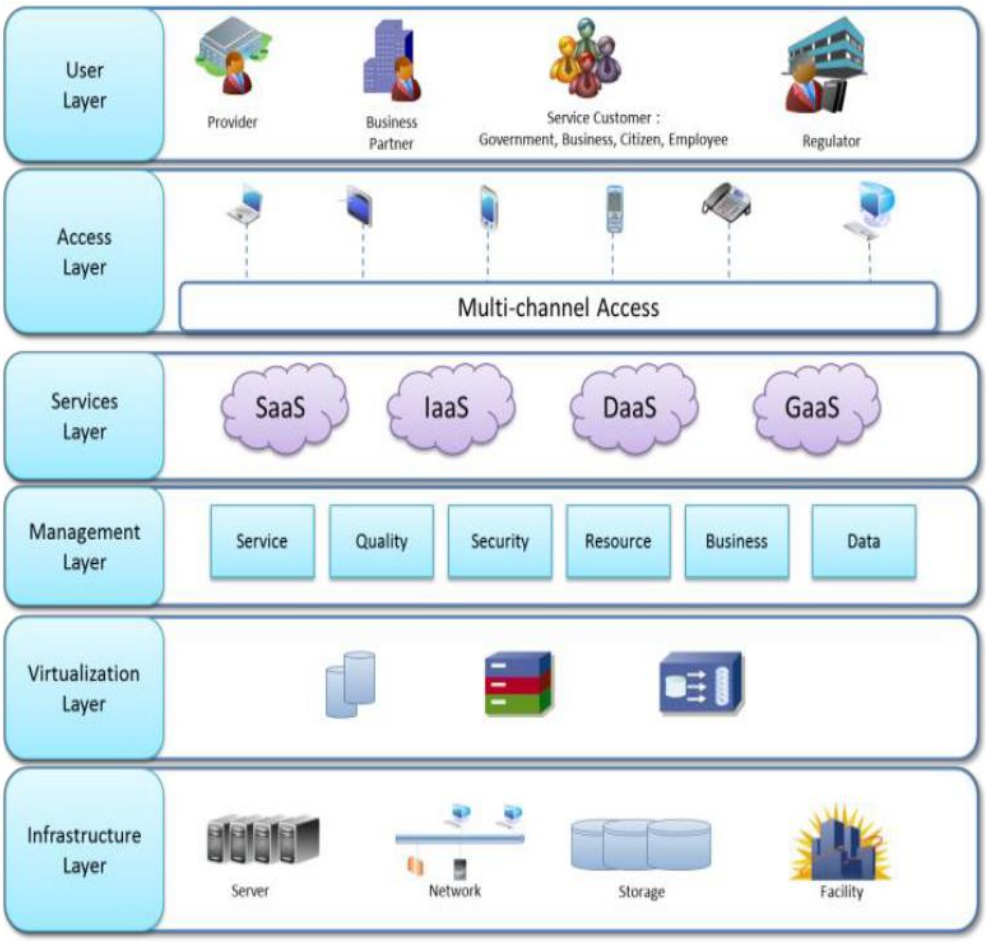

Figure 6.9: The Model for Indonesia [20]

In one of the previous studies has suggested a framework for evaluating e-readiness to adopt cloud computing. The framework focuses on the advantages and challenges for E-government. It has shown that (ICT infrastructures benefits and human capital benefits) have the lowest weight. (Connectivity challenges, policies, and regulation challenges) Have the most weight [28]. As in Figure 6.10. The proposed model in our research aims to profit from the cloud computing benefits when it has adopted in E-government.

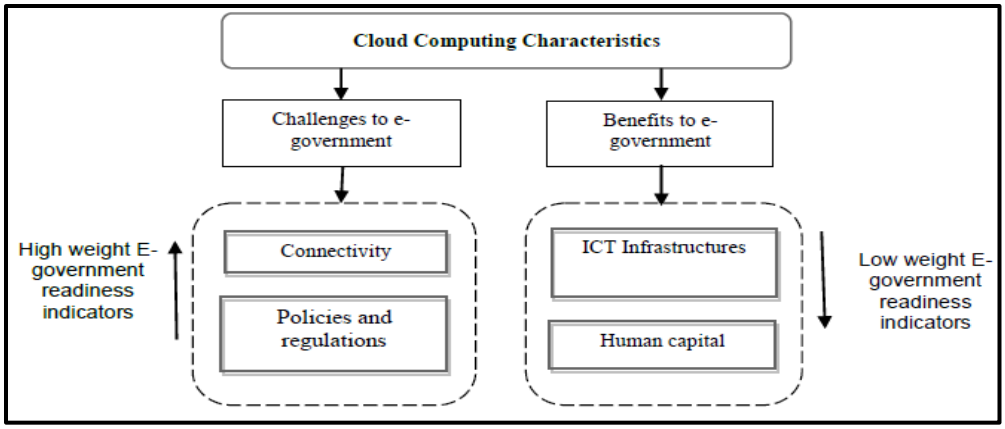

Figure 6.10: The Model in Previous Study [28]

One of the previous studies has a conceptual model of the factors affect the adoption of cloud computing in E-government, these factors have divided into technological factors and organizational factors [67]. As in Figure 6.11. Level 1 is created based on this previous model, but this previous study stopped at the suggested of this model. However, our work expanded by proposing a model for limiting the influence of the factors affect the adoption of cloud computing in E-government.

