An-Najah National University

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Opportunities and Challenges of Open-source Initiatives in the Palestinian e-Government Program

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Declaration

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Opportunities and Challenges of Open-source Initiatives in the Palestinian e-Government Program

اقر بأن ما اشتملت عليه هذه الرسالة، إنما هي نتاج جهدي الخاص، باستثناء ما تمت الإشارة إليه حيثما ورد، وأن هذه الرسالة ككل، أو أي جزء منها لم يقدم من قبل لنيل أية درجة علمية أو بحث علمي أو بحثي لدى أية مؤسسة تعليمية أو بحثية أخرى.

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

Student's name: **اسم الطالب:**

Signature: **التوقيع:**

Date: **التاريخ:**

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Abbreviations

OSS	Open Source Software
FSF	Free software Foundation
OSI	Open Source Initiative
FOSS	Free and Open Source Solutions
TCO	Total Cost of Ownership
GCC	Government Computer Center
MTIT	Ministry of Telecommunications andInformation Technology

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Abstract

The purpose of this study was to discover the opportunities and challenges of OSS adoption in the Palestinian e-government program. In addition, this study was intended to access the feasibility of OSS adoption in the Palestinian e-government program. It is also intended to study and identify the expected impact of full OSS adoption in the Palestinian e-government program.

Inductive research approach was used to control this qualitative study. Structured interviews were the data collection tool used since the population size was small. A total of thirty interviews were made with the Palestinian e-government team members and the heads of IT departments at all Palestinian public sector agencies.

The results of the interviews revealed that there were neither financial nor technical problems in the internal IT infrastructure in the Palestinian public sector agencies that may hamper OSS adoption. Yet, there were some problems in the level of awareness of the objectives and benefits of OSS adoption, the required expertise, the level of higher governmental leadership, support and the cross-agency cooperation among the Palestinian public sector agencies.

The researcher had proposed some suggestions and recommendations to solve the previously mentioned problems that may hamper OSS adoption in the Palestinian public sector agencies and then in the e-government program.

If the Palestinian government decides to adopt OSS in the Palestinian public sector agencies and the e-government program, the process of change to OSS will be easier than expected. This can be attained if the Palestinian government takes the recommendations provided in this dissertation into account.

A strategic plan to adopt OSS in the Palestinian public sector agencies and then the e-government program must also be developed

Chapter 1

1. INTRODUCTION

1.1 Overview

The Palestinian National Authority seeks to push forward the information society in the Palestinian territories through the development of plans and future strategies and to take formal decisions necessary to implement these plans and projects (PCBS, 2007). There was a whole set of decisions approved by the Palestinian Council of Ministers in 2005 to support the plans and future strategies related to the Palestinian information society development. Two major decisions were: national strategy for information technology development, and e-Palestine project initialization.

National Strategy for Information Technology: The Palestinian Council of Ministers approved the National Strategy for Information Technology. This strategy represents the general guidelines that organize the Palestinian society's efforts toward developing the Palestinian information society. Proposals for a group of vital projects in the area of telecommunications and information technology had been developed to continuously be connected with all ministries and institutions of the Palestinian National Authority, and keep abreast of developments at the local, regional and international levels. This strategy was the product of a teamwork which included the public sector represented by a number of interested ministries, the private sector, civil society organizations and the Palestinian universities.

e- Palestine project: The Palestinian Council of Ministers approved the draft e-Palestine on May 2005 (PCBS, 2007). The Ministry of Telecommunications and Information Technology was ready to launch e-Palestine, and the project included the implementation of a deliberate and systematic plan. This plan needed 3 to 5 years to be fully implemented, at a cost of approximately $ 100 million in the area of communication and information technology (PCBS, 2007). This plan included the implementation of the six vital projects in the area of communication and information technology to continuously connect all ministries and institutions of the Palestinian National Authority, and keep abreast of technological development at the local, regional and international levels. One of the major projects included in this plan was the e-government project which seeks to provide information in electronic format, and determine the status of all ministries and institutions of the Palestinian government. The e-government project would facilitate citizens' transactions through PCs and the internet. The e-government project could cost approximately $ 300 thousand with the support of the program United Nations Development Program (PCBS, 2007). The expected start date of working on e-government project was July 2006 (PCBS, 2007). But, because of the unstable political situation in Palestine, the Palestinian government didn't accomplish much of the project (PCBS, 2007).

1.2 Problem Formulation

Leveraging open standards and open source is a major information and communication principles that have been referred to in the Palestinian e-government strategic plan (PNA, 2005). These principles weren't clear because they do not have sufficient explanation in the strategic plan. In addition, the Palestinian government did not develop any special strategic plan for applying these indicated principles.

The Palestinian government was in need of knowing the objectives and benefits of OSS adoption. It also needed to ensure that the IT infrastructure in the Palestinian public sector agencies supports OSS. The Palestinian government did nit check the availability of adequate OSS experts. So, it had to conduct a research for achieving this. In addition, the Palestinian government needed to enforce cross-agency cooperation among the public sector agencies. However, such an activity actually started April 2010.

Before deciding to adopt OSS, the Palestinian government measured the availability of adequate financial resources for OSS adoption.

The main problem was that all of the mentioned activities were not performed by the Palestinian government, and the decision of adopting OSS was not also made by it.

The researcher aims to help the Palestinian government by studying the OSS adoption in the Palestinian public sector agencies and the e-government program. He began by reviewing the literature and some case studies for countries that already adopted OSS. Then the researcher identified the main measures that will help in identifying the opportunities

and challenges of OSS adoption in the Palestinian public sector agencies and the e-government program. In addition, analyzing these measures will help him to assess the feasibility of OSS adoption in the Palestinian public sector agencies and the e-government program. Therefore, the researcher intended to perform the basic analysis that should be conducted before developing a strategic and action plans to adopt OSS.

1.3 Research Objectives

The researcher aimed to achieve the following two main objectives:

1. Assessing the feasibility of open source software adoption in Palestinian e-government program
2. Studying and identifying the expected impact of fully adopting open source software in the Palestinian e-government program

   To achieve the above objectives, the researcher subdivided them into more manageable sub-objectives. These include the following:

a) Assessing the level of interest in performing and developing e-government program and the level of support by the Palestinian government
b) Identifying the level of technical readiness to adopt OSS in the Palestinian government agencies and also in the Palestinian e-government program
c) Identifying the opportunities of adopting OSS in the Palestinian e-government program

d) Specifying the challenges of adopting OSS in the Palestinian e-government program and proposing some solutions
e) Measuring the level of government's awareness of the objectives and benefits of OSS adoption
f) Determining the level of administrative support from the Palestinian government to adopt OSS in the government agencies
g) Assessing the availability of the different resources (financial, professionals… etc) needed to adopt OSS in the public sector
h) Estimating the economic impact of OSS on Palestinian government agencies
i) Identifying the overall impact of OSS adoption on the Palestinian public sector agencies and the e-government program in Palestine

1.4 Research Questions

To achieve the mentioned main objectives the researcher proposed the following three major research questions:

1. Is open source feasible in the Palestinian e-government context?
2. What benefits can the Palestinian government gain from adopting open source in its e-government program?
3. What are the obstacles of OSS adoption in Palestine?

Providing answers for those questions helped the researcher to make conclusions and propose some recommendations that are beneficial for the Palestinian e-government program (Chapter 5).

1.5 Research Hypothesis

The researcher has made the following two hypotheses based on the data collected from the interviews held.

H1: The technical infrastructure in the Palestinian government agencies is well ready when the change to adopt OSS happens.

H2: There was neither enough support nor decisions made by the Palestinian government that encourages the Palestinian government agencies to adopt open source.

The researcher had used statistical analysis tools to test the validity of these two hypotheses. This will be detailed in chapter 4.

1.6 Research Challenges

The researcher had faced some challenges during the research progress, for example, studying the status quo of the Palestinian e-government was so uneasy. This was because of the continuous spin off of e-government teams during the last decade (Omar Al-Maslamani, 2011). This resulted in some official documents being neglected. In addition, the latest version of strategic and action plans are still in-progress (Omar Al-Maslamani, 2011). Some heads of IT departments in some government agencies in Palestine have no knowledge about the current strategies and policies and the latest events and plans for implementing e-government. But, all of these heads are always informed and invited to share workshops for this issue since beginning of 2010 .In addition, some heads of IT departments in some government agencies in Palestine did not cooperate with the researcher.

They declined to hold personal interviews with the researcher. Furthermore; there was a difficulty in getting the telephone numbers of some government agencies that were needed by the researcher to coordinate for interviews. This was due to outdated information on the websites of these government agencies, and because there was a lack of coordination among government agencies and call centers in Palestine like PalTel Group for updating their contact information. Another challenge included the difficulty in arranging meetings with interviewees working in most government agencies. Most of them claimed to be busy most of the time. Finally, interviewees responded with approximations to some questions due to the lack of available official documents they have. The OECD Document (Assessment study) covers some of the needed issues. For example, the percentage of the budget dedicated for software development and maintenance related to the overall budget annually, the percentage of annul budget for training related to the overall budget annually, and the number of projects that are shared between different ministries. These approximations, however, gave the researcher a reasonable feedback.

1.7 Research Importance

The importance of this study can be drawn based on the findings achieved. As we know, OSS adoption was promoted in the national strategy for the Palestinian e-government program and it had been mentioned as a major principle in the Palestinian e-government strategic plan (PNA, 2005).

However there was neither a strategic plan nor an action plan for implementing this part of the strategy.

This study can provide the Palestinian government with some perspectives that help to appreciate OSS adoption. It also can help the Palestinian e-government team members to develop action plans to change from proprietary software to OSS in the public sector agencies and also in the e-government program. In addition, this study was intended to explain the organizational benefits of OSS which can be summarized as: reliability, stability, better auditing, cost, flexibility and freedom, support and accountability…etc (GBdirect Ltd, 2011). All this mean more efficiency in the system (this will be discussed in details in chapter 4). Furthermore, this study aims to check whether the OSS adoption can make the Palestinian e-government program more efficient. This study can also help in identifying the possible impact of OSS adoption on public and private sectors and on the Palestinian economy at large. In addition, this study will add new input to the literature that may be beneficial for other researchers interested is this topic. The findings of this study may also be a good input for the Palestinian private sector institutions interested in OSS adoption. Finally, this study had also participated in evaluating the current and the future attitude toward OSS adoption in the Palestinian public sector agencies and the Palestinian e-government program.

