Measuring the Success of Adoption of Voice over Internet Protocol; A Case Study of Ministry of Municipality

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DEDICATION

This thesis is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time. I also dedicate this work to my brother; who has encouraged me all the way and whose encouragement has made sure that I give it all it takes to finish that which I have started. And last not least, to my Wife who has stand by my side and encourage me to complete this thesis.

ACKNOWLEDGEMENT

ABSTRACT

Communication is a basic innovation in the present society. As we move into the advanced age where innovation increments in significance, communication likewise moves alongside us and is presently being digitalized as Voice over IP (VoIP). This research centers around the effect of VoIP on the center business of Ministry association and the part of obtaining a focused by utilizing the innovation. Because of the absence of past research in this field, the examination is exploratory. An investigation is led on VoIP by utilizing a subjective research strategy bringing about inside and out meetings with delegates from two distinct associations that have executed VoIP. The observational information is sorted and deciphered. Ends were drawn from the interpretation.

This research bolsters the view that VoIP presents a dimension of upper hand into organizations that is principally brought about by cost reserve funds. Likewise, contrariness issues with inheritance frameworks are distinguished as the primary hindrances when VoIP is executed. The capacity of VoIP to increment proficiency is talked about together with the perspective that future improvements in correspondence innovation can influence the center business of associations relying upon their showcase segment. Concerning the associations met for this exploration it is seen that VoIP has negligible effect on the center business (forms) of organization while the support process is impacted to a more noteworthy degree.

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Chapter 1

INTRODUCTION AND INFORMATION TECHNOLOGY SYSTEM BACKGROUND

1.1 INTRODUCTION

As the society is moving into the digital age where the role of technology is coming more important than ever, telephony also moves with us. Now telephony had been digitalized in the form of VOIP. The society depends heavily on the technology to function in efficient way. This can be seen for example from the way we use the electronic payment in the supermarket using any bank card through the Internet Protocol or even making a phone call through this protocol. The IP protocol is a set of rules to transport data packets through a digital network. VOIP comes into the picture as a replacement of the analog telephony for organizations.

Nowadays the effectiveness and efficiency play an important role in saving the cost and competitive acquiring advantage, the technology integrity being used by the business is very important.

VOIP is stand for Voice Over Internet Protocol. It is fundamentally a phone association over the system. Information been sent carefully, utilizing IP rather than simple phone general lines. This innovation enables individuals to talk together for long separation and around the entire world without paying any charges or any worldwide telephone expenses. In other way, it is basically doing your regular phone job, but the only main difference is that you will use the internet as a connection, even if you do not have a standard phone line.

There are numerous reasons why to utilize VOIP. Topping the rundown is its cost-adequacy. It's ordinarily offered by suppliers as additional items to link channels or cell phone bundles. In this way, there's no requirement for you to pay for additional charges.

You can likewise escape with the conventional charges Telco's add to your bill, for example, long-remove and meandering expenses. Besides, if the call is from PC to PC, you might not need to pay for anything by any means.

For using VOIP, it needs three main requirements which are the following:

- Phone.
- An internet connection.
- VOIP software.

Municipalities Affairs which the study will be conducted on it department's and environment of how will VOIP Project impact and improve it service's and work efficiently.

The Ministry of Municipalities Affairs and Urban Planning is entrusted with giving broad administrations coordinate bearing on each home, business outlets, and offices / addresses each subject, expat inhabitants and bosses. The arrangement of such administrations requires a high level of flawlessness and expedient reaction to the necessities of the recipients and in addition adaptability, flexibility, an awesome measure of coordination between the concerned substances and offices. The Ministry is managing a significant extremely requesting, testing and dynamic condition whose requests are developing by a wide margin in term of amount and quality, intensified by the Ministry's offer of commitment to the aggregate improvement of the Kingdom.

With the presentation of the Kingdom of Bahrain's 2030 Vision and the activities of the Economic Development Board proposed to bring forth and create a legislative managerial condition that leads the pack in the monetary and social progression, all these offer a vital chance to rebuild and refashion the part of the Ministry of Municipalities Affairs and Urban Planning as a team with the four official city subdivisions as intended to change the Ministry into a key accomplice in the improvement of approaches, use of the advancement designs, arrangement of metropolitan administrations that are receptive to the neighborhood needs, consequently boosting the natives and occupants in the legislature and urging the subjects to end up proactive members in the activities expected to advance their nearby groups. (www.bahrain.bh, 2008)

Inside this unique circumstance, the Ministry of Municipalities Affairs and Urban Planning is occupied with aggregate and far reaching audit of this part, procedures and execution in a stage expected to redesign this part in a manner that serves the best enthusiasm of the group and adds to the acknowledgment of the 2030 Economic Vision.

"We aspire to shift from an economy built on oil wealth to a productive, globally competitive economy, shaped by the government and driven by a pioneering private sector – an economy that raises a broad middle class of Bahrainis who enjoy good living standards through increased productivity and high-wage jobs. Our society and government will embrace the principles of sustainability, competitiveness and fairness to ensure that every Bahraini has the means to live a secure and fulfilling life and reach their full potential".

Bahrain vision 2030 that constraint on many terms, mainly on economic. Keep up with 2030 vision, Bahrain economy needs change. Bahrain is confronting a spillage and deficiency of two main resources, appropriate skills and quality employment. Bahrain government seeking to change the way IT business is done and bring a new sense of responsibility to how we manage IS directorates. Bahrain government working to implement the power of technology to performance improvement and decreasing the cost of government operations.

1.2 PROBLEM STATEMENT:

Main question: What is the impact of VoIP technology on the core business of MUN environment?

This question will be answered through answering the below questions:

1- From a ministry's point of view how does VoIP differ from analog communication solutions?

2- To what extent is the functionality of VoIP utilized in an organization and what are the obstacles to implementing VoIP features?

3- How can VoIP use be enhanced with a specific end goal to upgrade the help of the (center) business forms?

4- Does VoIP give organizations an upper hand?

The municipality affairs service providing confront excellent data innovation (IT) challenges in the twenty-first century: information force, processing power, effectively and efficiency seize the workforce. Bahrain has been a good example of a country where a digital divide exists. VOIP one of the technologies the Bahrain was pioneer in it. Municipality Affairs one of the main ministry in Bahrain and everywhere, also it got the largest environment comparing with the other ministries. Municipality affairs always looking for ways to improve their business, helping to identify possible improvements and find ways to make them happen. So saving cost and improving their services are the main targets of the affairs vision. However, it is one of the government instructions that circulated to all its own sector.

VOIP project is very important to be applied in the municipality affairs to improve their work and service. Improving following:

- Accessibility.
- Cost.
- Flexibility.
- Voice Quality.

1.3 SIGNIFICANCE OF THE STUDY

The result of this study will add a clear image of VOIP benefits toward municipality services and how factors affect the usefulness of using VOIP, where nowadays almost all sectors are using VOIP. Consequently, VOIP is very important tool that every organization should have and will improve the technology skills of municipality services. Adoption of VOIP in municipality operations introduces a new method in services than old methods that most organizations go over it that they were depends on. VOIP needs to be organized by ISD in municipality affairs in the Kingdom of Bahrain. In addition, results of this study will help municipality affairs to identify and control bills and cost.