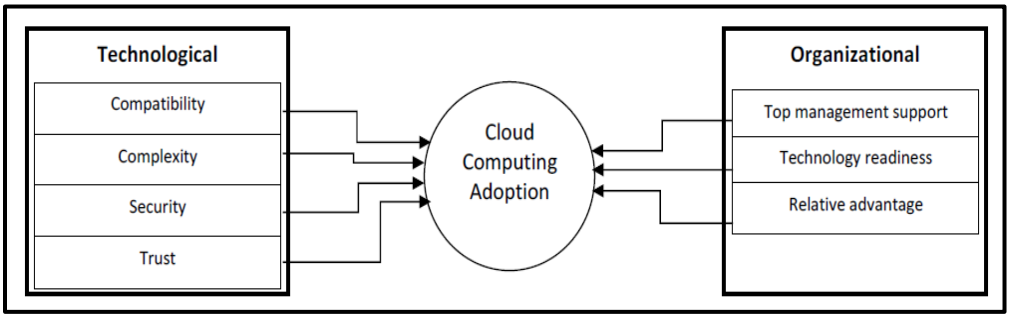

Figure 6.11: The Model for Previous Study [67]

CHAPTER SEVEN

CONCLUSION

Our research is focused on proposing a cloud computing model for E-government in Iraq. The value of our research is to propose a model of cloud computing for Iraqi E-government, the proposed model contributes to reducing the cost required for the development of E-government by using available cloud computing services. Also, there is no previous study propose a cloud computing model for Iraqi E-government.

The model is proposed depending on determining the factors affect the adoption of cloud computing in E-government by considering previous other countries' studies. The questionnaire is proposed to distribute to the IT staff in the Iraqi organizations and ministries. The questionnaire contains ten factors (trust, budget, compatibility, complexity, security, IT infrastructure, IT knowledge, technological readiness, managerial support, and relative advantage). The selection of these factors based on comparing previous studies. Data collected from 338 respondents, the data is analyzed by the analytical program SPSS version 23. The findings of the analysis showed the nine factors (trust, budget, compatibility, complexity, security, IT knowledge, technological readiness, managerial support, and relative advantage) affect the adoption of cloud computing in E-government in Iraq. IT infrastructure factor is ineffective on the adoption of cloud computing in E-government. The analysis of SPSS shows that the most important factors are the budget

followed by Compatibility, Trust, Managerial support, Relative advantage, IT Knowledge, Technology readiness, Complexity, and security. The proposed model passes via four Levels 0-3. Level 0; describes the context model; this Level contains 9 factors affect the adoption of cloud computing in E-government. Level 1 focuses on the division of the factors influencing the adoption of cloud computing in E-government to technological factors (trust, compatibility, complexity, security), and non-technological factors (budget, IT knowledge, technological readiness, managerial support, and relative advantage). The division of the factors in the Level 1 based on previous studies. Level 2 focuses on the description of the technological factors, as well as finding solutions to these factors when adopting cloud computing in E-government. The framework must include secure ways for users' login in systems and database, and this approach includes employees and citizens.

It is better to use a strong algorithm for encryption transmitted data among different ministries and governmental organizations. Moreover, data centers and storage units must be saved in secure places under appropriate circumstances to keep data from losing and manipulating. To promote trust between the government and providers as well as government and citizens, adopting cloud computing depends on reliable providers could strengthen the trust among different stakeholders to achieve the benefit of cloud computing. Furthermore, to promote confidence in government services and government data Protection, it is better to adopt a private cloud because the Iraqi government will manage it, but private cloud is too expensive. To avoid the high cost, we suggest the services should provide from the hybrid cloud combines between the public and private cloud.

The government must achieve compatibility among adopted and exist systems, DBMS, software, and so on. Moreover, It is vital to confident the adoption of cloud computing will be successful. The difference between adopted and legacy systems can cause fatal danger of the entire project

because it will be important to change or upgrade existing systems which might cost a high budget and long time. Lastly, to ensure the advantage of cloud computing will achieve completely, complexity in systems, interfaces, tasks, and so on, must be avoided. Therefore, websites, smart phone applications, and any connections between services and stakeholders must be easy to use. Complex and challenging use, which requires efforts and a great mentality to use cloud services can cause aversion of cloud computing adoption and lead to failure. Level 3 contains a proposed model which includes cloud computing services take into accounts the factors affect the adoption of cloud computing in E-government.

In the proposed model, the cloud computing provider provides (SaaS, IaaS, PaaS) services to all Iraqi ministries. These services provide (storage, database, and network, user interface, system operating, the Internet and central database) for all ministries; Central database location will be in the General Secretariat of the Council of Ministers which is responsible for the E-government services in Iraq. Furthermore, each Iraqi ministry will connect with the others via network service. The structure of linkage is a starburst structure, to represent the cloud-based E-government model. The reason for using the starburst structure is to avoid the risk of disrepair or penetration. If there is any malfunction or break in one of the links between cloud computing providers and ministries, this leads to egress the ministry is connected to the broken link from the model and avoid disruption of the whole model. Finally, the proposed model reduces the cost of E-government by 97.7%.

As a future work, the legacy, laws, and regulations must align to use cloud computing model. Governmental employees need to educate to use electronic services. Government to government interaction need to increase sharing data and information. Also, need to platform to sustain proposed cloud computing model for the Iraqi government.