1.8 Thesis Outline

The following table shows the structured outline of the thesis:

Table 1.1: Thesis Outline

Chapter Name	Description
Chapter one: Introduction	An Introduction to the research including problem statement, research objectives, research questions, the challenges faced the researcher during the research development progress, and finally the importance of this research
Chapter Two: Background and Literature Review	Provides background information on the topic of e-government, open source and open source in e-government, and examines literature about the topic
Chapter Three: Research Methodology	Describes the methodology used for data collection and analysis in order to achieve the research objectives
Chapter Four: Data analysis and Discussion	Describes the way the research was conducted, the data processing tasks, and finally discuss the findings.
Chapter Five: Conclusions and Recommendations	Presents the final conclusion of the research along with future recommendations for the government as well as the researchers in the same field

Chapter 2

2. BACKGROUND AND LITERATURE REVIEW

2.1 e-Government

While the focus and purpose of e-government globally remains the same, the implementation and successes of digital governance vary from country to country (Pour, 2005). A common sentiment of the implementation of e-government was voiced by D.M.West, who stated,

> ***"In general, we find that e-government has fallen short of its potential. Governments are not making full use of available technology, and there are problems in terms of access and democratic outreach*** *"(West, 2000).*

In the previous decade, the concept of e-government was typically seen as a new process with unlimited potential in the rapidly expanding global environment.

> ***"Electronic governance involves new styles of leadership, new ways of debating and deciding policy and investment, new ways of accessing education, new ways of listening to the citizens and new ways of organizing and delivering information and services"*** (Ferguson, 1999).

Now, just a few years later, the processes are no longer new and we find ourselves in the phase of refining and redeveloping the foundation upon which e-government first appeared: to improve the efficiency and effectiveness of government.

To learn more about the true potential of e-government, a re-evaluation of the processes is necessary for e-government to continue to be accepted in the mainstream and be a more efficient system of government with access by all. If the models that were first introduced continue to be improved, e-government in our knowledge society will be an open and transparent tool that provides a maximum of services with minimum of intrusion in the lives of the users.

Overall, while the basic goals of e-government have not shifted, the vision and responsiveness of the system have been forced to adapt globally in order to fulfill the public's needs. Instead of a broad-based program to seamlessly interweave government workings with information technology, nations around the world now are struggling to implement internet access, e-government interests and most importantly, safe and effective programs that serve society more efficiently.

2.1.1 e-Government Definitions

e-Government can be defined as a generic term that refers to any government functions or processes that are carried out in digital form over the Internet **(**Maureen Brown, 2003**).** Local, state and federal governments essentially set up central portals from which the public (both private citizens and businesses) can find public information, download government forms, contact government representatives, and perform some transactions.

The term e-government has so many different definitions the following are some of them:

1. The OECD (Organization for Economic Co-Operation and Development) states that

   "the term e-government focuses on the use of new information and communication technologies (ICTs) by government as applied to the full range of government functions".

   In particular the networking potential offered by the internet and related technologies has the potential to transform the structures and operations of government (Puma, 2001).

2. According to the World Bank

   "e-Government refers to the use by government agencies of information technologies (such as Wide Area Networks, the Internet, and Mobile Computing) that have the ability to transform relations with citizens, businesses, and other arms of government" (World Bank, 2011).

2.1.2 e-Government Goals

The Working Group on e-Government in the Developing World has identified five broad categories of goals commonly pursued for e-government.

The goals are not listed in any particular order of importance, as each country must determine its priorities in e-government.

e-Government goals are listed as below (Pascual, 2003):

1. Creating a better business environment

2. Customers online, not in line
3. Strengthening good governance and broadening public participation
4. Improving the productivity and efficiency of government agencies
5. Improving the quality of life for disadvantaged communities

Let us discuss each goal separately:

1. Creating a better business environment: Technology is a tool used for increasing productivity and economic growth, especially in developing countries. The ICT usage in government and building an e-government infrastructure can help in business-friendly environment creation by streamlining the interaction and improving the interface and direct connection between government and business, by eliminating redundancies in procedures and emphasizing and enforcing immediate and efficient delivery of services, e-government creates the conditions that attract investors/ investment

2. Customers online, not in line: This refers to the effective delivery of public goods and services to citizens accompanied by quick response government with minimal direct intervention by a public official, and that means more efficient processes that make the life easy for customers and save their efforts and time in their transactions and that will increase the satisfaction of citizens

3. Strengthening good governance and broadening public participation: Promoting transparency and accountability in government through the prevalence of ICT in management and operations makes it possible for

citizens to be more actively involved in the policy- and decision-making processes of government.

As a major tool in building a tradition of transparency and good governance, e-government can advance the fight against corruption. However, e-government by itself will not put an end to corruption. It must be accompanied by other tools to be fully effective.

At the same time, e-government facilitates the swift delivery of complete information. The broad dissemination of information helps empower citizens and facilitate decision-making. The transparency of information does not only lead to democracy but also creates and enforces a sense of accountability among government leaders and that leads to effective governance

4. Improving the productivity and efficiency of government agencies: Reengineering processes and procedures (processes and procedures reform) will help to facilitate delivery of services, increase productivity of the bureaucracy, and increase savings which are benefits inherent in e-government. More specifically, e-government can help to:

- Increase government staff productivity, reduce overhead from fewer offices and less paper management, improve capacity for planning management by government (using better tools and improving access to critical information, for example, in a city planning through the use of GIS), and increase revenue as businesses and citizens actually apply for more licenses

- Induce cost savings in the medium to the long term. In the short term, however, staffing and costs tend to increase as government must offer multiple delivery platforms (both the traditional and e-government) during the initial transition
- Simplify the operations of government. Most government processes have evolved over many years, and usually involve many steps, tasks, and activities. Simplifying government processes through ICT eliminates redundant procedures and makes the life easy for government

5. Improving the quality of life for disadvantaged communities:

The quality of life of disadvantaged or marginalized communities can be improved by the usage of ICT that can reach to such communities; this improvement can be easily achieved by empowering these marginalized groups through their participation in the political process, as well as delivering the much-needed public goods and services.

> ***"Ultimately, the goal of e-government is to enhance the interaction between three main actors in society government, citizens and business, in order to stimulate political, social and economic progress in the country"*** (Pascual, 2003).

2.1.3 e-Government Models

e-Government models are important guide for governments to start implementing e-government programs. These models save governments a

lot of efforts, costs, failures and frustrations (Rabaia, 2009). We can find already developed e-government model suitable for any step performed in the e-government development progress.

Five delivery models according to the specific target groups have been developed (Rabaia, 2009, Pascual, 2003):

- Government-to-Citizen (G2C): G2C are those activities in which the government provides on-line access to information and services to citizens (Shailendra, Sharma, 2007). G2C applications enable citizens to receive answers from government agencies, ordering of birth/death/marriage certificates and filing of income taxes, as well as citizen assistance for such basic services as education health care, hospital information, libraries, renewal of driving licenses, payments of traffic tickets, change of address, and reserving appointments for vehicle inspections and driving tests (Shailendra, Sharma, 2007; Pascual, 2003) . In addition, government may publish information on the web, provide downloadable forms online, conduct training, help citizens to find jobs, provide citizens with tourism and recreation information, provide advice about health and safety issues, and the list goes on (Shailendra, Sharma, 2007). The purpose behind this model is to provide citizens with high quality online services (Rabaia, 2009).
- Government-to-Business (G2B): In G2B, the government deals with businesses such as suppliers using the internet and other Information and Communication Technologies (ICTs) (Shailendra, Sharma,

2007). Business services offered include obtaining current business information, downloading application forms, renewing licenses, registering businesses, obtaining permits, and payment of taxes (Pascual, 2003). There are two key G2B areas: e-procurement and auctioning of government surpluses (Shailendra, Sharma, 2007). Typically, e-procurement Web sites allow qualified and registered users to look for buyers or sellers of goods and services. Depending on the approach, buyers or sellers may specify prices or invite bids (Pascual, 2003). e-Procurement makes the bidding process transparent and enables smaller businesses to bid for big government procurement projects (Pascual, 2003).

> "***In this model, we seek to reduce the administrative burden related to the different interactions of businesses with the government*** **"**(Rabaia, 2009).

- Government-to-Government (G2G): Activities and transactions that take place at two levels: at the local or domestic level and at the international level (Shailendra, Sharma, 2007; Pascual, 2003). Many of these activities are aimed at improving the efficiency and effectiveness of overall government operations (Shailendra, Sharma, 2007). In addition, government optimizes its services responsiveness, and usability according to this model (Rabaia, 2009). G2G services are transactions between the central/national and local governments, and between department-level and attached agencies and offices

(Pascual, 2007). So, it is the online non-commercial interaction between government entities with other government entities

- Government-to-NGOs (G2N): NGOs help the government in implementing public projects even e-government projects (like Palestine). e-Government should ensure efficiency and better access to information during interaction with this supporter, in order to coordinate efforts better, and make it easy to achieve their project objectives (Rabaia, 2009).
- Government-to-Employee (G2E): the G2E services are like G2C services but the difference here is that these services cover only the government employees.

> "***Such as the provision of human resource training and development that improve the bureaucracy's day-to-day functions and dealings with citizens***" (Pascual, 2003).

Government employees always need an optimization of information delivery in order to do their jobs better. If the information is gathered automatically, that can reduce the burden on government employees and also can reduce their faults (Rabaia, 2009).

2.1.4 e-Government Benefits

e-Government may provide better service to citizens and businesses (Commonwealth of Massachusetts, 2011). In addition, the e-government makes it easy for citizens to interact directly with government. This can help citizens to conduct their affairs with government and to simply

retrieve important information they need (Commonwealth of Massachusetts, 2011). Beneficiaries of e-government include governments, citizens and businesses (Rabaia, 2009; Commonwealth of Massachusetts, 2011).

Key benefits of e-Government for governments include huge savings in cost, better governance and internal efficiency (Rabaia, 2009).