1.4 CONCEPTUAL FRAMEWORK OF THE STUDY
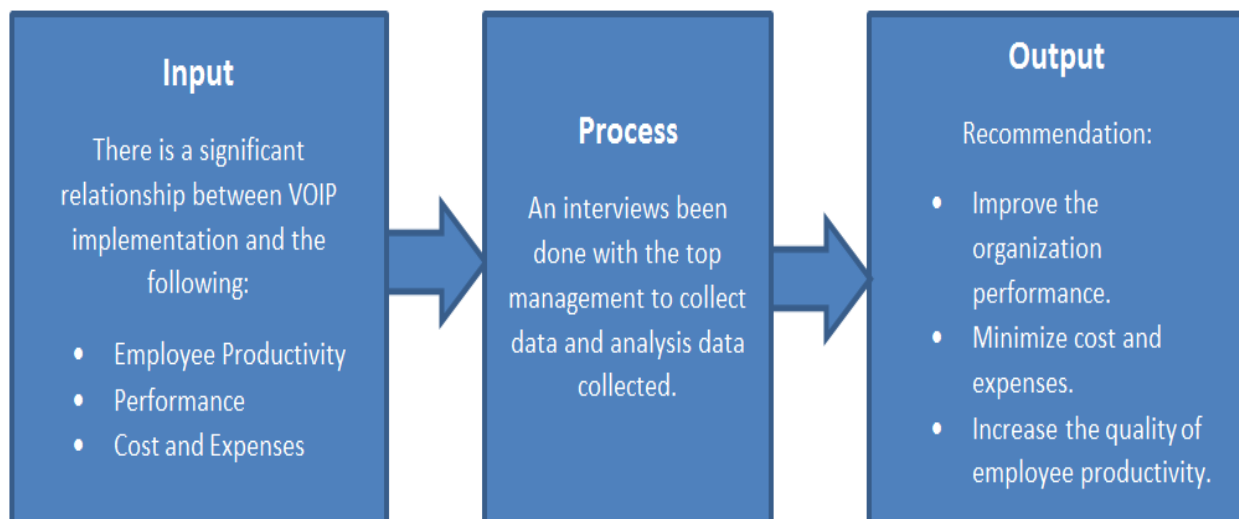
1.5 SCOPE AND LIMITATION

The scope of this study is to demonstrate that the implementation of new innovation can decrease costs and does not take a look at the real cost an organization may need to pay to change or dismantle their present framework.

Today we are intensely dependent on the web and system availability and will dependably confront difficulties to keep the data streaming, however in the realm of telephone frameworks, VOIP and SIP trunks are adaptable and solid for the greater part of the present business.

1.6 LIST OF AVIATION

IP	Internet Protocol
VOIP	Voice Over Internet Protocol
PC	Personal Computer
IT	Information Technology
IS	Information System
MUN	Ministry of Municipality
ISD	Information System Directorate
PSTN	Public-Switches Telephone Network
PBX	Private Branch Exchange
QOS	Quality of Service
UDP	User Datagram Protocol
LAN	Local Access Network
RTP	Real-Time Transport Protocol
SIP	Session Initiation Protocol
SMS	Short Message Service
HQ	Head Quarter
GDN	Global Data Network
CIO	Chief Information Officer

CHAPTER 2

REVIEW OF RELATED LITERATURE AND STUDIES

2.1 RELATED LITERATURE

2.1.1 VoIP Background and Development

This Chapter will include multiple literature reviewed that describes the researcher's opinion in concerning the VOIP technology and its impacts. The importance and growth of the VOIP communication technology will be discussed. After that I will describe the technical base for the VOIP technology mentioning different protocols used in the technology. Then I will give an architecture overview that explains how the technology is deployed in the organizations who wants to adopt it. This technical overview is important to discuss the topics later. The topics are: deploying the technology, Quality of service factor, reliability, security known issues and the advantages of deploying the VOIP technology regarding the cost and benefits.

Since the invention of the telephone, communication has been simplified. "Everybody has been using the Public-Switches Telephone Network(PSTN) to communicate through phones for decades. VOIP technology was first developed in the 70's but it was only commercial in the 90's. Nowadays the technology demand is more than 1 billion (Varshney et al.,2002)" . The lack of reliability on the IP infrastructure is behind the slow commercial development of the VOIP technology and this is in the past PSTN was more reliable option. It was more reliable because of the VOIP technology QoS issues (Paul E. Garstki, 2015).

Some Users in the business sector created a unique system to route Incoming/Outcoming calls in the organization building. This approach called a private branch exchange (PBX) that works as a switch for regulating communication traffic.

The difference between the two technologies is the communication devices which in the old technology the traditional analog telephone is enabled on the other hand the VOIP requires a special packet-based device (phones or softphones). Softphones accomplish the same goals as IP phones but with no special hardware such as Skype.

The VOIP development unique perspective focuses on the correspondence technology models that the organization uses, and improvement training attributes in view of new innovation gauges. The Internet and IP innovation advancing will move towards the VOIP innovation likewise the improvement of new correspondence principles and correspondence innovation criteria.

As per some expert opinions the technology now in a transitional phase where the traditional system is replaced by the VOIP (Vetteth, A., & Joseph, 2009).

The VOIP gives the voice communication to appear over the network using different network protocols. These protocols are basic initiation rules, transitions and conducting the traffic on a digital network. The user datagram protocol UDP is used by the VOIP technology to transfer digital information. The UDP is a simple transport protocol to transport data but it doesn't have the ability to reassemble the data packets the are received in an incorrect order transfers data in a speedy way regardless of its correctness.

2.1.2 VoIP Architecture
Now I will give a small overview on the 3 most popular methods for a VOIP network.

2.1.2.1 Method # 1 : Toll Bypass
This method is regarding all communications that occurs between different branch offices and their main organization using the web rather than a leased simple phone lines to transport correspondence information. This strategy is can be likewise a half and half arrangement which in both simple and VOIP telephones can convey together underneath graph demonstrates a case of a setup of two branch remote workplaces which impart together utilizing a rented line which called tie line.
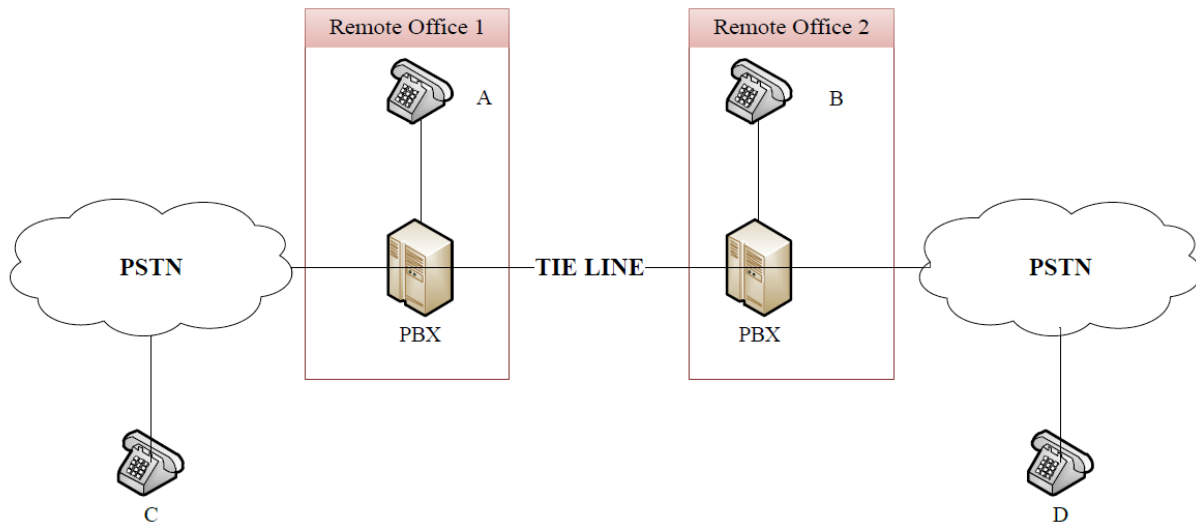
Fig 1:- Tie Line Connecting 2 Remote Offices (Vetteth & Joseph, 2009)