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APPENDIX

APPENDIX1: Electronic Services Provided by the Iraqi Ministries

Table A.1: The Services Provided by the Ministries of Iraq [4] [33]

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
The Ministry of Interior	Directorate General of Nationality And Civil Status	G2C	-The issuance of the ID card and things related -Registration of births and deaths -Registration of marriages and divorces	Citizens
	Directorate Identities, And Licenses	G2N	-Granting licenses to establish demonstrations -Licensing of civil society organizations	Non Governmental Organizations
	General Directorate of Passports	G2B	Granting residency visa for foreign companies and employment	Foreign Companies and Businessmen
	Directorate Identities, And Licenses	G2B	The granting of work permits inside Iraq	Iraqi companies and businessmen

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	Directorate Identities, And Licenses	G2G	Licensing of the political blocs	The political Blocs
	Directorate-General for Communication and Informatics	G2G	Provide information to the competent authorities	All Ministries
	General Directorate of Traffic	G2C	-The issuance of driving licenses -Vehicle Registration -Issuing and obtaining traffic fines -Anti-car theft	Citizens
	Federal Police Directorate	G2C	Anti-murder, theft and armed robbery	Citizens
	Directorate of Civil Defense	G2C	Fire-fighting	Citizens
	General Directorate of Passports	G2C	-Issuing passports -Granting of the visa and residence card for foreigners -Registration of foreign arrivals to Iraq	Citizens

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	Central Office of Information	G2C	-Record the movement of citizens within the country and housing change -Issuing housing cards	Citizens
The Ministry of Defense	Volunteering Management Directorate	G2G	Supervision and follow-up phases of the army volunteering	Ministry of Defense
The Ministry of Industry	General company for the manufacture of Batteries	G2C	Battery industry	Citizens
	General Company For Pharmaceutical Industry	G2C	Medicine production	Citizens
	General Company for Glass Industry	G2C	Production of glass panes and glassware	Citizens
	General Company For Vegetable Oils	G2C	Edible oil industry and cleaning materials industry	Citizens

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	State Company For Phosphate	G2G	Production of chemicals utilized in other industries in addition to the production of phosphate fertilizers	All Ministries
	Ministry of Industry	G2G	Contribute to the implementation of Government projects	All Ministries
	General Company For Sulfur	G2G	Production of chemicals utilized in other industries in addition to the production of sulfur	All Ministries
	General Company For Cement Industry	G2C	Production of cement	Citizens
	General Company For Spinning and Weaving	G2C	Textile and clothing industry	Citizens
	General Company For Electrical Industries	G2C	Electrical appliance industry	Citizens

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	General company for the Petrochemical Industry	G2C	Production of petrochemical fertilizer	Citizens
The Ministry of Education	Ministry of Education	G2G	Send the results of the final examinations at the secondary level	Ministry of Higher Education
	Authority of Literacy	G2C	Literacy campaigns	Citizens
	Board of Education	G2C	Supervision of primary and secondary education	Citizens
The Ministry of Higher Education	Department of Missions And Cultural Relations	G2C	Cultural Missions	Citizens
	Department of Construction and Projects	G2G	Consulting offices	All Ministries
	Department of Scientific Affairs	G2B	Private colleges	Companies and Businessmen
	Department of Scientific Affairs	G2C	Universities and institutes	Citizens

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	Department of Scientific Affairs	G2G	Agencies and research centers	All Ministries
	Department of Research and Development	G2G	Training of civil servants	All Ministries
	Department of Missions And Cultural Relations	G2N	Civil society organizations	Non Governmental Organizations
The Ministry of Trade	General Company For Central Markets	G2B	Contracting with importers to provide the needs of citizens	Companies and Businessmen
	General Company For Trade And Commercial Services	G2B	-The establishment of trade shows and receiving companies and businessmen -Recording companies and commercial agencies	Companies and Businessmen
	General Company For Central Markets	G2C	Provide the needs of the citizens of consumables	Citizens

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	General Company For Trade of Construction Materials	G2C	Providing construction materials to citizens	Citizens
	Ministry of Trade	G2G	Import and provide for the needs of other ministries	All Ministries
	General Company For Foodstuff Trading	G2C	Providing of food to citizens	Citizens
	General Company For Car Trading	G2C	Provide a vehicle for citizens	Citizens
The Ministry of Justice	Ministry of Justice	G2G	-Appointment of prison administrations and follow-up its affairs -The ratification of the laws and follow-up implementation	All Ministries

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	Ministry of Justice	G2C	-The establishment of the courts and the administration of the judiciary -Documentation of commercial contracts -Registration of Marriages and Divorce	Citizens
The Ministry of Finance	General Commission For Taxes	G2B	Obtaining taxes from companies and Businessmen	Companies and Businessmen
	General Commission For Taxes	G2C	Providing information and obtaining taxes from citizens	Citizens
	General Insurance Company	G2C	Provide insurance mechanisms to life and property	Citizens
	Ministry of Finance	G2G	The financial budget of the country	All Ministries
	General Authority For Free Zones	G2B	Cover free zones dealings	Companies and Businessmen

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	General Authority For Customs	G2B	Obtaining amounts of customs from the import companies	Companies and Businessmen
	General Retirement	G2C	Provide salary pensions for retirees	Citizens
	Ministry of Finance	G2G	Public financial reports	All Ministries
The Ministry of Health and Environment	Ministry of Health and Environment	G2C	-The provision of health care and treatment of citizens -Conduct vaccination campaigns for children -Send patients for treatment outside the country -Combating diseases and epidemics -Granting a certificate of birth and death of citizens	Citizens
	Ministry of Health and Environment	G2G G2B G2C	Issuing approvals for the establishment of industrial and commercial enterprises	All Ministries, Companies business men, and Citizens
	Ministry of Health and Environment	G2G	Provide government statistics on births and deaths	All Ministries