Huge savings in cost can be gained through sharing the core and support infrastructure and common processes which will decrease the costs, service externalization that means outsourcing some non-critical functions to a third party which could save government some efforts and costs, cheaper distribution channels, quality improvement of federal government agency administration, reduction in printed publications cost, less double handling, and reduction in working staff (Rabaia, 2009).

Better governance can be gained by better control of corruption, easier auditing, and better allocation of resources (Rabaia, 2009).

e-Government improves productivity and increase organizational performance. e-Government helps in time savings for administrative processes(Rabaia, 2009). It also speeds up processes by avoiding media/data inconsistency (Rabaia, 2009). Furthermore, it saves working time using a uniform document format (Rabaia, 2009). In addition, e-government can provide the governments with up-to-date information. e Government offers enhanced response to emergencies: through networked /connected government and simplifying government operations (Rabaia, 2009; Digital 4Sight, 2001). Finally, e-government can help in gather

information automatically (Rabaia, 2009; Digital 4Sight, 2001). All of these issues can lead us to conclude that the e-government is going to improve the internal efficiency of any government.

Key benefits of e-Government for citizens include convenience, improved quality of customer service, higher quality information, simplicity, cost reduction, higher efficiency, and empowerment (United Nations, 2005; Rabaia, 2009; Commonwealth of Massachusetts, 2011).

Finally, the key benefits of e-Government for businesses include cost reduction, efficiency and empowerment (Rabaia, 2009).

2.1.5 e-Government Challenges

e-Government still faces many challenges as it continues to develop.

In designing and implementing e-government sites, a government must consider elements of policy, including regulatory issues, economic issues, and the rights of users (Borins, 2002).

One U.S. General Accounting Office report specifically listed the challenges to implementing e-government as

> " ***(1) sustaining committed executive leadership, (2) building effective e-government business cases, (3) maintaining a citizen focus, (4) protecting personal privacy, (5) implementing appropriate security controls, (6) maintaining electronic records, (7) maintaining a robust technical infrastructure, (8) addressing IT human capital concerns, and***

> ***(9) ensuring uniform service to the public***" (General Accounting Office, 2001).

One of the mentioned challenges above is protecting personal privacy;

> "***many people have concerns over trust and privacy issues (e-voting, e-health…etc). This is a real issue in unstable countries where citizens might be discouraged to use e-government applications for the lack of trust in their government. The fear is that their government might later punish them for their opinions***" (Rabaia, 2009).

Another important challenge was maintaining a robust technical infrastructure. So, sharing common core technical platforms and centralizing many business functions would surely save the government a lot of costs (Rabaia, 2009). In addition, the government faces a challenge in implementing appropriate security controls as mentioned before. Institutions also devised modern tools for security (Rabaia, 2009).

Other researchers have noted additional broad challenges, such as defining the parameters of e-government (Aldrich, Bertot, McClure, 2002) and making e-government function so that it does not conflict with other laws (Jaeger, 2002). There are a lot of other issues that can be considered as challenges of e-government; one issue might be that some employees might not complete their jobs well and blame computers for the failures. Since those employees might claim that all mistakes and lack of efficiencies resulted from computers or systems (Rabaia, 2009).

Not all people can afford owning a computer at home. Besides, internet subscription fees are still high especially in developing countries (Rabaia, 2009). So, not all people have the ability and skills for conducting online services. Special hardware and software should be brought to involve disabled people. That added additional cost for e-government project. Another obstacle toward full e-government implementation is that enabling full online services required people to have any form of digital payment systems (Rabaia, 2009).

In order to have a well e-government implementation in any country; there is a challenge to develop an accessible and usable design for the government portal. If citizens find government portals difficult to use then, not all citizens will utilize the e-services (Rabaia, 2009). Besides, people need to be trained on how to use and fill in web forms and to learn using basic technologies. This requires a lot of resources and many efforts with no guarantee for success (Rabaia, 2009).

There is a new big challenge for any government trying to adopt e-government; this is because there is a different tendency toward using the internet among different layers of people. For example

> ***"younger people tend to use the internet more than older people. Rich people have higher rates than poorer people. Educated people are more likely to be able to use the modern tools than illiterate and low educated people "***(Rabaia, 2009).

2.2 Open Source Software

2.2.1 Introduction and definition

> ***"Open Source Software (OSS) is a model of computer software development where the source code is available for programmers to view, read, modify and redistribute without the property right restrictions of proprietary software"*** (Waringa, Maddocksb,2005).

When you hear 'Open Source', do not think of license. Think of the development methodology, and think of source code that is widely available. Source code that can be both viewed and changed by just about anyone who wants to bother. That is the essence of open source (GISDevelopment.net).

This model allows constant innovation by those who may be geographically widely distributed. The resulting Open Source programs may be available free of charge, although depending on licensing arrangements this does not always hold true. One of the best known early organizations that worked to promote the open source is Free Software Foundation (Danish board of technology, 2002)

Open source does not just mean access to the source code. The distribution terms of open source software must comply with the following criteria (OSI, 2010):

1. Redistribution is free:

The license should not be restricted by any party. So, any program developed using OSS has no financial restrictions for selling or reselling after performing modifications

2. Source code is free and modifiable:

The source code is available for all developers. They have full right to review and modify the source code of any program developed using OSS

3. Integrity of the author's source code:

Any software built from modified source code must require derived works to carry a different name or version number from the original software. The license must explicitly permit distribution of such software

4. There must be no discrimination against persons or groups:

The source code must be available for all developers and groups at the same level without any discrimination against persons or groups of developers

5. There must be no discrimination against fields of endeavor:

The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for different types of researches

6. Distribution of license:

> The program and all of its inherited programs have the same license. So, the rights must be applied to all to whom the program is redistributed without the need for execution of an additional license by those parties.

We can say that the open source is an approach to the design, development, and distribution of software, offering practical accessibility to the software's source code. Some consider open source as one of various possible design approaches, while others consider it a critical strategic element of their operations. Before open source became widely adopted, developers and producers used a variety of phrases to describe the concept. The term open source gained popularity with the rise of the internet, which provided access to diverse production models, communication paths, and interactive communities (Waringa, Maddocksb, 2005).

The internet was developed in open source environments. Some popular world-class open source projects are Linux, Apache, MySQL, PHP, and Ruby (OSI, 2010). However, OSS has only found its way into the public field within the past decade due to some major projects gaining significant market share from commercial developers such as Microsoft (Waringa, Maddocksb, 2005).

There are claims that open source is more secure than its proprietary alternatives. Certainly security holes have been found in proprietary software. Certainly also, holes have been found in open source code (Glass 2002). And both sides have made strong claims that their software is either secured, or that they are making it as should. Probably the most accurate

thing anyone can say about software security is that (1) it is all too easy for programmers to leave holes, independent of how the code is being written (Glass, 2003); (2) the perversity of crackers tends to mean that wherever they seek security holes, they are likely to find them, and they tend to seek wherever the loudest claims are that the software is secure. (Honeypot Project, 2002).

2.2.2 Advantages of Open Source Software

Today OSS has become critical for almost every organization and government. Most systems running on the organizations and the governments among the world require adopting OSS because of the benefits they gain from this adoption.

Open source software can have a major impact on your entire organization. There are several advantages of using OSS. The following are the main advantages of OSS:

1. Financial savings: Many OSS applications can be obtained at no cost or at a very low cost. This is often an important issue for individuals and in many cases this has been the main reason for an individual adopting a particular open source solution over a closed source alternative (Redpill Linpro, 2011). Since Linux and other open source solutions are easily portable and optimized, it takes lesser hardware power to carry out the same tasks when compared to the hardware power it takes on servers, such as, Solaris, Windows or workstations. With this less hardware power advantage, the

governments can even use cheaper or older hardware and still get the desired results (outsource2india, 2011; Williams, Clegg, Dulaney, 2005). However, other costs may arise: training, consulting, maintenance, etc. As a result, the TCO may not differ between a closed source solution and an open source alternative for institutions. However, in some markets the difference in price between a closed source solution and an open source solution can be significant (Redpill Linpro, 2011).

> ***"From a business perspective the purchase cost of software is only one factor; total cost of ownership (TCO) is what really matters. Other things being equal, the solution with lowest TCO is usually the most desirable one. Arguments in favor of low TCO for open source software include "*** (GBdirect Ltd, 2011):
>
> - Possibly zero purchase price
> - Potentially no need to account for copies in use, reducing administrative overhead
> - reduced need for regular upgrades (giving lower upgrade fees, lower management costs)
> - reduced need for expensive systems administrators

2. Reliability: Reliability can be taken to mean the absence of faults which cause incorrect operation, data loss or sudden failures or what many people would mean when they use the term bug (Gbdirect, 2011**)**. Determining what constitutes a bug is usually by agreement

amongst the developers and users of the software. Obvious failure to perform is easily recognized as a bug, as is failure to conform to appropriate published standards. Security related failings (exploits or vulnerabilities) are clearly bugs too. Each of these kinds of bugs is usually addressed with speedy fixes wherever possible and the open source proponents will claim very rapid time-to-fix characteristics for software. Severe defects tend to be fixed within hours of their being detected; a process which is undoubtedly assisted by the availability of the source code. Developers who discover a bug will commonly also fix it and then report it to the maintainers as well as issuing an updated version of the software on their own authority. Users of the software can choose whether to use the unofficial fix or wait for an official version. The pattern with closed-source software is typically that a defect report needs to be filed and then there will be a delay before the vendor determines when or whether to issue an updated release. Users of the software are much more at the mercy of the vendor's internal processes than with the open source arrangement and the personal experience of the developers is that it can be extremely frustrating to move from the open source to the closed model. It is also important to note that with open source solutions there is

> ***" near-zero vulnerability to viruses eliminating need for virus checking, data loss and downtime. Lower vulnerability to security breaches and hack attacks***

reducing systems administration load claimed ability to prolong life of older hardware while retaining performance" (GBdirect Ltd, 2011)

3. Stability: In a business environment there are special methodologies and tools for doing jobs and performing tasks. If changes occur on jobs or more efficient processes are discovered. This will increase the pressure and the need to alter the current software used for performing these tasks. This formulates a big challenge for software vendors because they are forced to provide a product that suits the needs of their customers without continuous fluctuations. Software vendors are always looking for stable revenues in order to maintain their business whereas the customers have no desire to change or upgrade any product that is working well enough to suit their needs. If the software suppliers have to force upgrades onto its audience, then the profits can be very high. Software vendors can apply a number of tactics to persuade their customers to upgrade willingly. This can produce pressures on the customers where the users do not have control over software application processes. So, the users will remain isolated if they decided to continue with the older versions that are considered acceptable. This has cost and control implications for the business. OSS adoption mitigates the worst effects of vendor-push. In the real world, no business is static and the software changes to meet new business requirements. A choice to use OSS can provide a counter to the pressures to upgrade for the vendor's commercial

purposes but cannot protect every user from any change. Having access to the source code can allow a business to choose to support itself on an old version where necessary. In addition, we also believe that in general it gives more options and choice to the users. Nonetheless, some upgrading and maintenance effort will always be needed (GBdirect , 2011).