There is another option under this method which we will explore now which is toll bypass. This option creates an alternative to the rented communication lines between branches. IP network replaces the Tie line which can be the internet. The below diagram explains it more.
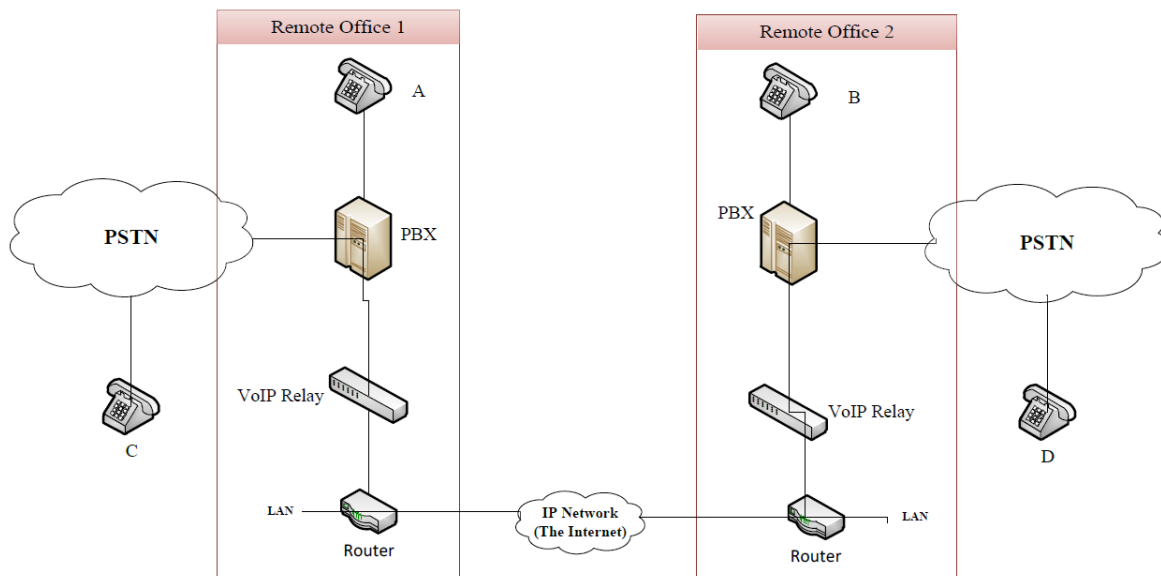

Fig 2: Simple VoIP Toll Bypass Implementation

The PBX's in the branch offices must be disconnected from the external rented line and connected to VOIP relays which is responsible of translating the data into the correct design for transportation over the IP organize. The transfers at that point ought to be associated with switches which are associated with an IP system and LAN (Vetteth & Joseph, 2009).

2.1.2.2 Method # 2 : Total IP Telephony network

Every other device connected to the network LAN is involved in this method. There are only 2 types of devices within the organization either IP phones or PC softphones. Specialized software gives the ability for higher usage of PC to PC communications to make calls via real time chat programs. All current telephone equipment should be replaced if an organization wants to use this method (John Q. Walker and Jeffrey T. Hicks ,2002).

2.1.2.3 Method # 3: IP enabled PBX

This is a choice as often as possible chose for executing any VOIP arrangement in any association. Completing a move up to the PBX is an unquestionable requirement to have the capacity to help the transportation of computerized information which doesn't require any links and handsets to be supplanted. The PBX must be upgraded to handle the function with the IP protocol and connection through the internet.

2.2 VOIP TECHNICAL DESCRIPTION

Real-Time transport Protocol (RTP) is also utilizing the UDP and concerned about the speed. It is also incapable of reassembling data packets which are received in an incorrect order. But at the same time, it is more reliable to detect issues which can affect the QoS.

The above description of protocols that VOIP use is a simple description of how this technology works as there are multiple initiation protocols involved into the communication process. The SIP protocol is related to the initiation of the session. It is responsible of signaling the protocol, instance messaging and presence and multimedia sessions. The nutshell SIP is an internet protocol that utilizes the internet arch functionality. It is used in manipulating a media session between two points through the internet, in the idle scenario the VOIP implementations utilizes multiple protocols to function correctly. Experts determines which protocol to be used, but SIP and RTP protocols are most popular.

Taste is the significant thing for correspondence cooperation between SIP User Agents and different kinds of servers which have distinctive functionalities (diverting transmissions and enrolling transmissions). In some routes there is an intermediary server which goes about as in the middle of gadget for exchanging the SIP messages to the end focuses. It is required to send a SIP message to the SIP server to begin, oversee and end a VOIP session. Then the message gets received and registered and the server acknowledges the recipient by sending a special coded reply to the SIP UA.

2.3 IMPLEMENTING VOIP: CHALLENGES & CONSIDERATIONS

Migrating to Packet-Based communication from Circuit switched in an organization is done when VOIP is implemented. In a certain period, the traditional and the digital phones will exist at the same. A Hybrid System will result to incorporates both solutions. This coexistence is very important as both technologies are used in the organization which wants to adopt the VOIP. Any organization which wants to deploy VOIP can't simply disrupt their daily operations by replacing the traditional system with VOIP (Varshney, U., Snow, A., McGivern, M., & Howard, C. ,2002).

Also, the organization must consider that there are operational differences between the 2 systems. The network configuration must be considered plus the devices that will support the VOIP. Here the planning phase is so critical in order to achieve the goals of the transformation to VOIP.
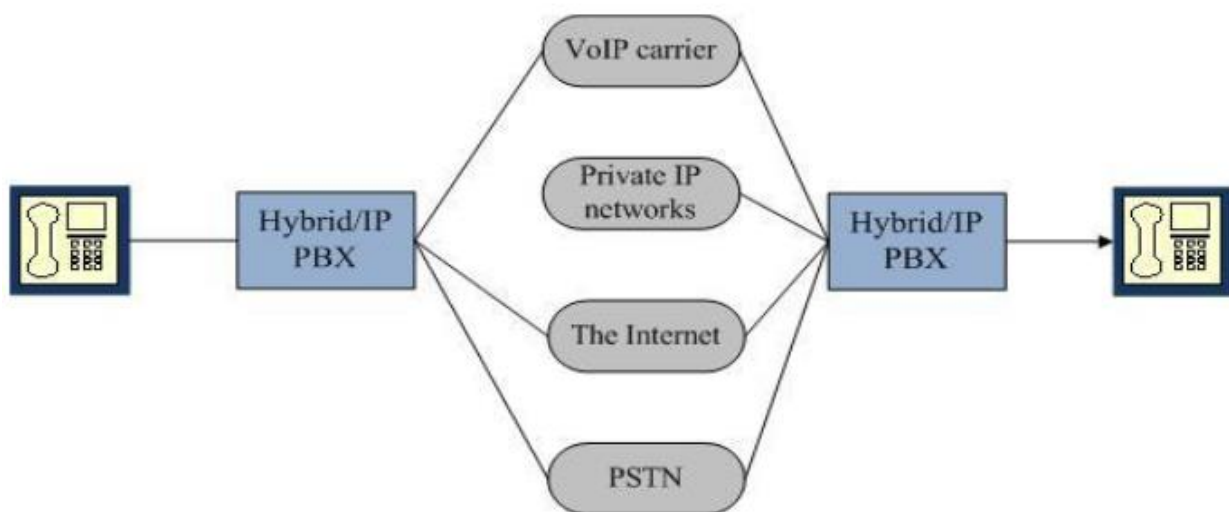

Fig 3:- Coexistence scenarios for PSTN & VoIP

2.3.1 Quality of Service

QoS indicates the latency and delay factors which users will encounter using the VOIP service. Latency is the time required for the data to transfer from the source to the destination. The QoS is the marginal which can measure the performance of the service and it should be at least equal to the quality and reliability using the analog telephone system. The problem with QoS that it is affected by the network security mechanisms in the organization which generates some complications. The below items are explanation for the main network issues which may affect the VOIP deployment:

2.3.1.1 Latency:

The logical idea for the system objective is to control the latency and keep it to its minimum. It is not handy to get vast postpone contrast between sending a data and accepting it, this will wreck the constant communication aspect. With the traditional system, it was not difficult to maintain a low level of latency. The traditional system latency level us 150 milliseconds which the VOIP must be in the same range. This latency is related to the requirement which is the successful delivery for the data packets.

2.3.1.2 Jitter

Jitter is the inconsistent delays of the packets which transfers the information. This is caused when a low level of bandwidth is available for the data network. The issue with this delay that it makes the information parcels get handled in an alternate wrong manner other than the transmitted way which will cause erroneous pointless messages (Dr. Wendy Rubin, 2017). To keep Jitter under control, buffers must be created to keep traffic packets under an acceptable uniform level. These buffers are controlling the traffic mechanisms by releasing the packets depending on the network needs. They must be created at certain points in the network to achieve the effectiveness point and the buffers must release the packets at least every 150 ms to avoid latency.

2.3.1.3 Packet loss

This is losing of packets or useless data packets. This new technology has got an abnormal state prejudice seeing the parcel misfortune as it is an ongoing correspondence. The reason for bundle misfortune may likewise be jitter. This means that the packets reach too late to the destination which replaced the late packets with other packets making the message useless and incorrect. Losing a packet in VOIP won't affect the QoS that much but unfortunately the packets got loss in groups not individual which affects the QoS badly.