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	Ministry of Health and Environment	G2C	Maintaining a healthy environment free from pollution	Citizens
The Ministry of Electricity	Ministry of Electricity	G2G	Generation of electrical projects for the ministries	All Ministries
	Ministry of Electricity	G2C	Provide electrical power to the citizens	Citizens
The Ministry of Communication	Ministry of Communication	G2G	Providing communication services and the Internet for ministries	All Ministries
	Ministry of Communication	G2B	Contract with mobile phone companies and Internet service providers	Companies Businessmen
	Authority of Literacy	G2C	Providing communication services and the Internet for citizens	Citizens
The Ministry of Labor And Social Affairs	Department of Employment And Loans	G2C	Provide jobs for the unemployed	Citizens
	National Center for occupational Health And Safety	G2C	Care workers affected	Citizens

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	Social Protection Network	G2C	Attention shelters orphans and the elderly Shelters	Citizens
	Department of Pension And Social Security For Workers	G2C	Provide a pension for workers in the private Sector	Citizens
	Department of Corrections Non Adults	G2C	Follow-up repair non-adult criminals	Citizens
	Department of Special Needs Care	G2C	Attention to people with special needs	Citizens
The Ministry of Housing and Construction	Ministry of Housing and Construction	G2C	-The establishment of residential complexes for citizens -Provide engineering consultancy for citizens	Citizens

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	Ministry of Housing and Construction	G2G	-The establishment of infrastructure and mega projects -Construction of roads and bridges -Creating buildings of ministries and government departments	All Ministries
	Ministry of Housing and Construction	G2B	Contracting with construction companies to set up construction projects	Companies Businessmen
The ministry of Culture	Ministry of Culture	G2C	Issuance of books, magazines, and newspapers	Citizens
	Ministry of Culture	G2B	Licensing news agencies and satellite channels	Companies Businessmen
The Ministry of Planning	Ministry of Planning	G2C	Follow-up and support projects	Citizens
The Ministry of Migration and Displacement	Department Immigration Affairs	G2C	Registration of the displaced citizens and to provide financial and material assistance to them	Citizen

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
The Ministry of Foreign Affairs	Ministry of Foreign Affairs	G2C	Issuance and certification of official documents for citizens outside the country	Citizens
The Ministry of Transportation	Ministry of Transportation	G2C	The transfer of citizens by land and air inside and outside the country	Citizens
	Ministry of Transportation	G2G	The transfer of government cargo	All Ministries
The Ministry of Oil	Ministry of Oil	G2C	The provision of petroleum products to the citizens	Citizens
	Ministry of Oil	G2G	-The export of oil and its derivatives -Supplying electric power stations with fuel	All Ministries
The Ministry of Water Resources	Ministry of Water resources	G2G	Supply water for injection of oil wells	All Ministries

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
	Ministry of Water resources	G2B	Includes the renewal fish licenses established in the arable and officially approved land	Companies Businessmen
	Ministry of Water resources	G2B	Includes saving Water share for water stations set up within villages, countries and districts and city centers in all governorates	Companies Businessmen
	Ministry of Water resources	G2C	Compensation of wrongs citizens from execution of irrigation projects (installation and plants) and pay amount of compensation for them	Citizens

Ministry	Service Provider	Service Type	Information Type	Carpetbagger
The Ministry of Agriculture	Ministry of Agriculture	G2B	The establishment of poultry farms and ruminants or expanded for the purposes of granting loans	Companies Businessmen
	Ministry of Agriculture	G2G	Import of fertilizers by the private sector	All Ministries
The Ministry of Youth and Sports	Ministry of Youth and Sports	G2C G2E	Submission of nomination forms on the ministry's departments and its subsidiaries as well as a form to request leave to employees	Citizens and Employees

APPENDIX2: Questionnaire

The purpose of this study is to adopt cloud computing solution for Iraqi E-government studies. If you are working at one of the ministries in the information technology department and you have the required knowledge about the E-government project in Iraq, please make a valuable contribution to our research study. Therefore, we invite you to join in this survey. The answers we get will be treated with strict confidentiality and remain anonymous. Only those who are related to the research will be able to see your answer. The questionnaire consists of three sections

1- Demographic questions.

2- Cloud utilization in your ministry.

3- Factors of E-government development using cloud computing. Answering the questionnaire takes approximately 10 - 15 minutes. When you need a query, please contact me directly **Israa.jaber88@gmail.com**

Your cooperation, effort, time, and feedback are highly appreciated.

SECTION ONE: Demographic questions

What is your gender?

- Male
- Female

What is your age?

- < 30 years
- 30-40 years
- 41-50 years
- > 50 years

What is your scientific qualification?

- High school
- Diploma
- Bachelor
- Higher Diploma
- Master
- PhD

Which ministry are you working?

- Ministry of Higher Education
- Ministry of Water Resources
- Ministry of Labor and Social Affairs
- Ministry of Transportation
- Ministry of Industry
- Ministry of Trade
- Ministry of Finance
- Ministry of Education
- Ministry of Planning
- Ministry of Communication
- Ministry of Health and Environment
- Ministry of Defense
- Ministry of Interior
- Ministry of Foreign Affairs
- Ministry of Electricity
- Ministry of Agriculture
- Ministry of Justice
- Ministry of Migration and Displacement
- Ministry of Housing and Construction

- Ministry of Oil
- Ministry of Culture
- Ministry of Youth and Sports
- Other: Please mention it _____.

Had you ever been worked in another ministry?

- Yes
- No

If you answered <u>YES</u> to the previous question, is there any systems used similarly to each other in those ministries?