4. Support and accountability: OSS support is mostly freely available and can be easily accessed through online communities. There are also many software companies that provide free online help and also varied levels of paid support. Most organizations that create OSS solutions also provide maintenance and support (outsource2india, 2011; Williams, Clegg, Dulaney, 2005).
5. High-quality software: Evidences and research indicated that OSS is a good stuff. The peer review process and community standards, plus the fact that source code is available for the world to see, tend to drive excellence in design and efficiency in coding (Williams, Clegg, Dulaney, 2005). OSS is mostly high-quality software. OSS is mostly well-designed. OSS can also be efficiently used in coding. These reasons make OSS an ideal choice for organizations (outsource2india, 2011). In addition, as stated before; OSS is available publicly. So that, large amount of developers globally contribute and analyze the code making it more secure and constantly increasing the quality (Cynapse India Pvt, 2011).
6. No vendor lock-in: Organizations are said to be locked-in to software

products when the costs of switching to alternatives are prohibitively high. Proprietary software vendors can lock users in to their products by ensuring that they are not readily compatible with potential rivals. Vendors may then increase the price of product upgrades or support without too great risk of losing existing customers (OSS Watch, 2011). IT managers in organizations face constant frustration when dealing with vendor lock-ins. Lack of portability, expensive license fees and inability to customize software are some of the other disadvantages. Using OSS gives you more freedom and you can effectively address all these disadvantages (Williams, Clegg, Dulaney, 2005; outsource2india, 2011). The very critical basis of OSS is an openness that ensures interaction between products and makes it impossible for one player to lock customers to their products by concealing the source code (Redpill Linpro, 2011).

7. Integrated management: specific open source technologies such as CIM (Common Information Model) and WBEM (Web Based Enterprise Management) provide the capability to integrate or consolidate server, service, application, and workstation management for powerful administration. This integration would result in efficient administration (Williams, Clegg, Dulaney, 2005; outsource2india, 2011).
8. Simple license management: When you use OSS, you would no longer need to worry about licenses. OSS enables you to install it several times and also use it from any location. You will be free from

monitoring, tracking or counting license compliance (outsource2india, 2011; Williams, Clegg, Dulaney, 2005; outsource2india, 2011).

9. Rapid debugging: rapid further development: Because the source code is open, the developer/producer does not just receive feedback on any errors or problems, or proposals for new functions, but feedback reports that can include what should be done to solve the problem or to fix the bug. It is therefore far simpler for the producer to implement changes on the basis of feedback reports since these often say precisely what program changes must be made and also any errors in the original source code may be corrected by the person who detects the error without having to wait for the original programmer (Redpill Linpro, 2011). When a bug is spotted in proprietary software, the only people who can fix it are the original developers, as only they have access to the source code. Open source software is different. As a large number of users can access and change the code, bugs tend to be more visible and more rapidly corrected (OSS Watch, 2011).
10. Greater Security: OSS is available publicly. Linux is inherently a multi-user system and has many built-in safeguards to manage user security (Varian, Shapiro, 2003). A large amount of developers globally contribute and analyze the code making it more secure and constantly increasing the quality (Cynapse India Pvt, 2011; Varian, Shapiro, 2003). In addition, having access to the source code allows

the user of that software to choose the approach of security that they want. In other words, it allows the user/developer to take ownership of his/her security approach. It also enables certain approaches that are not available with closed source and it is possible to decide on his/her security priorities and to allocate resources accordingly (OSS Watch, 2011). Given the number of programmers who can access and edit open source code, compared with the few that are entitled to access closed source code, it should not come as a surprise that flaws in OSS tend to be fixed more rapidly, before serious damage can be done (OSS Watch, 2011). So, a lot of open source proponents claimed that the OSS had greater security compared with closed proprietary software.

11. Customizability: Closed source applications can only be customized or adapted within the scope provided by the original vendor but never outside its boundaries. OSS applications may be customized by anyone with the requisite skill. Thus, OSS can be readily adapted to meet specific user needs. Even if you cannot program yourself, if you would like something added or customized you can generally pay an appropriately skilled software developer to do it for you (OSS Watch, 2011).
12. Support from major companies: In the past many businesses have been reluctant to invest in OSS because of the lack of support and training available (Varian, Shapiro, 2003). Now this has been changed as major IT companies begin to support OSS (Butcher,

2003). IT suppliers such as IBM, Hewlett-Packard and Oracle have pledged to support Linux and are providing this support through Red Hat and SuSE (Anon, 2003). This approach benefits the suppliers whose business models now include revenue from supporting OSS, and also benefits the users who are reassured that support will be available.

13. Usability: Microsoft has invested heavily in applications usability in recent years and many usability experts have praised Microsoft XP as a significant advance over previous systems. Unlike Windows, Linux allows the user to customize the user environment. So, different users can use different environments. It is possible to configure standard Linux operating environments to look and operate a lot like Windows, making it relatively easy for users to migrate from one system to another (Varian, Shapiro, 2003).

2.2.3 The User's Rights according to Open Source Licenses:

Open source licenses give the user (Danish board of technology, 2002):

1- Access to the source text: Access to the source text means that the code can be accessed and reviewed by some experts who are independent of the supplier

2- The right to use the software: The right of use means that the software can be used for different purposes without any limitations (i.e. for commercial, military or other purposes). The right to use also

means that open source programs may be used together with traditional, proprietary software

3- Software modification right: The modification right gives the user of the software the right to customize and debug the software according to the organizational needs. The right to modify is linked to access to the source text. The right to modify can be conducted internally by IT staff

4- Software distribution right: The right to distribute means that the user has the right to create several copies of the software and to distribute them, both internally in the organization and to other organizations. Here it is important to note that The Free Software Foundation developed what is known as the GNU license.

> ***"The GNU license requires that modified versions of the original software are also made available to other users under open source license term"*** (Danish board of technology, 2002)

2.2.4 License Choice

There are over 80 free and open source licenses that have been approved by the FSF, the OSI, or both. Those licenses can be broadly grouped into permissive or reciprocal licenses (The 451 Group, 2008).

- Permissive Licenses (The 451 Group, 2008):

As the name declares, permissive licenses make it possible for redistribution under a small set of rules. The software can be

modified or redistributed under any license, including proprietary licenses. The author claims copyright only for the purpose of disclaiming warranty. Permissive licenses provide third-party vendors and enterprise users with the most flexibility in terms of how the software is used, and don't require them to contribute code back to the original developer or the wider community. They are therefore more likely to be used by vendors that want to create proprietary products from open source code or embed open source code within a larger proprietary package. Examples of permissive licenses include BSD licenses, the Apache License (previously known as the Apache Software License), the Mozilla Public License and the Eclipse Public License.

- Reciprocal Licenses (The 451 Group, 2008):

Reciprocal licenses ensure that all published modifications are available under the same license, meaning that rivals can compete via the provision of support services but are not legally able to turn the code into proprietary products. In fact, if a vendor owns the copyright for the project, reciprocal licenses enable that vendor and only that vendor to also license the code under a commercial license, expanding revenue opportunities. Examples of reciprocal licenses include the GNU General Public License and the GNU Lesser General Public License.

2.2.5 Drivers of Open Source Software Adoption

Following are a few of the drivers behind a more widespread adoption of open source software (ITAA, 2004):

1. The advent of the internet: The emergence and availability of the modern internet served as a mechanism for the growth in open source development communities that are necessary for successful development and continued improvements in the programs
2. Software license cost: The license cost is a major driver for OSS adoption since there is a perception that OSS products cost less than products developed by companies following a closed source software development model
3. Flexibility: OSS supporters frequently argue that because the source code is viewable to all, the underlying technology can be used in many innovative ways, offering a flexible platform to meet present and future software needs
4. Global innovation: Since the source code is opened and viewable. More and more developers able to view the source code, so, the innovation became greater as the barriers to software modification are lower
5. Security: Security is a major driver for open source adoption. Source code free availability could promote more robust and secure software because a wider group of people may inspect and test the software for bugs

6. Customer involvement: OSS supporters suggest that open source development models may provide more opportunities for customer-driven innovation than the traditional proprietary approach
7. Transparency: OSS is available along with its source code which can be studied and modified. This can ensure the security of the software as its processes can be examined and reviewed in detail. It also allows appropriate stakeholders to understand and monitor the functioning of government processes that are implemented precisely in the software like voting systems for example (Ghosh, Glott, Boujraf, Schmitz, 2010).

2.2.6 Open Source Motivation

One of the most challenging aspects of the OSS movement is that economists have difficulty in explaining there is a motivation for people to contribute to an open source project without financial remuneration. It appears to be against economical logic and has been the subject of many research studies (Ljungberg, 2000; Lerner & Tirole, 2002; Raymond, 2001). One suggested reason for this paradox is the existence of altruism whereby programmers within the open source software communities believe they are supporting their community by laboring in this way (Kogut , Metiu, 2001; Lakhani , von Hippel, 2003; Lerner , Tirole, 2001). Other researchers are not so sure that altruism on its own explains the actions of so many disparate and geographically diverse programmers. Bonaccorsi and Rossi suggested that altruism may explain the actions of open source

software programmers who become involved in projects in their free time, but by itself altruism is not enough to explain the actions of people who devote considerable time and intellect to projects (Bonaccorsi, Rossi, 2003). Dasgupta and David have linked open source software development to the scientific/academic system of research and discovery, and closed-source software to technological innovation (Dasgupta, David, 1994). This technological model would indicate that traditional rewards for innovation as maximization of profits by securing program intellectual property rights. Therefore, maximum profits come from suppression of knowledge or know-how. However, even this model is not that simple.