2.3.1.4 Bandwidth & Effective Bandwidth

VOIP implementation issue that needs to be implemented on a network which is designed only for a certain amount of data traffic. In addition to the voice data these networks can become an obstacle which results a degradation of the QoS. The bandwidth is affected by the level of security deployed in the network. A combination between the security level and QoS must be determined and balanced.

2.3.2 Reliability

The traditional system gives an abnormal state of unwavering quality because of long periods of usage. Clients aspects a high level of reliability from VOIP technology and won't be satisfied easily. VOIP must meet the reliability standard which the PSTN offers at least. System availability can be described as:

Since VOIP uses the same data network to operate and transport data, its availability mostly will be depending on the network utilization. Systems are burdened by arbitrary downtimes, arrange limit issues, programming issues and different challenges.

2.3.3 VOIP security

As any other new technologies which utilizes the transfer of any sensitive info security is the major thing. Regardless of the benefits that can be achieved by this technology, but the security aspects remain a major issue to be concerned by the organizations which wants to deploy it. The threat may occur from the people who may get unauthorized access to the PBX or the voice mail system. Another breach may occur when free calls had been taken place and the company must pay it.

Any technology that uses the IP protocol may get affected by Viruses, Malwares, Worms etc. .. Also, VOIP may get affected by such threats, such threats will affect the day to day operations and interrupt the smoothness of the daily work (Jim Cavanagh ,2010).

There are many basic security requirements must be considered before deploying VOIP in any organization. It can be divided into Functional and technical security requirements. Functional requirement example such as the service provider only have access to the data not a third-party company. Technical requirement such as encrypting all connections between the network objects.

It is relatively difficult to make any framework 100 percent anchored yet it must be an adequate level to ready to keep the threats which will faced.

Adding a high level of secure encryption may affect the QoS and causes more delay on the network and transmission. This leads to a major security platform must be followed and enhancements should be done on the network Firewall and the encryption mechanism.

2.4 SOME EXAMPLES OF ENTITIES WHO HAVE SUCCESSFULLY DEPLOYED VOIP TECHNOLOGY

2.4.1 Association of Chartered Certified Accountants

Acca staff are 650, whom 50 work in its Glasgow call centre. The organization provides training, professional qualifications for accountants and education, so it communicates with its members and students by fax, phone, email and letters for information and advice.

This organization had 2 offices in Glasgow and was planning to open a third office in London. This plan was the reason to transfer from their manual telephone old system to the VOIP technology to insure their Business continuity, enhance the management and reduce their operation and phone calls cost. By deploying the VOIP technology Acca reduced 10% of its £700,000 annual communications cost.Another benefit for such deployment is that the new technology gave the staff the ability to work from any of associations office without affecting the quality of services offered by Acca.It enhanced the management procedures for the IT and Finance departments where they had the full ability to control the technical features and calls cost (Marcelo E. Fernandes, Carlos R. C. Lima ,January 2011).

2.4.2 Intel

In this white paper Intel conducted a pilot project for deploying the VOIP technology through some of the building it owns. This pilot succeeded technically and productivity users who used the new system enhance their ability to perform tasks faster and in more efficient way than the old system.

The outcome of this study showed that the new VOIP technology achieved the below points:

1- Measurable productivity benefit.

2- Efficiency in voice messaging and accessibility.

3- Cost reduce in the ownership.

4- Long term savings.

5- Flexible and simple management technically and financially.
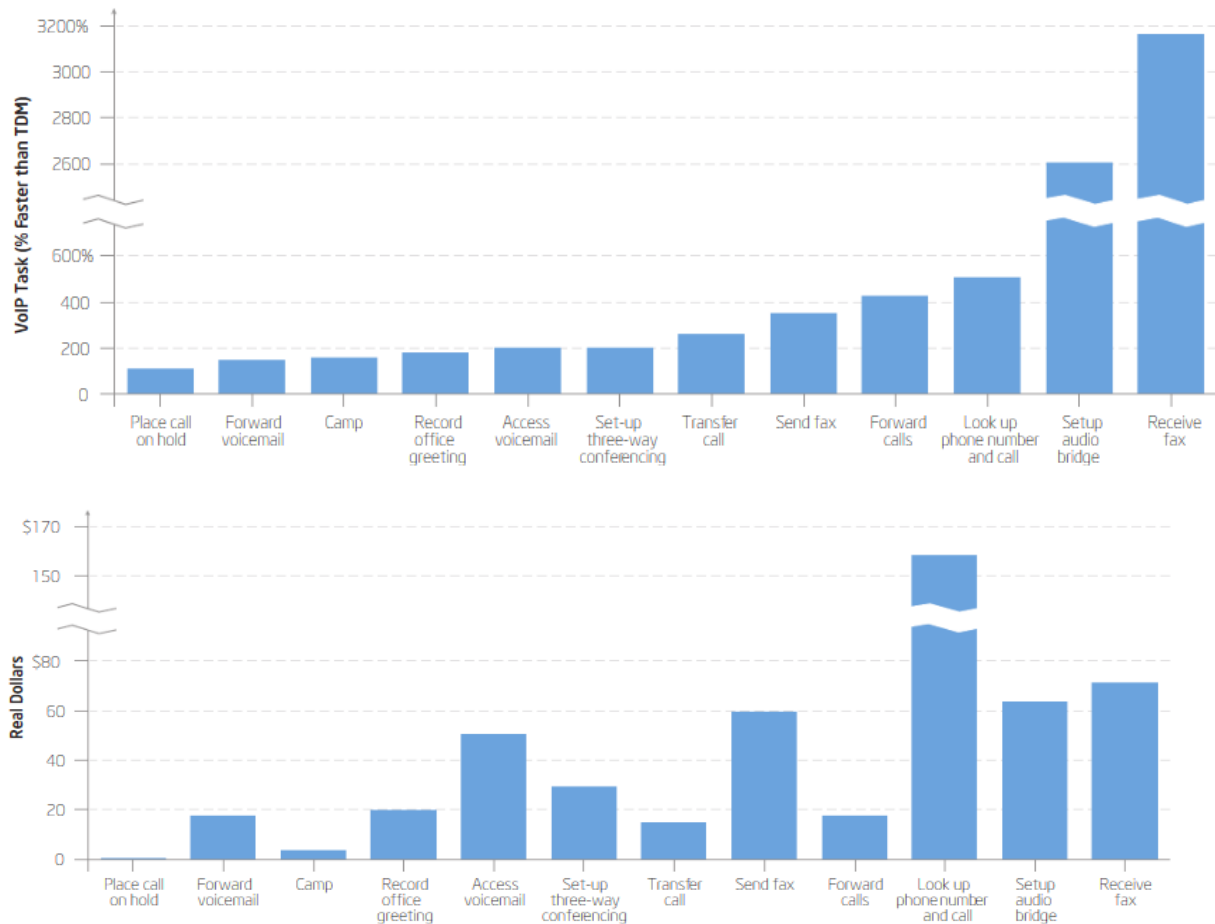
Fig 4:- VOIP task performance VS. traditional voice solution per employee

From the above images and after analyzing this pilot project outcomes, it demonstrats that Intel can accomplish critical cost reserve funds through moving from a current analog system to a new VOIP system. By examining both hard and delicate cost reserve funds, Intel can see a positive ROI following two years. Not with standing hard costs reserve funds, client efficiency gains on successive voice assignments can likewise demonstrate a sensational advantage to both the undertaking client and the IT office. VoIP keeps on driving profitability through new communication.

2.4.3 South African business

As per this study below are the points of interest of utilizing VoIP:

The principle focal points of utilizing VoIP are the after effect of the non-reservation of lines for correspondence purposes and the transmission of parcels of information alongside other information

parcels on the information arrange. This converts into cost funds and viable system usage, which can result in further advantages because of the digitization of the procedure.

2.4.3.1 Cost investment funds on phone calls

Most global providers of the tradition system split a month to month rental into a fixed rental and call charges, where long separation calls cost more than short separation calls. Abroad providers of VoIP, anyway will in general charge a level month to month charge, in light of the preferred standpoint coming about because of parcel exchanging and the non-reservation of lines, which results in long-separate exchange of information over the Internet being basically free . A case of this is the Virgin Amusement Group, which supplanted every one of the traditional system with VoIP systems. This brought about cost investment funds of up to $700 000 every year on long separation calls alone (Lydia Uys ,2009).