- Yes
- No

How many years have experience in your current job?

- < 2 years
- 2-6 years
- 7-10 years
- > 10 years

What is your title in your department?

- Director of information technology department
- Assistant director of information technology department
- Team leader in information technology department
- Employee in information technology department
- Other, please specify _____.

How long have you been working in the information technology (IT) department?

- □ < 5 years
- □ 5-10 years
- □ 11-15 years
- □ > 15 years

Do you have any experience with the electronic government project?

- □ Yes
- □ No

If Your Answer to the Previous Question Is "YES", Please Explain Your Experience Briefly_____.

Which kind of internet connection is used in your ministry (you can choose more than one option)?

- □ Dial Up
- □ Satellite
- □ Fiber optic
- □ Other, please define _____.

What are the External Sources Your Ministry Supports(you can choose more than one option)?

- □ Network
- □ Software
- □ Hardware
- □ Unavailable
- □ Other, please define _____.

SECTION TWO: Cloud Utilization in Your Ministry

Do you have any idea about cloud computing?

- Yes
- No

Is your ministry adopting cloud computing?

- Yes
- No

If Your Answer To The Previous Question Is "Yes", Explain Which Part Your Ministry Adopts Cloud Computing?

_____.

If Your Answer To The Previous Question Is "No" Please Explain Briefly, Why Your Ministry Did Not Adopt The Cloud Computing?_____.

What Is The Reached Stage By Your Ministry Using Cloud Computing?

- Not involved
- Discussing
- Trial
- Implemented

What Is The Most Kind Of Structures Available For Your Ministry? (You can choose more than one option)?

- Infrastructure as a Service (IaaS), like (storage, servers)
- Software as a Service (SaaS), like (e- mail, Google Docs)
- Platform as a Service (PaaS), like (database, web servers)
- Other, please define _____.

SECTION THREE: Factors of E-government Development Using Cloud Computing

Please assess the following questions using the scale provided:

(1) Strongly Disagree

(2) Disagree

(3) Neutral

(4) Agree

(5) Strongly Agree

Adoption of cloud computing

Items	**1**	**2**	**3**	**4**	**5**
ACC-1 Cloud computing is not difficult for using					
ACC-2 Cloud computing reduces time of transactions completion					
ACC-3 Cloud computing reduces the cost					
ACC-4 Cloud computing is safe					
ACC-5 Cloud computing is reliable					

Trust

Items	**1**	**2**	**3**	**4**	**5**
TR-1 Cloud computing will be controlled on technology difficulties Existing in E-government					
TR-2 Cloud computing provides an environment of confidence to connect citizens with the e-government					
TR-3 Adoption of cloud computing in e-government can be trusted with the implementation of online transactions quickly and reliably and faithfully					
TR-4 Cloud computing service providers are trustworthy					
TR-5 Overall, e-government can be trusted when adopting cloud computing					

Budget

Items	1	2	3	4	5
BU-1 Cloud computing reduces the budget by redeploying Information Technology staff in government institutions					
BU-2 Cloud computing reduces the number of the used devices in E-government, which leads to cost reduction					
BU-3 Cloud computing helps to build interconnected environments work which contributes to improving the performance and reducing the costs					
BU-4 Cloud computing reduces the costs of (software, operations, hardware) in e-government					

Compatibility

Items	1	2	3	4	5
CA-1 Changes introduced by cloud computing are compatible with e-government					
CA-2 In the case of any problem of incompatibility, the cloud service provider will provide integrated services					
CA-3 Cloud computing is compatible with current information technology infrastructure					

Complexity

Items	1	2	3	4	5
CX-1 When adopting cloud computing, the current work will be integrated easily with platforms and cloud computing services					
CX-2 Cloud computing has flexible interaction with e-government					

Security

Items	1	2	3	4	5
SE-1 When adopting cloud computing in e-government, there is no loss or manipulated in government data					
SE-2 The sharing of government information with cloud computing suppliers does not endanger ministry					
SE-3 There are enough regulations in ministry to protect the government's data from the cloud computing dangers					
SE-4 Overall, cloud computing provides security for data of e-government					

IT Infrastructure

Items	1	2	3	4	5
ITI-1 Information technology infrastructure at your ministry is ready to adopt cloud computing technology					
ITI-2 The use of cloud computing will reduce the load of infrastructure management for information technology					
ITI-3 Based on cloud computing, it is not necessary to remain the infrastructure for information technology					
ITI-4 The creation of Infrastructure depending on the basic needs of the institution reduces the storage costs					

IT Knowledge

Items	1	2	3	4	5
ITK-1 The staff knows a lot about cloud computing services					
ITK-2 Staff has knowledge about the benefits and disadvantages of cloud computing					
ITK-3 Staff has enough experience for adopting the cloud computing in e-government					

Technology Readiness

Items	1	2	3	4	5
TRE-1 The ministry can implement cloud computing technology – unlimited access to the computer, due to it has enough technology recourses					
TRE-2 The ministry allocates a part of the total profit to contribute to cloud computing implementation in the ministry					

The managerial support

Items	1	2	3	4	5
MS-1 The manager is ready to bear the risks occur in the ministry when adopting cloud computing					
MS-2 The manager supports the development of cloud computing technology in the ministry					
MS-3 The managers have knowledge about the cloud computing benefits in the ministry					
MS-4 The managers provide the necessary resources to adopt cloud computing technology					