2.2.7 Open Standards

Open source software preferentially uses open standards. These standards concerned are definitions of file formats, layout, protocols etc. The standards typically define interfaces between the software and its surroundings, for instance standards for how the software transfers data to and from files on the computer, or in exchange with the programs of other computers via the internet (Danish Board of Technology, 2002). There is no specific definition of open standards, and so we don't always mean the same thing when we talk about them (Rosen, 2004). Open standards can be defined as publicly available technical specifications, without individual vendor restrictions on access, that are developed or affirmed in a collaborative or consensus based process (ITAA, 2004). An open standard is understood fundamentally as being a published definition. HTML and

TCP are examples of open standards. In a broader sense, the term open standard contains some other requirements, including that a standard is developed in a consensus process, which is not dominated by a particular supplier, and that the standard is not merely public in principle but is available free of charge or cheaply (OSI, 2010). Open standards are not the same as OSS. There is no requirement that open standards must be implemented by OSS. Open standards (technical specifications) may be implemented by all types of software (ITAA, 2004).

Lawrence Rosen proposed the following principles of open standards (Rosen, 2004):

1. Everyone should be free to implement open standards in both proprietary and open source software
2. Open standards should be available to everyone on royalty-free terms
3. Open standards should be developed using a collaborative, balanced, and consensus-based approval process
4. Open standards should be developed under formal and binding commitments for the disclosure and licensing of copyrights and patent claims
5. Open standards should be made available under reasonable reciprocal licenses that require licensees to share under the same terms their own patent claims reading on the standard
6. The specifications for open standards should be available to everyone on open source copyright license terms

2.3 Open Source in e-Government

The emergence of OSS, with the promise of relative longevity compared to proprietary software, could be seen to present an opportunity for the public sector to shift away from the short-terms of management thinking and plan strategically for future requirements (Waringa, Maddocksb, 2005).

A change over to e-government will necessitate huge investments in IT over the next few years. It is therefore natural that a close assessment is made in connection with these investments of the forms of information technology it is intended will be applied, and who controls the development and ownership of the fundamental technologies in e-government (Waringa, Maddocksb, 2005). This increases interest in the opportunities opened up by OSS, and makes the question of the potential for the use of OSS in e-government economically advantageous and relevant (Waringa, Maddocksb, 2005; Danish board of technology, 2002). To date, the public sector has mainly made use of proprietary software. One of the many technology choices the public sector now faces is the question of whether OSS has sufficient functionality and user friendliness in comparison with proprietary software and whether it is cost effective from an overall perspective (Waringa, Maddocksb, 2005).

Several papers or books analyzed e-government (Perri, 2001; Bovaird, 2003; Heeks, 2005; Yildiz, 2007), but few academic articles could be found concerning a connection between Free and Open Source Solutions (FOSS) and government. Cook and Horobin revealed that governments of developing countries are at least aware of FOSS and wish to foster its use

(Cook, I. and Horobin, 2006**)**. Evans and Reddy describe how the open source movement produces and distributes software and examines whether there is a significant market failure that would justify such intervention in the software industry (Evans and Reddy, 2003). A skeptical view of government's role in supporting FOSS is represented by Berry and Moss who showed that an analysis of official discourse and government policy for non-proprietary software suggests that its introduction into government would bring more politics as usual rather than democratization (Berry and Moss, 2006). Representing a more positive view, Lee reports that some governments have actually begun to procure FOSS, whereas others have channeled public funds to large-scale FOSS projects. The most fundamental argument of Lee's study is that in lending its support to FOSS, the difference between a government user and a business user is that the government should take into account society's long term interests (Lee, 2006). Regarding access to FOSS, Hemphill shows that for governments the most effective and efficient procurement decisions would result from an encouragement of neutral standards, open competition for research funding of software development, and non-discrimination in computer software procurement policies (Hemphill, 2005).

Bonaccorsi, Andrea, and Rossi contributed to the literature by providing empirical evidence on the incentives of the firms that engage in OSS activities. Findings on firms' motivations are compared with the results of the surveys on individual programmers aiming at analyzing the role played by different classes of incentives (social, economic and technological) in

determining the involvement in the movement of different typologies of agents (individual vs. organizations) (Bonaccorsi, Andrea, and Rossi, 2006). Bonaccorsi, Andrea, Giannangeli, and Rossi analyzed the strategies of software firms that have entered the open source field. Empirical evidence based on a survey of 146 Italian software firms showed that firms have adapted to an environment dominated by incumbent standards by combining the offering of proprietary and OSS under different licensing schemes, thus choosing a hybrid business model. Their paper examined the determinants of the degree of openness toward OSS and discussed the stability of hybrid models in the evolution of the industry (Bonaccorsi, Andrea, Giannangeli, and Rossi, 2006).

Comino, Stefano, and Manenti analyzed the impact on social welfare of government policies supporting OSS through their paper. They studied three government policies: (1) mandated adoption, whereby the government forces public agencies, schools, and universities to adopt OSS, (2) information provision, whereby the government informs the uninformed users about the existence and the characteristics of OSS, and (3) subsidy, whereby the government makes a payment to consumers if they adopt OSS. They show that mandated adoption and information provision may increase social welfare, but the subsidy always reduces it. When network externalities are added to the model, they showed that mandated adoption and information provision may increase social welfare if they help the market to tip towards standardization (Comino, Stefano, and Manenti, 2005).

Forge had found that there was an emphasis on the need for investment, education and encouragement in OSS, by both the public and private sectors. This emphasis was to build a strong knowledge based society in Europe. He also introduced the ideas of the basic economic mechanisms of volume sales of software as a good, with analysis of the industry impacts of confluence of the network effect coupled with the law of increasing returns with volume to drive monopolistic positions in the proprietary software package industry (Forge, 2006).

Berry and Moss considered the implications that the use of FOSS in government might have for democracy and public participation. From a constructionist perspective, the democratic effects of non-proprietary software are contingent on how the practice of FOSS is discursively represented and constituted as it is translated into new e-government systems. Berry and Moss Berry imagined circumstances in which the practice of non-proprietary software contribute to opening up and democratizing e-government, by protecting and extending transparency and accountability in e-governments and by offering scope for technology to be shaped by citizens and associations as well as by administrators and private interests (Berry and Moss, 2006).

Chapter 3

3. RESEARCH METHODOLOGY

3.1 Introduction

This chapter explains the methodology followed to control this study. This research is a qualitative research. Inductive researching approach had been used to control this study. The inductive approach is a systematic procedure for analyzing qualitative data where the analysis is guided by specific objectives (Thomas, 2003). This approach helps in making generalizations based on individual instances. The researcher chose this approach because his study is of qualitative type and because it is known that in the inductive approach the researcher will move from specific observations to broader generalizations and theories (Burney, 2008). This will best suit this study; where the researcher has to identify some major themes and draw conclusions based on the analysis of these specific themes.

The researcher chose the structured interview as an instrument for data collection because it was assessed to best fit in such a research. With structured interviews there is generally little room for variation in responses (Crabtree, 2006). In addition, structured interviews can produce consistent data that can be compared across a number of respondents (Crabtree, 2006). It was advocated that with structured interviews, it is easier to compare and analyze data (Sewell, 2006). Furthermore, structured interviews are best used when the literature in a topical area is highly developed as in our case (Crabtree, 2006). Qualitative interviews can lead to the development of new ideas and hypotheses or to the discovery of new

dimensions of a problem to be studied (Miller, 2003). As the sample was small, the researcher preferred to use structured interview as data collection tool rather than quantitative questionnaires that best suit larger populations.

The results of the structured interviews helped answer the first research question that had been mentioned in chapter 1. The researcher needed to conduct structured interviews with the heads of information technology departments in all ministries and government (public sector) agencies that provide services to citizens. However, these people formulated our population, since they have the right to make decisions when deciding to adopt OSS.

The researcher is also going to evaluate the opportunities and challenges of adopting OSS in the Palestinian e-government program from the government's perspective. The researcher met the Palestinian e-government team members and conducted structured interviews with most members of this team. This team was responsible for e-government strategy formulation, strategy implementation, and strategy evaluation. Thus, it was so important for the researcher to identify the attitude of team members based on their responses to the questions. The interview questions had been organized based on some main measures that should be studied and analyzed carefully to help in extracting conclusions.

3.2 Structuring the Interviews

Part one:

The first step of applying the above methodology was to formulate the structured interview questions. The researcher started doing this by identifying the two main research objectives (mentioned in chapter 1):

1. Assessing the feasibility of open source software adoption in the Palestinian e-government program
2. Studying and identifying the possible impact of full adopting open source software on the Palestinian e-government program

   The second step was to identify proper measures that should be studied and analyzed carefully to achieve the first objective.