In the South African condition, organizations, for example, Decision Technologies introduce VoIP frameworks with innovation of the business' decision, with changing costs. Darker (2007) expressed that the month to month expenses remain the customary charge charges for the information arrange. For whatever length of time that calls are made between business systems (LAN or WAN), the calls are free, however when a tradition system phone or cell phone is called, Telkom or cell rates apply. These VoIP-to-traditional system charges are purportedly lower than the charges for traditional-to-traditional or traditional-to-cell calls.To give a South African model, the Department of Minerals and Energy moved up to VoIP in 2005. The division is utilizing IP communication over its LAN and WANs, which brought about substantial cost reserve funds on intra-organization calls (Choice Technologies official statement on IT Web, 2005).

2.4.3.2 Powerful usage of system limit

Another real favorable position of utilizing VoIP is that a business can make utilization of underutilized arrange limit while bringing about insignificant extra expenses. The South African Department of Minerals and Energy reported a diminishing in system working expense as far as fixes and support since voice and information utilize the VOIP.

2.5 VOIP AND COMPETITIVE ADVANTAGE

There are different elements impacting the reception of VoIP by the business network. VoIP works as a digitalization of correspondence information that can without much of a stretch cooperate with the Internet and be transported over it. This enables the correspondence information to be put away, controlled and joined with other information that would then be able to be transported to any gadget that has an organization with the Internet. It is trusted that VoIP will fill in as a bringing together stage for different business applications. Generally, it is anticipated that VoIP will bolster new interchanges works that are not yet exhibit today.

There are parts of VoIP that can affect organizations to move towards the new innovation (Vetteth, A., & Joseph, 2009). For an examination we can take a gander at the discoveries of a VoIP test case program that was directed by the Intel Corporation. By underneath **table 1** shows an examination of customary telephone highlights and the VoIP highlights. VoIP gives some new highlights like Unified Communications which is the coordination of ongoing correspondences, for example, texting, IP communication and call conferencing with non-continuous interchanges, for example, SMS informing and email. Later on, organizations try to expand the usefulness of the VoIP telephone framework by utilizing a wide range of custom applications that can keep running on the IP telephones and can be particularly intended to serve to the requirements of the organization.

Traditional Features	VoIP-Enabled Features
Hold	Fax
Transfer	Follow me
Mute	Unified Communications
Conference	Remote call management
Redial	Inbox voicemail
Forward	Automated attendant
	Presence information
	Directory access
	Click to call
	Click to conference
	Screen pop

Table 1 :- Traditional Features Vs. VoIP-Enabled Features

As indicated by the experimental run program that was directed by the Intel Corporation, there was a huge increment in the efficiency and execution of workers that were utilizing the VoIP arrangement in contrast with those that still used customary telephone arrangements. For instance, dreary errands, for example, getting to voice message, are finished quicker when utilizing a VoIP arrangement. The execution increment given by the new innovation results in a net profitability gain which makes an interpretation of over into cost investment funds for the organization.

Toll bypass can be utilized by associations with a specific end goal to bring down their correspondence costs, particularly when various branch workplaces are included. Typically, associations rent correspondence lines (Tie lines) between two workplaces keeping in mind the end goal to convey straightforwardly. This choice can be costly, as these tie lines are required for each different branch office all together for (secure) interchanges to happen. Another disservice of this choice is that installment of the rent sum is required paying little mind to the level of utilization of the correspondence line. With toll sidestep no additional correspondence costs are important as the association's own information arrange is utilized for transportation which would enable the association to get a specific level of (aggressive) advantage over a rival as far as expenses.

Solidly VoIP gives a more financially savvy option in contrast to customary communication and accordingly associations that have executed it appreciate less expensive correspondence and operational expenses over the long haul. The degree that the already said advantages impact the center business of different associations depends vigorously on the idea of the center business forms. An association in which the center business forms are vigorously entwined with correspondence innovation, for example, a call focus or a specialized help organization experiences a more noteworthy effect VoIP than for example a development organization. A clarification could be that telephone-based correspondence is one of the main business forms in a call focus and VoIP gives a less expensive and more effective approach to perform it. This empowers the association to pick up favorable position over its rivals which still utilize customary communication. For a development organization the effect of VoIP can be of a lesser degree as telephone-based correspondence isn't regularly observed as a center business process yet falls more into the supporting procedure class. By and by even in a supporting job VoIP can give productivity gains and included usefulness that specifically and in a roundabout way increase the value of association and its procedures. Eventually this enables it to gain an upper hand over its opponents.

CHAPTER 3
METHODOLOGY OF THE STUDY

3.1 RESEARCH METHODOLOGY

This research was conducted to explore the affect and benefits of deploying the VOIP telephone technology in the Ministry of Municipalities with a small comparison with the traditional telephony technology to achieve the vision, mission and strategic objectives of the Ministry of Municipalities in Kingdom of Bahrain. Therefore, a qualitative descriptive approach was followed to conduct this research.

To accomplish the research objectives the data for this study was collected through self-administered questionnaires and interviews.

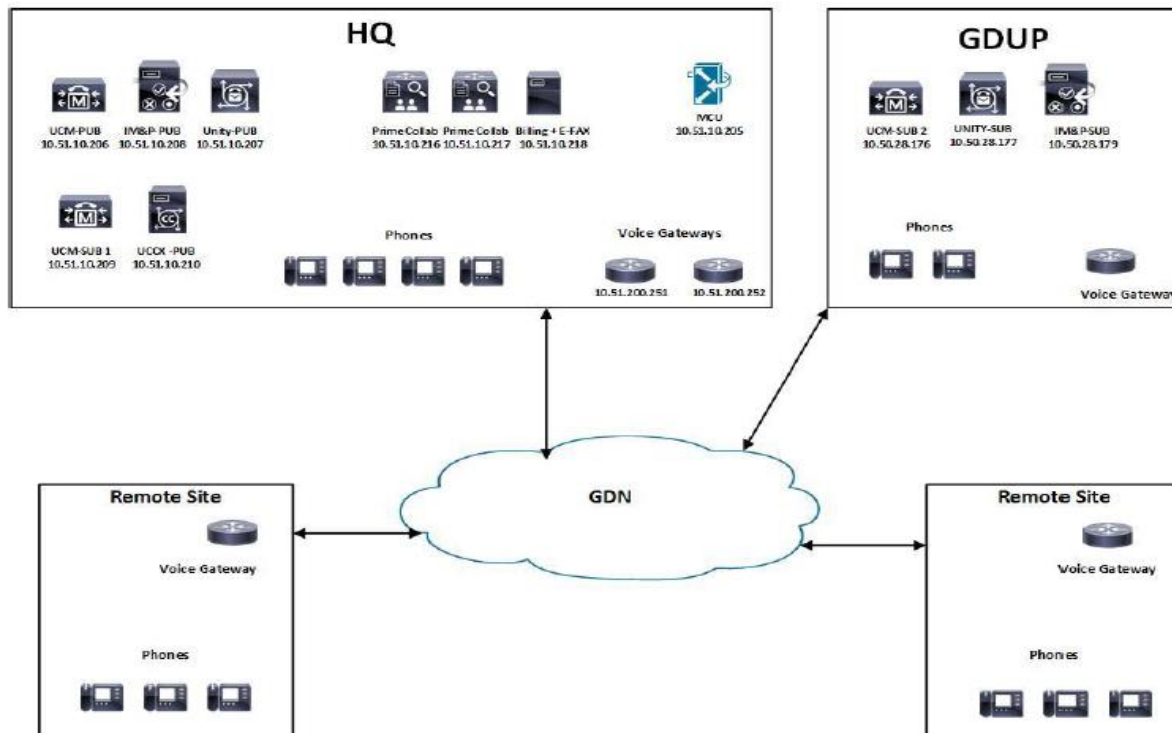## 3.2 MUN GEOGRAPHICAL SETUP – SITE AND STAFFING

Fig 5 :- MOMUN Design

3.2.2 Network and design consideration

Ministry of Municipality is in the phase to deploy Cisco Equipment in network. The new infrastructure design will have the following specifications.