Relative Advantage

Items	1	2	3	4	5
RA-1 Cloud computing provides information to users in any era and any area					
RA-2 When adopting cloud computing, The Ministry pays only for the services have used					
RA-3 The performance level of cloud computing services will not weaken when increasing the number of users					
RA-4 Cloud computing can improve the efficiency of communication among government institutions					

APPENDIX 3: Questionnaire in the Arabic Language

أهمية الحوسبة السحابية في المؤسسات العراقية

إذا كنت تعمل في إحدى الوزارات العراقية في قسم تكنولوجيا المعلومات أو قسم علوم الحاسبات أو قسم الاتصالات والشبكات أو قسم هندسة البرمجيات أو أي قسم مرتبط بتكنولوجيا المعلومات, ولديك المعرفة المطلوبة حول مشروع الحكومة الالكترونية في العراق، فأنت مدعو للمشاركة في هذه الدراسة. الأجوبة سوف تعامل بسرية تامة، فقط الشخص المسئول عن البحث سوف يكون قادرا على رؤية إجابتك.

الغرض من هذا الاستبيان هو لدراسة أهمية الحوسبة السحابية في الحكومة الالكترونية. يتكون الاستبيان من ثلاثة أقسام

1- المعلومات الشخصية و المعلومات التقنية.

2- استخدام الحوسبة السحابية في المؤسسة التي تعمل بها.

3- عوامل تطوير الحكومة الإلكترونية باستخدام الحوسبة السحابية.

الإجابة على الاستبيان تستغرق حوالي 10-15 دقيقة. إذا كان لديكم أي استفسار، لا تترددوا في التواصل معي عن طريق البريد الإلكتروني**israa.jaber88@gmail.com**

تعاونكم والجهد، والوقت، وردود الفعل هي محل تقدير كبير. شكرا لكم..

القسم الأول : المعلومات الشخصية و المعلومات التقنية

الجنس؟

- ☐ ذكر
- ☐ أنثى

العمر؟

- ☐ اقل من 30 سنة
- ☐ 30 – 40 سنة
- ☐ 41-50 سنة
- ☐ أكثر من 50 سنة

التحصيل الدراسي؟

- ☐ إعدادية
- ☐ دبلوم
- ☐ بكالوريوس
- ☐ دبلوم عالي
- ☐ ماجستير
- ☐ دكتوراه

المؤسسة التي تعمل بها ضمن أي وزارة؟

- ☐ وزارة التعليم العالي والبحث العلمي
- ☐ وزارة الموارد المائية
- ☐ وزارة الزراعة
- ☐ وزارة الصناعة والمعادن
- ☐ وزارة العمل والشؤون الاجتماعية
- ☐ وزارة النقل
- ☐ وزارة التربية
- ☐ وزارة النفط
- ☐ وزارة الداخلية
- ☐ وزارة الدفاع
- ☐ وزارة الخارجية
- ☐ وزارة الكهرباء
- ☐ وزارة الصحة والبيئة
- ☐ وزارة العدل
- ☐ وزارة التخطيط

☐ وزارة الهجرة والمهجرين

☐ وزارة المالية

☐ وزارة الاتصالات

☐ وزارة الإسكان و الأعمار

☐ وزارة الثقافة

☐ وزارة الشباب والرياضة

☐ وزارة التجارة

☐ أخرى

_____

هل عملت في مؤسسة أخرى سابقا؟

☐ نعم

☐ لا

إذا كان جوابك على السؤال السابق "نعم", فهل لاحظت أن هناك تشابه بين الأنظمة المستخدمة في المؤسسات التي عملت فيها؟

☐ نعم

☐ لا

كم عدد سنوات خبرتك في وظيفتك الحالية؟

☐ اقل من 2 سنوات

☐ 2-6 سنوات

☐ 7-10 سنوات

☐ أكثر من 10 سنوات

ماهو منصبك في قسمك؟

☐ رئيس قسم تكنولوجيا المعلومات

☐ معاون رئيس قسم تكنولوجيا المعلومات

☐ مسؤول شعبة في قسم تكنولوجيا المعلومات

☐ موظف في قسم تكنولوجيا المعلومات

☐ أخرى _____

كم عدد سنوات عملك في مجال تكنولوجيا المعلومات؟

☐ اقل من 5 سنوات

☐ 5-10 سنوات

☐ 11-15 سنوات

☐ أكثر من 15 سنوات

هل لديك خبرة في مشروع الحكومة الالكترونية؟

☐ نعم

☐ لا

إذا كان جوابك على السؤال السابق "نعم", وضح باختصار ماهي خبرتك في مشروع الحكومة الالكترونية؟ _____

ما هو نوع ربط الانترنت المستخدم في مؤسستك ؟ (يمكنك اختيار أكثر من خيار)

☐ الاتصال الهاتفي (Dial Up)

☐ الأقمار الصناعية (Satellite)

☐ الألياف الضوئية (Fiber Optics)

☐ أخرى _____

أي من المواد الخارجية التالية يتم تجهيز مؤسستك بها الكترونيا (بدون الذهاب إلى مكان التجهيز) ؟ (يمكنك اختيار أكثر من خيار)

- ☐ الشبكات (Network)
- ☐ البراجيات (Software)
- ☐ المكونات المادية (Hardware)
- ☐ لا يوجد
- ☐ أخرى

القسم الثاني : استخدام الحوسبة السحابية في المؤسسة التي تعمل بها

هل لديك أي فكرة عن الحوسبة السحابية؟

- ☐ نعم
- ☐ لا

هل مؤسستك تعتمد الحوسبة السحابية؟

- ☐ نعم
- ☐ لا

اذا كان جوابك على السؤال السابق "نعم", وضح باختصار بماذا تعتمد مؤسستك تكنولوجيا الحوسبة السحابية؟_____