   To address the first objective, the following measures were set forth:

a) Financial resources: the availability of financial budget needed for OSS adoption
b) Infrastructure: IT infrastructure assessment in ministries and government agencies
c) Experience and support: the professionalism and expertise owned by people working in both public and private sector. In addition, the needed technical support provided by those people for the Palestinian government
d) Leadership support: The level of government's interest in OSS adoption, and the level of support provided by the top-level management in the Palestinian government for the e-government project

e) Awareness: the level of understanding the benefits and objectives of OSS adoption by the Palestinian e-government team members, the chiefs of IT departments at all government agencies, and the Palestinian government

f) Cross-agency cooperation: the level of coordination and cooperation among different government agencies, and the possibility of efficiently exchanging data among these different agencies

After setting forth these measures, the third step was to develop structured questions to assess each measure

a) Starting by the first measure (Financial resources), seven indicators were developed:

1. Checking whether the low cost of OSS will be the main reason for adopting OSS or other factors are most important according to the government's perspective
2. Identifying whether the amount of money needed to upgrade the IT infrastructure in the government agencies is high or low, if needed
3. checking the availability of adequate budget to adopt OSS in the Palestinian public sector agencies
4. Exploring the percentage of the available budget dedicated annually for software development and maintenance in the Palestinian public sector agencies (if any)
5. Ensuring the availability of annual budget for IT training in the Palestinian public sector agencies

6. Identifying the percentage of annual IT training budget in case there is an annual budget for IT training in the Palestinian public sector agencies

b) For the second measure (infrastructure), nine indicators were developed:

1. Assessing the status quo of OSS implementation in the Palestinian public sector agencies
2. Identifying technical problems that may hamper the adoption of OSS in the Palestinian public sector agencies (if any)
3. Determining the level of technical readiness to adopt OSS in Palestinian public sector agencies
4. Identifying whether the current IT infrastructures in the Palestinian public sector agencies support OSS
5. Identifying whether the current IT infrastructures in the Palestinian public sector agencies support open standards or not
6. Identifying the open standards already adopted in the Palestinian public sector agencies in case they are already supported by current IT infrastructure (if any)
7. Determining whether there is a particular and unified ontology (semantics) among all Palestinian public sector agencies
8. Looking for interoperability standards in the Palestinian public sector agencies (if any)

9. Assessing the level of government perception of higher security gained in OSS environment when compared with proprietary software environment

c) For the third measure (experience and support), six indicators were developed:

1. Ensuring the availability of enough trained experts on OSS in the Palestinian public sector agencies
2. Identifying the type and amount of help provided by Palestinian open source communities of practice to the Palestinian government when a decision of adopting OSS in the Palestinian public sector agencies is made
3. Ensuring that there was an exchange of knowledge between the Palestinian government and outside experts or not
4. Determining whether the Palestinian government benefits from the experience of other countries on OSS adoption in e-government programs
5. Checking whether the number of IT corporations in Palestine was adequate to perform public private partnership (PPP) through projects coordinated by both public and private sector institutions
6. Checking whether the number of OSS experts was adequate to perform shared projects that are coordinated by both public and private sector (PPP) in Palestine

d) For the forth measure (leadership and support), Fourteen indicators were developed:

1. Determining whether the emphasis on OSS adoption on the Palestinian e-government strategy was adequate. Or the e-government team needed more than just indicating it in the strategy and plan
2. Checking whether there was an interest in OSS adoption in the Palestinian public sector agencies or not
3. Evaluating the level of interest in OSS adoption in government agencies (if any)
4. Identifying the level of interest in OSS adoption in e-government program (if any)
5. Assessing the level of easiness in developing a strategic plan to adopt OSS in the Palestinian public sector agencies
6. Deciding whether there was an already developed change management plan, designed to resolve the resistance to change when the change to OSS is being occurred
7. Identifying the size of effort exerted by the Palestinian government in analyzing and evaluating the e-government applications that had been built based on OSS. Furthermore, it is needed to compare them with other e-government application that build based on proprietary software
8. Checking whether the Palestinian government had studied and analyzed some case studies of countries that already adopted OSS in their e-government programs or not

9. Determining whether the Palestinian government agencies had already used OSS in some new in-house developed information systems
10. Finding out if there was an attitude toward adopting open standards in Palestinian government agencies or not
11. Identifying the level of seriousness of Palestinian government in applying e-government program
12. Checking whether there was an enforcement of cooperation among all public sector agencies by the Palestinian government or not
13. Evaluating the level of support offered by the Palestinian government to perform e-government program

e) For the Fifth measure (awareness), four indicators were developed:

1. Ensuring whether the Palestinian government continuously holds workshops and conferences to increase the awareness of the benefits of open source or not
2. Assessing the level of awareness of the objectives of OSS adoption
3. Evaluating the level of government agencies' awareness of the benefits of OSS
4. Finding out whether the Palestinian government is always nominating some of its experts and professionals to attend local and international workshops and conferences talking about OSS or not

f) Finally, for the sixth measure (cross-agency cooperation), two indicators were studied:

1. Identifying the number of projects shared between different ministries or governmental agencies (if any)
2. Determining whether there was a methodology for exchanging data among different Palestinian government agencies or not

Part Two:

The second objective is global and has indirect measures. The methodology followed was partly to review the relevant literature. The aim was to inspect the impact of OSS adoption on Palestinian e-government program, based on the impact of OSS adoption on other countries' e-government programs. This can be explored from the literature, best practices and case studies for other countries. One measure though, was measuring "cost reduction". This can be easily estimated by figuring out the number of servers in all Palestinian government agencies and the number and cost of licensing of software installed on them. Given that most OSS is free license and free to use and modify, we can easily estimate the savings. In addition, we can study and understand some indirect benefits such as unemployment, locally developed solutions… etc.

3.3 Interview Design

Hands-on study was done between 2010 and 2011. Working on this research required making interviews with e-government team members in Palestine and heads of IT departments at all government agencies in Palestine. This chosen sample of interviewees represented the people responsible for strategy formulation and implementation in the e-

government project. Dr.Safa Nasser El Din was -at that time- the General Coordinator of the Palestinian e-government Program. She provided very important input.

A formal structured email was sent to the main interviewees to coordinate for a meeting, also to provide them with a brief description of the research objectives. The first interview the researcher conducted was with Dr. El Din. She answered the researcher's questions honestly. She also reviewed some official documents that describe the Palestinian e-government status quo. Dr. El Din encouraged the research idea and she showed her enthusiasm toward OSS adoption in the Palestinian e-government program. She also mentioned some barriers for the Palestinian e-government such as lack of political stability, lack of firm and clear political decision from the highest levels, lack of some legal and technical professionals necessary for implementing the project, and lack of financial resources necessary to implement the project (Dr.Safa Nasser El Din, 2011). During the interview with Dr. el Din, the interviewees were selected so as to encounter a diverse set of actors working in different institutions. The interviewees (about 38) included the heads of IT departments in Palestinian government agencies and the e-government team members. The frequency of meetings and interviewing activity was high. Moreover, a few local workshops and conferences talking about OSS had been attended by the researcher during the research progress. Additional documentation, such as governmental policies and procedures, media and journal articles, and information retrieved from the internet was also used as supplementary material.

Various papers and case studies for different countries were collected to understand the vision and plans of e-government in order to reflect them on the Palestinian e-government program. In addition, these papers helped in gathering the elements of the current state of e-government program implementation. During the interviews, the researcher also asked some unstructured and semi- structured questions to get some facts and some additional details about the current state and the future plans toward adopting OSS in the Palestinian e-government program. The researcher asked the interviewees about their recommendations in order to share ideas with them.

Chapter 4

4. DATA ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter presents a discussion of the study's results for each of the 6 measures mentioned in chapter 3 and was represented by the main fully structured questions in the structured interviews held by the researcher. In addition, this chapter discussed the possible impact of fully adopting OSS in the Palestinian e-government program. The keyhole (lens) comparisons methodology had been used in analyzing the qualitative data collected. The researcher also used Chi Square analysis tool in data analysis scheme in order to check the hypothesis indicated in chapter 1. Chi Square statistical analysis had been completed using SPSS program.

In Palestine, we have 23 ministries and 54 government agencies. The Palestinian e-government team consists of 5 sub-teams: policies team, interoperability team, information security team, infrastructure team and legal framework team. The research overall contact population consists of 30 persons. The actual meetings were held with those 30 persons. These respondents were divided as 25 persons from the public sector agencies and 5 persons from the e-government team.

The interviewees were very interested in responding honestly for the interview questions. They also showed enthusiasm to help the researcher and provided him with some beneficial information like the challenges that hampered OSS adoption and some financial and

technical challenges they continuously face. In addition, they suggested some ideas that are helpful to efficiently adopting OSS in the Palestinian public sector. The average time to complete the interview was nearly 20 minutes. A period of three months was needed for the completion of the interviews. There were some difficulties in meetings arrangements.

4.2 Discussion of Results

This section elaborates on data analysis. It also answers the first research question. Analyzing the data collected here had also helped achieving the research objectives mentioned in chapter 1. The results were classified and arranged based on the 6 measures mentioned in chapter 3. As noted earlier, the researcher chose a representative sample that consisted of the major strategists and consultants who have the right to make decisions related to e-government program in Palestine. The researcher chose this sample of population because it is the best sample that helps in achieving the research objectives. There are no administrative differences in the hierarchal model among this sample of interviewees. Twenty five of the major interviewees had the same administrative position but at different government agencies. The other five interviewees are also working at the same level but in different sub-teams of the e-government team

4.2.1 Financial Resources Measure

The core questions asked in this part of the interview included one set of five binary (Yes/No) questions, and one set of two open-ended questions. The first set aimed at measuring the availability of financial resources required for OSS adoption. Money may be needed for paying off the license fees, infrastructure technical upgrades, starting open source projects, and conducting technical training for employees. The second set aimed at specifying the percentage of the annual budget dedicated for software development and maintenance related to the overall budget and the percentage of annul budget dedicated for training.

In this section, a direct question was asked about the availability of adequate budget for new open source project to replace the old software systems with new OSS systems. A summary of answers is shown in Figure 4.1.

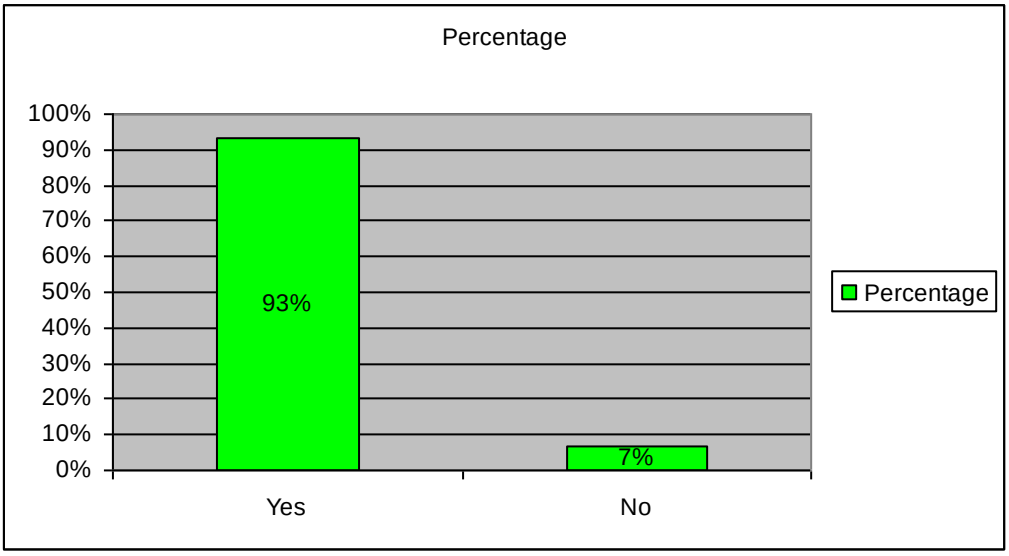

Figure 4.1: The availability of budget for open source adoption

As we see, most of the respondents (93%) emphasized that there was an available adequate budget to change from proprietary software to OSS in the Palestinian public sector agencies. Those respondents took into account that there is no need for money to perform this change. This lead the researcher to conclude that there were no financial limitations, that may hamper OSS adoption in the Palestinian public sector agencies and the e-government program. But, nearly 73 % of the respondents said that there was no special annual budget for IT training to develop the skills of employees working in the Palestinian public sector agencies. See Figure 4.2. As we know, when conducting cost/benefit analysis for OSS adoption project we should look at the Total Cost of Ownership (TCO) that includes not just the purchase cost , license fees, upgrades price, but also includes the training cost. Yet, the problem of not having specific training budget at the Palestinian public sector agencies had been solved, since the Palestinian Government Computer Center (GCC) continuously offers free training courses for public sector employees.