- MOMUN network design is based on Cisco call Manager Business 7000.
- Cisco call Manager Business 7K contains Call Manager, Unity Connection, Presence, Call Centre express.
- Access layer switches will connect phones and PCs.
- One server will be used for 3rd party application and management server.
- Video Network will be considered.
- Active directory and Exchange server might be required.

3.2.3 Network Topology

Ministry of Municipality Head Quarter in Manama is connected to other Municipalities and Counsels through GDN network. MOMUN network subnets are following the CIO regulation.

3.3 DATA GATHERING

Because of the constrained measure of time that is accessible for the exploration, the decision was made to perform inside and out meetings to collect information. Since the research questions are unmistakably characterized, the investigation is more centered around social event data with the aim to answer the inquiries. The examination instrument utilized is a meeting poll. There are two variants of this poll. One is intended for organizations that have executed VoIP with a specific end goal to upgrade their organization (these are customers) and the other one is intended for VoIP suppliers that offer VoIP as an administration.

Information gathering is a piece of the examination methodology and is finished by having a couple of gatherings with key work constrain who have enough learning of the VoIP structures starting at now set up inside the affiliations. The gatherings are the essential source from which data is gathered from the affiliations and are of a semi-made nature enabling the part to light up his very own particular story and proceed forward to subtopics while not straying too a long way from the general research questions. The instrument that is utilized as a piece of the semi-composed gatherings is a gathering guide that contains a couple of key request that are basic amid the time spent taking note of the rule look at questions. In this research, two organizations were interviewed:

I chose MUN because first of all I work there and I well know the environment and what did MUN faced to deploy the new technology. Second, it gave me the opportunity to research through all project documents and be able to access the needed information whenever needed.

Third, MUN is one of the biggest government entities with approx. 40 buildings and more than 3500 employees and one of the largest budget amount is going for its projects. So the financial and management effect of deploying the new technology will be obvious and easy to study.

3.4 DATA ANALYSIS

The observational learning that was accumulated all through the meetings is shown inside the accompanying part. In order to supply a great deal of passionate synopsis, the information is segmental per organization into entirely unexpected subsections that compare with the subjects from the shape that was utilized all through the meetings. The ordered exact learning is exclusively on inside and out portrayal of the arrangement given by the people that were met inside the organizations.

Before the empirical knowledge may be analyzed a choice should be created regarding the info analysis technique to be used. It may be thought-about harder to pick out associated execute a satisfactory information examination strategy for subjective investigation as, in qualification to quantitative investigation, the brilliance between learning social affair and learning examination isn't always very much laid out. for instance, the inquiries that are used in polls all through meetings and furthermore the scientist's own assumptions for the most part confirm the outcomes. The examination and furthermore the learning have a significant outcome on each other. Hence, it'd be contemplated higher to state methods of research rather than knowledge analysis.

3.5 RESEARCH APPROACH

There are two sorts of research that are broadly utilized in the instructive world. These are quantitative and unique research techniques. The picked ask about procedure as a rule depends upon what the investigator thinks about and his capacity as neither one of the research's form is generally seen as better than the following. For this circumstance the decision has been made to revolve around an abstract methodology as opposed to

quantitative one. Accordingly investigate instruments that are viewed as more quantitative in nature, e.g. studies, won't be utilized to search for after the examination questions. A general depiction of quantitative and passionate research is given underneath.

3.5.1 Quantitative

This exploration strategy uses quantitative data to think about the marvel being referred to. Quantitative data basically implies that it tries to measure the examination information which can appear as numbers and figures. "This quantifiable information is then generally utilized in factual models keeping in mind the end goal to help/refute an exploration question or hypothesis. The main importance of quantitative research is the data measurement process because this provides the foundation for the statistical analysis (Oncken, Onno ,2008).

3.5.2 Qualitative

As opposed to the next quantitative research strategy, subjective research centers around subjective data for reviewing the marvel. Such data is more often than not as words and stories. "It provides a different approach to studying complex phenomena and for some cases it is viewed as the most adequate method to be used (Oncken, Onno ,2008).

3.5.3 Why qualitative?

The reason behind the assurance of an emotional research methodology is set up in its attributes and the sort of contemplate that is inspected. "Qualitative research is a technique that is more qualified for studies when quantifiable information isn't accessible or is harder to gain. Regularly quantitative research appears as a contextual investigation which is a strategy for directing examination that includes a top to bottom investigation of an individual, a specific gathering or wonders (Blumberg et al., 2008)". In this examination the "wonder" to be inspected is VoIP and its impact on the middle business of MUN organizations. In spite of the fact that VoIP isn't so much a direct detectable event, its advancement and market advancement can be characterized regarding quantitative and subjective estimations. With "VoIP marvel" the event and improvement of the VoIP innovation in general is implied.

Because of the absence of comparable research in the field of VoIP in Middle East, this investigation is described as exploratory. To lead subjective exploratory examinations, the main by and large acknowledged approach is the usage of a relevant examination. In addition, the examination approach is described as an exploratory relevant investigation of an interpretive nature.

3.6 RESEARCH QUESTIONS

The main question of the study is:

What is the effect of VoIP technology on the center business of Ministry?

To find the solution of this inquiry, a few meetings were held with a few number of employees from different backgrounds (Technical, end users and Financial) that use or utilize VoIP innovation. The information assembled from these customers was inspected and the underneath sub-questions were tended to:

Financial:

- What are the supporting business procedures of an organization that the VOIP will satisfy and enhance?

Technical:

- Which options of VoIP were deployed within the organization?
- What square measure the barriers keeping the usage of further alternatives and what troubles wherever experienced executing current VoIP highlights?
- Which enhancements may be enforced to accumulate bigger have the benefit of VoIP within the organization?

End Users:

- What square measure the barriers keeping the usage of further alternatives and what troubles wherever experienced executing current VoIP highlights?
- Is there a perceived competitive advantage by the organization when the introduction of VoIP?

CHAPTER 4

PRESENTATION ANALYSIS AND INTERPRETATION DATA

4.1 PRESENTATION OF DATA

In this Chapter the data was gathered after interviewing of one organization. It is MUN administrators and end users.

Because of the confidentiality issues the interviewees and IT companies info are not mentioned in my thesis. However, a general idea is included regarding the organizations operational info as it is important perspective. The operational information is for instance the MUN employee size and sector. *Refer to appendices*

In the "Description of the interviewee" paragraph fact concerned of operational information about MUN or the ICT company with a small focus on the interviewee background. Then the "Interview Results" will be mentioned. The results will hold the detailed answers provided related to the questions asked by the interviewer.

4.2 ORGANIZATION 1: DATA SUMMARIZATION.

Refer to appendices

4.2.1 Description of the interviewee 1

This interview was done in the Kingdom Ministry of Municipality. MUN is a government entity which has more than 2000 employee with more than 40 building through the Kingdom. As any other government entity, it has a fair amount of bureaucracy that could be a limitation factor once new technology is evolving. The MUN provides services for all citizens in Bahrain nearly 1 million.

The Head of Computer Support was involved during the implementation of the new VOIP tech at the MUN. She also occupied a service desk position in the IT department in the ministry. Which means that she has a good knowledge in the shortcomings, planning and implementation phases during the project. Interview

Results She shared her opinions regarding her experiences with the VOIP technology and the users through the organization.

4.2.2 Interview Results: Summary

A: VoIP and the core business

MUN core business process is to provide governmental services to all citizens occupying a municipality. These services are wide ranged. It includes assistance for acquisitions for permits, Licensing, support services for all the kingdom citizens. The communication through the ministry's different buildings through the country and the phone support for the kingdom citizens is one of the core processes on daily basis. This process is conducted by MUN dedicated service desk. To manage and enhance the service desk operation in the most efficient way MUN had to implement VOIP technology by doing normal tasks such as call forwarding. Call management system can add value is such organization, it gives the organization the ability to record calls and build a statistical module too (David H. Yedwab ,2004).

The communication current method didn't change much, for the first view the difference was that the users has to use a new manufactured CISCO telephones. The VOIP was not implemented one shot through the ministry but the implementation appeared incrementally. The users started to enjoy the VOIP capabilities after the system was fully implemented and stable. The digital phone book was the most important feature (from the user point of view) as it simplified their daily task in forwarding the internal calls which needed to be forwarded, or even share a call with different parties. The contacts are saved alphabetically in the address book by the first and the last name. The users also can forward all their incoming calls to another IP phone or to a mobile device. This can be configured from any place in the world by connecting remotely to the IP device and follow the configuration instructions.