إذا كان جوابك على السؤال السابق "لا" وضح باختصار لماذا لم تعتمد مؤسستك تكنولوجيا الحوسبة السحابيه؟_____

ما هي المرحلة التي وصلت لها مؤسستك باستخدام الحوسبة السحابية؟

- ☐ لم تشارك
- ☐ مرحلة المناقشة

☐ مرحلة التجربة

☐ مرحلة التنفيذ

أي نوع من الهياكل التالية مفيدا جدا لمؤسستك ؟ (يمكنك اختيار أكثر من خيار)

☐ البنية التحتية كخدمة (IaaS) مثل (التخزين, الخوادم)

☐ البرمجيات كخدمة (SaaS) مثل (الايميل, مستندات كوكل)

☐ المنصة كخدمة (PaaS) مثل (قواعد البيانات, خوادم الشبكة)

☐ أخرى

القسم الثالث : عوامل تنمية الحكومة الالكترونية باستخدام الحوسبة السحابية

الرجاء تقييم الأسئلة باستخدام المقاييس التالية

"1" لا أوافق بشدة

"2" لا أوافق

"3" محايد

"4" أوافق

"5" أوافق بشدة

اعتماد الحوسبة السحابية

العناصر	1	2	3	4	5
الحوسبة السحابية سهلة الاستخدام					
الحوسبة السحابية تقلل من وقت انجاز المعاملات					
الحوسبة السحابية تقلل الكلفة					
الحوسبة السحابية آمنة					
الحوسبة السحابية موثقة					

الثقة

العناصر	1	2	3	4	5
الحوسبة السحابية سوف تتغلب على الصعوبات التي تواجهها الحكومة الالكترونية					
الحوسبة السحابية توفر بيئة موثقة لربط المواطنين مع الحكومة الالكترونية					
باعتماد الحوسبة السحابية في الحكومة الالكترونية فأن تنفيذ المعاملات عبر الانترنت سوف يكون بسرعة و وثوقية					
مجهزي خدمات الحوسبة السحابية موثوقين					
بشكل عام, الحكومة الالكترونية يمكن الوثوق بها عند اعتماد الحوسبة السحابية					

الكلفة

العناصر	1	2	3	4	5
الحوسبة السحابية تقلل من الكلفة عن طريق إعادة توزيع موظفي تكنولوجيا المعلومات في المؤسسات الحكومية					
الحوسبة السحابية تقلل من عدد الأجهزة المستخدمة في الحكومة الالكترونية, الأمر الذي يؤدي إلى خفض التكلفة					
الحوسبة السحابية تساعد على بناء بيئات عمل مترابطة تساهم في تحسين الأداء وتقليل التكاليف					
الحوسبة السحابية تقلل من تكاليف (البرمجيات والعمليات والمكونات المادية) في الحكومة الالكترونية					

التوافق

العناصر	1	2	3	4	5
الحوسبة السحابية تحقق تغييرات متوافقة مع الحكومة الالكترونية					
في حال وجود مشكلة عدم توافق, فأن مزود خدمات الحوسبة السحابية سوف يوفر خدمات متكاملة					
الحوسبة السحابية متوافقة مع البنية التحتية الحالية لتكنولوجيا المعلومات					

التعقيد

العناصر	1	2	3	4	5
باعتماد الحوسبة السحابية سوف يكون من السهل دمج العمل الحالي للحكومة الالكترونية مع منصات وخدمات الحوسبة السحابية					
الحوسبة السحابية سوف تتفاعل بمرونة مع الحكومة الالكترونية					

الحماية

العناصر	1	2	3	4	5
عند اعتماد الحوسبة السحابية في الحكومة الالكترونية, سوف لا يكون هناك خسارة أو تلاعب في البيانات الحكومية					
مشاركة المعلومات الحكومية مع مجهزي الحوسبة السحابية سوف لا يشكل خطرا على المؤسسة					
هناك لوائح كافية وضعتها مؤسستك لحماية البيانات الحكومية من مخاطر الحوسبة السحابية					
بشكل عام, الحوسبة السحابية توفر الحماية لبيانات الحكومة الالكترونية					

البنية التحتية لتكنولوجيا المعلومات

العناصر	1	2	3	4	5
البنية التحتية لتكنولوجيا المعلومات في مؤسستك على استعداد لتبني تكنولوجيا الحوسبة السحابية					
اعتماد الحوسبة السحابية سوف يقلل من عبء إدارة البنية التحتية لتكنولوجيا المعلومات					
عند اعتماد الحوسبة السحابية فأن مؤسستك سوف لا تحتاج للحفاظ على البنية التحتية لتكنولوجيا المعلومات					
بناء البنية التحتية التي تعتمد على الاحتياجات الأساسية للمؤسسة تقلل من تكاليف التخزين					

مدى معرفة موظفي تكنولوجيا المعلومات

العناصر	1	2	3	4	5
الموظفين يعرفون الكثير عن خدمات الحوسبة السحابية					
الموظفين لديهم معرفة حول فوائد و مساوئ الحوسبة السحابية					
الموظفين لديهم خبرة كافية لاعتماد الحوسبة السحابية في الحكومة الالكترونية					

الجاهزية التكنولوجية

العناصر	1	2	3	4	5
مؤسستك لديها موارد تكنولوجية كافية لتنفيذ الحوسبة السحابية (وصول غير مقيد إلى الكومبيوتر)					
الوزارة تخصص نسبة من إجمالي الإيرادات لتنفيذ الحوسبة السحابية في المؤسسة					