Most interviewees (about 97%) agreed that the cheap or free license feature of OSS will have a positive impact on OSS adoption in the Palestinian public sector agencies and the e-government program. considering that OSS is being adopted in the Palestinian public sector agencies and the e-government program, 63% of interviewees thought that the lower costs of OSS adoption compared with proprietary software adoption will be the major reason for OSS adoption. The other 37% considered the financial factor as unimportant when compared with

other factors that may encourage the Palestinian government to adopt OSS like reliability, vendor lock-ins avoidance, customizability, stability, flexibility and freedom, support and accountability, better software quality and security… etc. Here, we can conclude that just 37% of the interviewees have a better awareness of the objectives and benefits of OSS. In addition, nearly 83 % of the interviewees mentioned that the costs of upgrading the current infrastructure in the Palestinian public sector agencies -if needed- were low, since the current technical infrastructure already supports OSS and need not to be upgraded. The other 17% of the interviewees said that they need some upgrades on the current technical infrastructure and systems and the cost of this upgrade is relatively high. These people when asked to explain their answer, they replied that the government would need to purchase new servers and install Linux operating system which is free license on these new servers. These people were not thinking about full OSS adoption in the Palestinian public sector. So, they suggested keeping the readily existing servers with their Microsoft licensed operating systems and purchasing new ones to be used for some OSS applications that are going to be adopted. Table 4.1 details data results for this section of the interviews.

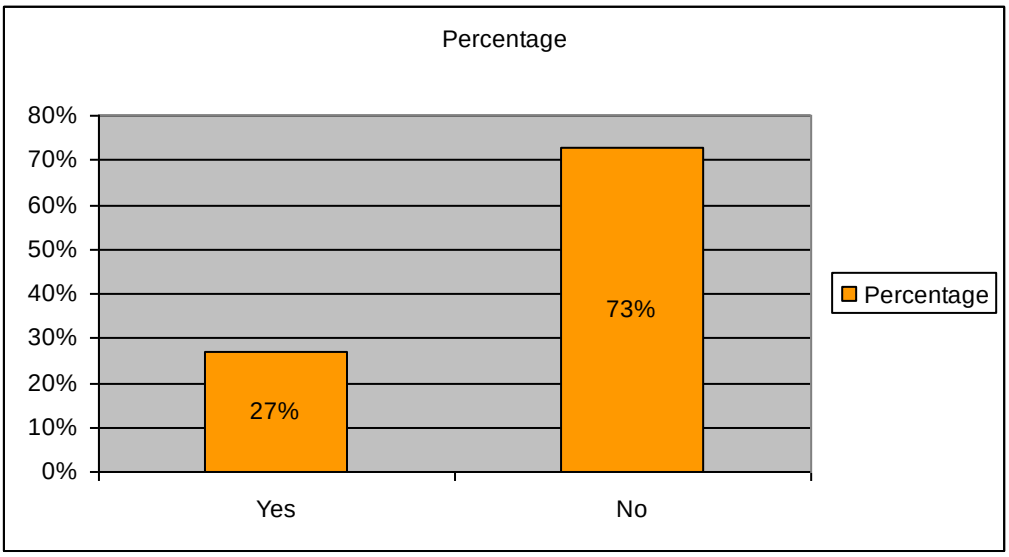

Figure 4.2: The availability of annual budget for IT Training in the Palestinian public sector agencies

Table 4.1 Financial Resources Data Results

Question	% of Yes	% of No
1. Do you think that the cheap or free license feature of open source will have a positive impact on open source adoption?	97	3
2. If open source is being adopted, do you think that the low cost of this technology will be the major reason for adoption?	63	37
3. If the infrastructures in the government agencies need to be upgraded to suit the adoption of open source software, is the cost of this upgrade high?	17	83
4. Do you think that there is an available budget for new open source project?	93	6
5. Is there an annual budget for IT training?	27	73

The Keyhole (lens) analysis had been used to conduct comparisons among the answers of the two qualitative questions at this section of the interview. The results showed that 73% of the interviewees said that there was no

specified budget dedicated neither for software development and maintenance nor for IT training. According to some of those interviewees, the software development and maintenance budget can be covered by the European financial support. Some other interviewees argued that the reason why there was no dedicated budget for software development and maintenance in their institutions was because that there were no IT departments in their old administrative hierarchies, and when these institutions reframed their hierarchies and added IT units to the new hierarchy, the government didn't specify a special budgets for these newly developed units. In some ministries the budget specified for software development and maintenance had gone to be transferred to purchase other equipments or procurements. Some government agencies had some qualified IT professionals who are responsible for software development and maintenance. The GCC is also responsible for developing some internal software systems needed in the government agencies (Fadi Morganeh , Omar Al-Maslamani, 2011). This center is also responsible for providing network solutions and technical support for all government agencies in Palestine (Fadi Morganeh , Omar Al-Maslamani, 2011). The GCC played a key role in establishing the unified governmental network that can be considered as a basic component of the e-government infrastructure (Dr.Safa' Nasser El Din, Fadi Morganeh, Omar Al-Maslamani, 2011). The IT free training courses are always held for employees working in the public sector at this center. (Dr.Safa' Nasser El Din, Fadi Morganeh , Omar Al-Maslamani, 2011). Other 27% who claimed

that their institutions had a specified budget for software development budget argued that the percentage of the budget dedicated for software development and maintenance ranged from 2% to 30% of the total annual budget of their institutions. Whereas the budget specified for IT training ranged from 2% to 10%.

The main conclusion here is that there was some awareness of the objectives and benefits of OSS adoption among the people who can be considered as strategists in the Palestinian public sector. In addition, there was an adequate financial budget for the change from proprietary software to OSS in the Palestinian public sector. Most of the interviewees argued that the expected cost savings when adopting OSS will be the major driver that may lead the Palestinian government to adopt OSS in the public sector and the e-government program because our economy depends extremely on the European financial support the United States of America.

There was no specified budget for software development and training, but this problem had been mitigated by the Government Computer Center (GCC) that provides continuous training courses for public sector's employees. In addition, most ministries have its own IT departments and the employees working there are responsible for developing the needed software applications.

4.2.2 Infrastructure Measure

The researcher concluded that the current technical IT infrastructure at all public sector agencies in Palestine was ready for adopting OSS when a

decision for this adoption is being made. As shown in table 4.2 and Figure 4.3, about 87% of the interviewees classified the level of government agencies technical readiness to adopt OSS as high. Other 7% of them said that the level of technical readiness was very high. The remaining 7% said that this readiness is low because there were no OSS experts in their institutions. There was also a shortage in the number of servers and some network equipment. Finally the current infrastructure doesn't support open standards.

Table 4.2: Level of government agencies' technical readiness to adopt OSS

Question	% of Very Low	% of Low	% of High	%**of very High**
What is the level of government agencies technical readiness to change to open source?	0	6.67	86.66	6.67

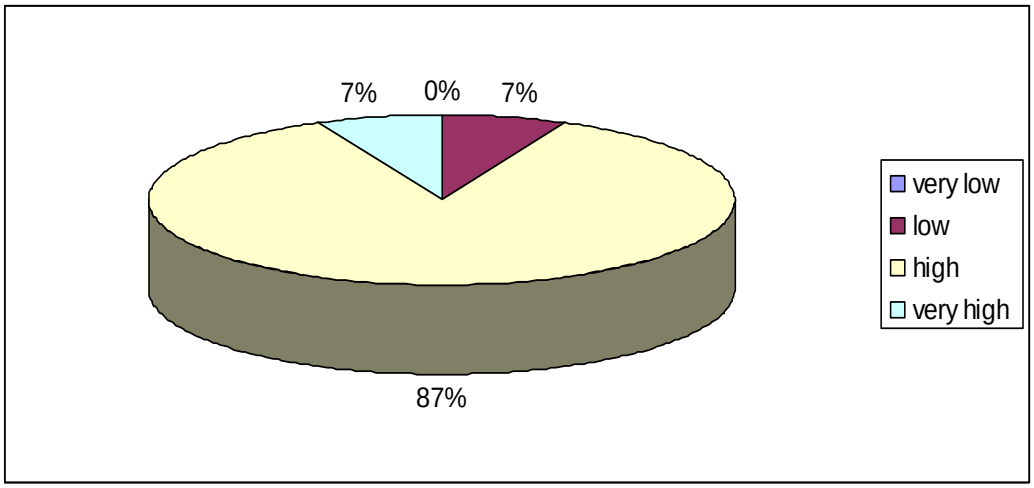

Figure 4.3: Level of government agencies' technical readiness to adopt OSS

Table 4.3: Evaluation of current technical infrastructure in the Palestinian government agencies

QUESTION	% OF YES	% OF NO
1. Is open source already being used in some government agencies in Palestine?	60	40
2. Are there any technical problems that hamper the adoption of open source?	23	77
3. Does the current technical infrastructure in the government agencies support open source software?	87	13
4. Does the current technical infrastructure in the government agencies support open standards?	10	90
5. Have the government agencies a particular ontology?	13	87
6. Are there interoperability standards among different ministries and government agencies?	3	97
7. Are you convinced that the open source environment is more secure than proprietary software environment?	87	13

Other results gained in this section of the interview had supported the mentioned conclusion. The results showed that about 77% of the interviewees agreed that there were no technical problems that may hamper the adoption of OSS in the Palestinian public sector agencies and then in the e-government program. In addition, about 87% of them emphasized that the current technical infrastructure in the government agencies had a full support of OSS.