Deploying the VOIP system in the ministry simplified the employee's relocation through the buildings and offices. The analog system line had to be physically moved when the employee reallocates his office and wants to have the same number. The new system has a feature for group monitoring using a specialized software to monitor the calls and who and for how long the user is logged into a phone or a call. It also gives the ability to the user to act when any of their colleagues is not available. The VOIP technology makes the ministry employees work in a more efficient way.

B: VOIP Improvements and boundaries

The VOIP technology has one main downside during implementation phase which is the lack of stability. As per the interviewee the new system had major problems such as Quality of the Sound and availability. MUN chose to have the new technology deployed in stages creating a hybrid environment where for a certain time both communication systems were working at the same time to deliver the service. While the implementation phase it was common for the organization VOIP failure due to hardware and software incompatibilities and issues while configuration. This affected number of users not being able to communicate. At some point users had to use 2 types of phones. The CISCO IP phone and the analog phone when the VOIP system fails. This situation caused some confusions for the users specially when the call forwarding service is down and a call needed to be forwarded. The problems got eliminated once the VOIP system is fully implemented and stable, but in fact it left a bad impression. This created a less accepting situation for the new system. However, once the system is fully deployed and stable with no failure events, they started to accept the new technology and created new positive ideas comparing the possibilities VOIP technology presented. Another issue was the phones themselves which depends on the small amount of power signal through the network cable. So, when a power outage occurs then no communication can be done. This leaded the ministry to consider a backup power solution in such cases to avoid this issue. Another issue raised by the interviewee is the security, all the communications must meet a high level of security to secure such private information shared. Especially when citizen's information is involved. This leads extra testing for the new system and faced by some obstacles (Roysden, R. J., & Schiller, S. Z. ,2015).

C: Advantages and benefits

In 2017 MUN started the process of upgrading the existing communication system, at that time the VOIP system appeared to be the correct direction where the market is going. The implementation phase stared in 2018. The current system at that time was old and the maintenance cost was high. The management decided that the support level from the provided is better and will last longer. The contract with the provider for the old system is not cost effective for the ministry and doesn't comply with the vision of MUN. On the other hand, the implementation cost of the VOIP is large comparing it to the old system but it will enhance the services and last longer. The cost benefits will appear after a long term and greater functionalities and efficiency factors eliminated the initial disadvantages. Utilizing the budget and the resources the interviewee mentioned that the savings from the operation services can be allocated and used is different projects to enhance the ministries services. Implementing the VOIP system was not MUN decision alone, it was a government strategic plan to

deploy this system to meet the Bahrain 2030 vision and reduce the operation cost and enhance the services done for the citizens.

4.2.3 Interpretation of data

The interviewee said that in the following years VoIP will control most of the business showcase and supplant the current simple communication frameworks. As per her the conceivable outcomes that VoIP can give will be instrumental in its acknowledgment by the business network. Long haul cost sparing and the additional adaptability by utilizing extraordinary applications that keep running on the VoIP stage will turn out to be exceptionally appealing. She predicts that Unified Correspondences will interestingly affect associations that give telephone-based administrations or remote help as the new innovation can possibly radically change their forms. For associations that don't have center procedures that incorporate communication and where VoIP is viewed as even more a help procedure, any future correspondence innovation would at most make forms more financially savvy or give more noteworthy adaptability to clients. The immediate impact on center procedures would anyway be viewed as insignificant.

4.3 ORGANIZATION 2

4.3.1 Description of the interviewee

This association is one of the real players in the worldwide systems administration and communication showcase. It appreciates wide going acknowledgment in the business network, has been assigned for various grants and was positioned in front of the pack for its execution with Unified Communications. Besides the association is spoken to in more than 30 deployments. The individual that was met at this association is a senior technical specialist who has different long stretches of involvement with the nearby communication showcase. He has broad learning of the items the association produces and the administrations that are advertised. Besides because of his long periods of experience keeping up business associations with GCC organizations he has a fundamental comprehension of the general inclinations that nearby organizations have. This enables him to precisely demonstrate and examine the general pattern of the MUN communication showcase.

4.3.2 Interview Results

A: VoIP and the core business

Over the most recent five years' associations in the Bahrain have turned out to be progressively mindful of VoIP also, trust in the correspondence innovation has risen considerably. By and large Bahrain associations tend to be marginally hazarded loath which makes them less slanted to quickly present new advances which can typically contain shrouded flaws. Due to the expanded market infiltration of VoIP, a wealth of reference cases and information, VoIP has picked up a solid piece of the overall industry in the Kingdom. The pattern is that most substantial associations in the country right now have a VoIP stage or are thinking about actualizing one. less associations are increasingly reluctant about presenting VoIP as the execution expenses can be high while the additional usefulness probably won't be totally used.

Because of the worldwide money related emergency numerous associations deferred their arrangements to redesign their correspondence frameworks and are presently choosing to actualize a VoIP correspondence arrangement. Typically, VoIP executions are performed gradually in which a transitory half and half situation exists. This implies the heritage correspondence framework is working nearby the VoIP framework so as to guarantee correspondence congruity inside the association. An element that is regularly asked for when VoIP is acquainted is a redesign with the PBX which makes it ready to exchange computerized information utilizing the association's information organize. An unadulterated IP communication stage, where the PBX equipment is totally expelled, and programming plays out the communication routings undertakings, is not frequently asked for all things considered a usage is progressively costly. Straightforward IP calling usefulness utilizing VoIP telephones which transport information over the association's information organize is an element which most associations want. Other than essential IP calling usefulness, associations typically ask the board programming to most likely control and arrange their very own VoIP system to a certain degree. An advanced phone directory is likewise a regularly asked for highlight among the associations. The VoIP highlights that are introduced in associations can have an impact in the center business of the association in which it is utilized. The dimension of progress acquired by the center procedures is firmly subject to the individual conditions of the host association. Factors, for example, the showcase segment of the association, the executive's culture, mechanical and spending imperatives all have an impact on which VoIP highlights are actualized and how they are utilized. From a general point of view, it very well may be said that VoIP helps making a few procedures progressively productive while requiring less monetary assets. The interviewee makes reference to that the way VoIP impacts the center business of associations varies.

B: VOIP Improvements and boundaries

Frequently associations experience issues with precisely evaluating the additional advantage of extra VoIP usefulness. Associations do understand that VoIP is something other than a type of "computerized communication" yet extra usefulness is yet seen as being all the more an innovative embellishment rather than a device for advancing procedures. The interviewee makes reference to this is an attitude issue that is as yet present today, yet it is right now vanishing as more research led in the field of VoIP and correspondence frameworks. Another obstruction that appears to keep associations from actualizing extra VoIP highlights is the likelihood for similarity issues with current equipment/programming that is utilized inside the associations. To a lesser degree costs appear to frustrate associations from utilizing new VoIP highlights. Subsequent to completing an extensive execution direction and putting a lot of assets in a VoIP framework, associations need to see some arrival on speculation and ordinarily like to hold up before making any changes (putting in new VoIP usefulness) to their correspondence framework.

Amid a usage venture one of the as often as possible happening issues is equipment as well as programming contradiction with the heritage frameworks. The likelihood for a contradiction issue to emerge over the span of a VoIP usage is high as not all associations have an up to date foundation for transporting information on their systems. Regularly associations use certain programming that is pivotal for their day by day business forms that can make issues when VoIP information is likewise transported over similar information organize. Because of information serious procedures or an obsolete organize framework, QoS issues with VoIP can happen that postpone the execution venture what's more, bring about extra expenses. As per the interviewee, a couple of years back there were more issues concerning VoIP frameworks as bizarre irregularities happened after usage was performed.

A large portion of these issues have been settled with advances in VoIP innovation, yet some still happen once in a while. As far as general enhancements that could be made to VoIP frameworks, it is difficult to measure the general needs of all associations as their operational prerequisites contrast significantly. A usage of a Unified Communications arrangement is considered by numerous associations to be a conceivable subsequent stage for VoIP usefulness. Despite the fact that relatively few associations have really executed it, many are thinking about utilizing it later on and are effectively observing the improvement of the Unified Communications usefulness.