الدعم الإداري

العناصر	1	2	3	4	5
المدراء في مؤسستك مستعدون لتحمل المخاطر المتوقع حدوثها عند اعتماد الحوسبة السحابية					
المدراء في مؤسستك يدعمون التطور باتجاه تكنولوجيا الحوسبة السحابية					
المدراء في مؤسستك لديهم معرفة عن فوائد الحوسبة السحابية					
المدراء في مؤسستك يوفرون الموارد اللازمة لاعتماد تكنولوجيا الحوسبة السحابية					

الميزة النسبية

العناصر	1	2	3	4	5
الحوسبة السحابية توفر المعلومات للمستخدمين في أي مكان وزمان					
باعتماد الحوسبة السحابية فأن المؤسسة تشتري الخدمات التي تحتاجها فقط					
مستوى أداء خدمات الحوسبة السحابية لا يضعف عندما يكون عدد المستخدمين في تزايد					
الحوسبة السحابية تحسن من كفاءة التواصل بين المؤسسات الحكومية					

APPENDIX4: Correlation Table

		TR	BU	CA	CX	SE	ITI	ITK	TRE	MS	RA	CCA
TR	**Pearson Correlation**	**1**	**-.007**	**.032**	**-.053**	**.034**	**-.086**	**.063**	**-.015**	**.114***	**.014**	**.120***
	Sig. (2-tailed)		**.894**	**.556**	**.335**	**.537**	**.115**	**.248**	**.777**	**.036**	**.800**	**.028**
	N	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**
BU	**Pearson Correlation**	**-.007**	**1**	**.179****	**.229****	**.164****	**.153****	**.050**	**.026**	**.015**	**.018**	**-.010**
	Sig. (2-tailed)	**.894**		**.001**	**.000**	**.002**	**.005**	**.363**	**.635**	**.777**	**.744**	**.860**
	N	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**
CA	**Pearson Correlation**	**.032**	**.179****	**1**	**.021**	**.033**	**.081**	**.083**	**.008**	**.030**	**.129***	**.141****
	Sig. (2-tailed)	**.556**	**.001**		**.696**	**.542**	**.137**	**.130**	**.880**	**.587**	**.017**	**.009**
	N	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**
CX	**Pearson Correlation**	**-.053**	**.229****	**.021**	**1**	**.246****	**.165****	**-.049**	**.123***	**-.038**	**.093**	**.196****
	Sig. (2-tailed)	**.335**	**.000**	**.696**		**.000**	**.002**	**.367**	**.024**	**.486**	**.088**	**.000**
	N	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**
SE	**Pearson Correlation**	**.034**	**.164****	**.033**	**.246****	**1**	**.132***	**-.017**	**.114***	**-.014**	**.025**	**.169****
	Sig. (2-tailed)	**.537**	**.002**	**.542**	**.000**		**.015**	**.758**	**.035**	**.802**	**.644**	**.002**
	N	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**
ITI	**Pearson Correlation**	**-.086**	**.153****	**.081**	**.165****	**.132***	**1**	**.031**	**.203****	**.025**	**-.053**	**.064**
	Sig. (2-tailed)	**.115**	**.005**	**.137**	**.002**	**.015**		**.566**	**.000**	**.640**	**.330**	**.243**
	N	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**
ITK	**Pearson Correlation**	**.063**	**.050**	**.083**	**-.049**	**-.017**	**.031**	**1**	**.070**	**-.033**	**.079**	**.089**
	Sig. (2-tailed)	**.248**	**.363**	**.130**	**.367**	**.758**	**.566**		**.197**	**.550**	**.146**	**.104**
	N	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**
TRE	**Pearson Correlation**	**-.015**	**.026**	**.008**	**.123***	**.114***	**.203****	**.070**	**1**	**.009**	**-.007**	**-.061**
	Sig. (2-tailed)	**.777**	**.635**	**.880**	**.024**	**.035**	**.000**	**.197**		**.874**	**.896**	**.260**
	N	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**
MS	**Pearson Correlation**	**.114***	**.015**	**.030**	**-.038**	**-.014**	**.025**	**-.033**	**.009**	**1**	**.105**	**.096**
	Sig. (2-tailed)	**.036**	**.777**	**.587**	**.486**	**.802**	**.640**	**.550**	**.874**		**.053**	**.078**
	N	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**
RA	**Pearson Correlation**	**.014**	**.018**	**.129***	**.093**	**.025**	**-.053**	**.079**	**-.007**	**.105**	**1**	**-.065**
	Sig. (2-tailed)	**.800**	**.744**	**.017**	**.088**	**.644**	**.330**	**.146**	**.896**	**.053**		**.236**
	N	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**
CCA	**Pearson Correlation**	**.120***	**-.010**	**.141****	**.196****	**.169****	**.064**	**.089**	**-.061**	**.096**	**-.065**	**1**
	Sig. (2-tailed)	**.028**	**.860**	**.009**	**.000**	**.002**	**.243**	**.104**	**.260**	**.078**	**.236**	
	N	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**	**338**

CURRICULUM VITAE

PERSONAL INFORMATION

Name, Surname :Israa AL OGAILI

Date and Place of Birth : 30.06.1988

Email : israa.jaber88@gmail.com

Phone : 00905313264038

EDUCATION

Degree	Institution	Years of Graduation
High School	AL Askandarea School	2006
Bachelor Degree	Computer Science	2010
M.SC	Information Technology	2017