C: Advantages and benefits

Most associations see a specific dimension of upper hand when contrasted with opponent associations who have not actualized a VoIP framework. VoIP must not be viewed as an apparatus for programmed immediate advantages. Associations which gain the most out of a VoIP framework have generally done intensive research and testing before usage and consider VoIP to be a long-term key venture as opposed to a momentary fix. The interviewee referenced that the main purpose behind associations to relocate towards VoIP is cost-funds while included usefulness and adaptability fall into second and third place.

4.3.3 Interpretation of data: Conclusion

Advances in correspondence innovation can have wide going impact on the way in which organization lead their business. In all likelihood correspondence innovation will radically change some business forms, different procedures will vanish totally, and some may scarcely be influenced. The particular market segment associations work in will decide to a certain degree what dimension of progress the business procedures will cause because of advances in communication innovation. When glancing back at the presence of the Internet, one can say that new correspondence innovations can make whole new markets for associations to ace. These new markets are characterized by recently created correspondence innovation which thusly impacts the center business procedures of the associations working in these business sectors.

CHAPTER 5
SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

This proposed planned to find the effect of VoIP on the core business of the MUN in the Kingdom of Bahrain. An accentuation was put on investigating the likelihood for associations to obtain an aggressive advantage by utilizing VoIP. A subjective research approach was utilized for leading the investigate which included performing inside and out meetings at several organizations. For examining the exact information, a subjective substance investigation was performed. This included the formation of a classification framework of section the information into vital parts to answer the exploration questions.

This research is unique because there are not many researches done in an actual governmental entity with all the features deployed and the researcher is involved in the same entity. MUN is the best case study to perform a research on because it is one of largest entities in Bahrain and consumes a huge amount of the Kingdom budget to give services to all citizens of Bahrain. So it is very important to choose the best technology that suits such services and operations. It is very important also to control the operation cost and enhance the services and be able manage such huge entity. Many challenges were faced to conduct this research such as interviewing management staff and getting access and approval to share the design and financial study to know the effect of deploying the new technology.

From the literature review chapter and other literature revised before, it showed that the cost reduction is for sure and on the long term the operation cost will decrease as mentioned by Intel. It is also shown in the same chapter that the financial management will increase, and it will be easy to calculate operation cost and control the technology. This is shown also after the interviews made and the questioners enclosed with the research. The Interviews and questioners are performed and done through different levels of the ministry positions (Head of IT support, Financial staff, Network support, end user and Management position provider). This shows that the outcome of this research is driven through different levels of an association and can be used in future by any entity want to have an overview regarding this technology deployment from a financial and management point of view to be able to take a successful decision (Wall Street Journal, 2005).

Regarding usefulness and proficiency, VoIP is a better stage when looked at than conventional telephone frameworks. More seasoned frameworks have separate simple landlines that make a reconfiguration of the system (on account of reassigning telephone numbers to various areas) troublesome. VoIP is progressively adaptable and takes into account a reconfiguration of the system by utilizing particular programming, for example, Cisco call chief. The usefulness that a simple telephone framework has is likewise constrained when contrasted with VoIP. More seasoned frameworks give just essential usefulness. The new innovation gives more choices that representatives can use to make their assignment less demanding. Digitalized phone directories, remote phone arrangement and Unified Communications are a portion of the additional usefulness that VoIP presents. Other than the blurred usefulness, VoIP moreover gives proficiency gains in the help procedures of the associations that execute it. With a customary telephone framework costs are normally acquired each time a telephone call is made. Reconfiguration of the simple system likewise requires assets. VoIP does not require a different arrange to be executed. This spares the association the expense of building a separate system devoted to VoIP.

Moreover, VoIP furnishes associations with a more expense viable way to direct their interchanges by bringing down operational expenses and enabling access to increasingly worthwhile administration shrinks by suppliers. Almost certainly, a relationship exists between the dimension of impact that VoIP has on the center business procedures of an association and the market part it is working in. The primary changes brought about due to VoIP were centered around the help forms inside associations. For the most part the center business procedures of association were not influenced by the presentation of VoIP as long as there was no abnormal state of incorporation between the center business procedures and correspondence innovation. VoIP usefulness in associations was generally constrained to the essential capacities, for example:

- Basic IP calling usefulness

    Utilizing the IP technology connections with better functionalities to support communication.

- Management programming support for IP numbers

    Software to manage the VOIP system and generate management reports to visualize the financial and technical aspects.

- Call bunch structures

    The structure of the technology used in an organization (Mike Lytle ,September 2016).

Most of the associations from the exact information just executed the essential VoIP usefulness so as to enable their frameworks to work and to almost certainly oversee them. It could be estimated that the associations had as of late experienced costly usage ventures what's more, were not sufficiently inspired to buy extra updates for their VoIP framework. It was plausible that they initially needed to get an arrival on contribute from their frameworks previously choosing to actualize redesigns. Besides it was additionally the situation that the associations saw pretty much nothing included advantages by presenting new VoIP highlights. This observation debilitated associations from considering the usage of any extra VoIP usefulness. Regardless of this negative perspective, Unified Communications was viewed as an element that associations would likely actualize later on. As opposed to other VoIP highlights, Unified Communications was seen by numerous associations to improve their frameworks, advantage their help and perhaps their center business forms.

The issues that were experienced by associations due to VoIP were generally constrained as it were to the execution period of the correspondence framework. The primary deterrent experienced amid execution was the inconsistency among VoIP and the association's heritage frameworks. Most of the issues were settled after the VoIP framework achieved security. Following this, associations typically encountered a specific dimension of upper hand. The sum increased changed and was likely reliant on the degree of reconciliation between the center business procedures and VoIP innovation. The primary driver of upper hand gains in associations was because of cost reserve funds. Moreover, cost reserve funds were distinguished to be a critical purpose behind associations to relocate towards a VoIP framework. Before the associations from the exact information thought about gaining a VoIP framework, the dominant part initially played out a money saving advantage investigation to make an evaluation. The careful quality of such an investigation was viewed as sketchy as there had been cases where it was just performed externally. A couple of associations did not play out a money saving advantage examination at all. The purposes behind playing out a shallow examination or maintaining a strategic distance from it totally were credited to imperfect administration choices. Once in a while the board needed to compromise and quicken the basic leadership process by staying away from the money saving advantage examination or performing it as it were externally.

Associations referenced that new advancements in correspondence innovation have the potential to enormously influence the center business procedures of associations. A few associations are prone to see just a peripheral change because of new improvements while others will experience noteworthy changes to their

center business forms. It was suggested that the degree of the impact of these new improvements was reliant available division of an association.

A good point achieved by this research is the variety of using the technology by the interviewees and the mentioned staff who answered the questioner. Some of them had a good experience in using the technology for approx. 5 years and some had less than that. This supports the point that the research was performed on different levels of experience to cover all type of users. All the results were supporting and confirming the same results mentioned in the literature review and the data analysis chapter. Although based on the user requirements and the features deployed the value and outcome of the system will change.

5.2 RESEARCH LIMITATIONS AND RECOMMENDATION

This investigation has a few confinements that should be considered. First this examination does not look to research or make any supposition about the further developed specialized parts of the VoIP innovation, nor does it center around the general specialized parts of correspondence innovation. The inquire about uses an administrative methodology and is intended to give a knowledge into the likelihood for associations to secure an upper hand by utilizing VoIP innovation. So as to hold the degree and because of the time requirements of this examination just a generally modest number of associations were met. Future research could incorporate playing out an exploratory case consider so as to survey the relative included advantages for associations that present Unified Correspondences. Further quantitative examination could be directed by meeting a more extensive territory of associations that work in various areas of the economy (bigger information test) and concentrating more on the quantifiable upper hand picked up (or lost). This could then be utilized to make a thorough factual investigation on what the correct quantifiable gain in aggressive advantage is expected to VoIP.

5.2.1 RECOMMENDATION

a. Leverage successes of others, learning best practices from outside Middle East.

b. Leverage shared services and cloud-based IT, taking advantage of IT economies of scale.

c. Adapt the MUN workforce to the evolving needs of Kingdom government.

d. Apply enterprise architecture principles to drive digital transformation based on business needs.

e. Optimize IT investments via sound Project Management.

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