The results showed that 60% of the interviewees argued that the Palestinian public sector agencies had already adopted OSS in some applications. This led us to conclude that there is an attitude toward the adoption of OSS in the Palestinian public sector and in the e-government program in the near future; and the current IT technical infrastructure well suit OSS applications.

The current IT technical infrastructure in the Palestinian public sector agencies doesn't support open standards. About 90% of the interviewees argued this; but the other 10% who argued that the current IT technical infrastructure supports open standards relied on the fact that there was a task of upgrading the current IT technical infrastructure to support open standards. The e-government team started working to construct a unified ontology and interoperability standards. There is a Zinnar.ps that contains ontology and standards for government, but it is under construction till this moment. The Palestinian government agencies had neither unified ontology nor interoperability standards till this now since the work to construct Zinnar.ps is still in-progress. Most of the interviewees agreed to this fact.

About 13 % of the interviewees provided a positive response to the question that aimed to determine whether there was a particular and unified ontology (semantics) among all Palestinian public sector agencies or not. Those interviewees answered like this because this unified ontology is already under construction. In addition, about 3 % of the interviewees agreed in the fact that there were interoperability standards within the Palestinian government agencies; their agreement had based on their knowledge that the Palestinian e-government management assigned a particular team to work on developing interoperability standards.

The results gained in this section led us to conclude that there is a good opportunity for OSS adoption in the future with no expected technical problems. No worries about the unified ontology and interoperability standards because the progress of constructing a proper ontology and efficient interoperability standards (Zinnar.ps) is going well. The results were detailed in Table 4.3. It is also important to notice that all thirty interviewees had ignored the question that entailed them to identity the proper open standards that were supported by the Palestinian government agencies. None were really supported in the current infrastructure.

4.2.3 Experience and Support Measure

As shown in Table 4.4, most of the interviewees (97%) were very sure that there were no enough trained experts on OSS in the Palestinian public sector agencies. About 83 % of them also thought that the number of OSS experts was inadequate to organize and perform projects coordinated with

the government. Furthermore, about 57% of the interviewees said that the number of Palestinian IT corporations was inadequate to organize and perform OSS IT projects coordinated and cooperated with government. Whereas 43% of them thought that the number of IT corporations was adequate to fulfill the Palestinian market needs. Thus, there needs to be more corporations to organize and perform shared IT projects coordinated and cooperated with the government.

In the future we expect more IT corporations to be established, which may help in raising the cooperation between public and private sectors (public-private-partnership). This will have a positive impact on OSS adoption when the decision is being made by the Palestinian government. Because, there will be a knowledge sharing among IT professionals working in both public and private sectors. That can also help in applying systemically problem solution approaches.

Most of the interviewees (90%) said that there was cooperation between the Palestinian government and outside experts to exchange knowledge. They said that there were strong relations with some other governments. These governments volunteered to help the Palestinian government in formulating and applying a good strategy for e-government program. The OECD will help the government to formulate the e-government policy and strategic action plan. The Estonian government had helped in establishing the Palestinian e-government program from scratch. The Estonian government has to gain feedback about all Palestinian policies, legislation, regulations, technical infrastructure, and security issues. So, the Estonian government

can easily help in formulating the architecture and interoperability framework based on the feedback they will collect from the Palestinian e-government team. The Estonian government itself has already adopted OSS in its public sector agencies and its e-government program. That may attract adoption of OSS in the Palestinian e-government program.

The Palestinian e-government team members need to study the best practices of some other countries that adopted OSS in their e-government program. About 60% of the interviewees agreed that the Palestinian e-government team members had studied and availed from the experience of other countries in this regard. Whereas about 40% of the interviewees said that the Palestinian e-government team members had not studied the best practices of other countries since they were not interested in OSS adoption in the first place. Figure 4.4 shows these convergent percentages. It was difficult to prove whether the e-government team members had actually learned from the best practices of countries who adopted OSS. Because, there was a considerable percentage of interviewees who said that the e-government team members did not actually study the best practices of other countries that already adopted OSS. However, the e-government team members admitted that they did not study a lot of cases and best practices except the case of Estonia.

A precise qualitative question had been asked for all interviewees at this section of the interview. It was about the possible help that may be offered by the Palestinian open source communities of practice to the Palestinian government to take an action toward OSS adoption. Most of the

interviewees provided nearly the same answers for this question. Most of them expected the following from the Palestinian OSS community:

1. Conducting internal and external workshops and conferences about the objectives and benefits of OSS adoption
2. Providing the Government Computer Center and the IT sector at all government agencies with a suitable feedback about OSS and the requirements needed for OSS adoption
3. Offering internal and external professional technical training courses for employees working in the public sector. In order to provide them with insights about how OSS applications can be developed and how to install and run them on their servers
4. Volunteering in OSS development, by helping the Palestinian government to develop new information systems and websites using OSS

Table 4.4: Answers of experience and support questions

Question	% of Yes	% of No
1. Are there enough trained experts on open source in the public sector agencies?	3	97
2. Is there cooperation between the Palestinian government and outside experts to exchange knowledge?	90	10
3. Does the Palestinian government have benefited form the experience of other governments on open source adoption on their e-government program?	60	40
4. Is the number of companies adequate to organize and perform projects coordinated with government?	43	57
5. Is the number of open source experts adequate to organize and perform projects coordinated with government?	17	83

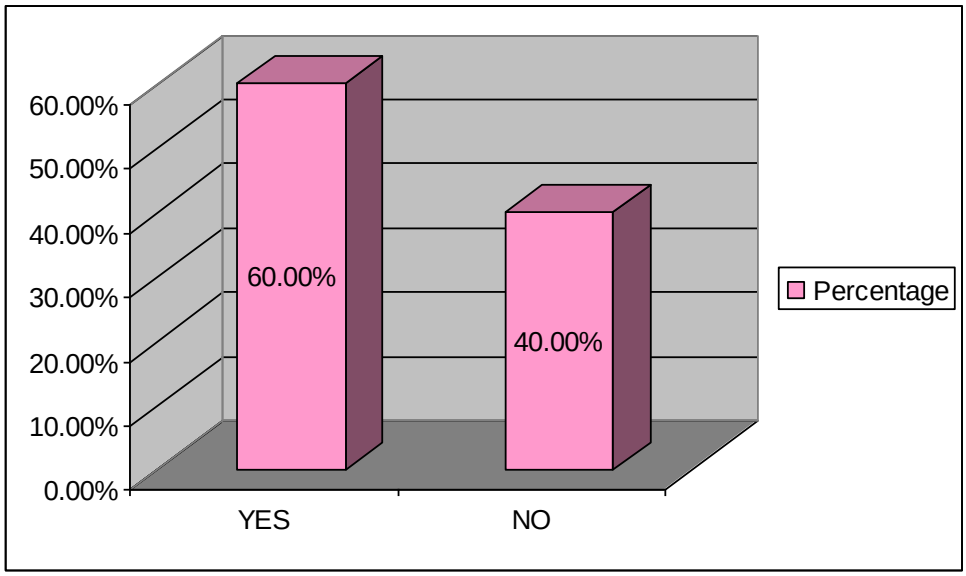

Figure 4.4: Palestinian availing from other countries in regards to OSS

The final conclusion in this section is very clear. The experience on OSS among IT professionals working in the Palestinian public sector agencies was inadequate. There was a shortage in the number of OSS experts in both public and private sectors in Palestine. In the private sector there were also an inadequate number of OSS experts. On the other hand, an unlimited number of external experts on OSS were available for the Palestinian government and some of them were ready to cooperate. This may solve the problem of the shortage of OSS experts in Palestine when the decision to adopt OSS is being made.

4.2.4 Leadership and Support Measure

Before measuring the level of top level governmental leadership, support and interest in OSS adoption in the Palestinian government agencies and e-government program, the level of seriousness in applying e-government program by the Palestinian government should be first measured. In

addition, the level of support offered by the Palestinian government to carry on the e-government program (provision of resources, cooperation enforcement, training …etc) should also be measured. These measures are detailed in Table 4.5.

The results showed that 53% of the interviewees said that the level of seriousness in applying e-government program by the Palestinian government was very high. Another 40% of them thought the level of seriousness was high. So, most of interviewees (about 93%) emphasized that the level of seriousness in applying e-government program by the Palestinian government was high. In spite of this high level of seriousness, there were only 60% of the interviewees who said that the level of support offered by the Palestinian government to perform the e-government program was high. As we can see, most of the interviewees considered the governmental support for the e-government programs were high. But, there were 40% of the interviewees had considered the governmental support for e-government program were low. About 33 % of them said that it was low, and 7% said it was very low.

Table 4.5: the level of seriousness in applying the e-government program, and top level governmental interest in open source adoption the e-government program

Question	% of Very Low	% of Low	% of High	% of Very High
1. How serious is the Palestinian government in applying e-government program?	3	3	40	53
2. What is the level of support offered by the government to perform e-government program (Resources, cooperation enforcement, etc…)?	7	33	60	0
3. What is the level of interest in open source adoption in the government agencies?	23	53	17	7
4. What is the level of interest in open source adoption in Palestinian e-government program?	3.33	33.33	50	13.34

The Palestinian government as mentioned above is so serious in implementing the e-government program. But this seriousness also requires more and more support. Actions need to be taken in order to succeed in the e-government program.

As shown in Table 4.5, about 50% of the interviewees thought that is the level of interest in OSS adoption in the Palestinian e-government program was high. Another 13% of them believed that the level of interest in OSS adoption was very high. Thus, most of interviewees (about 63%) agreed that the Palestinian government was interested in adopting OSS in its e-government program. About 37% of the interviewees were very sure that the Palestinian government wasn't interested in the adopting OSS. These people claimed that a lot of issues may hamper OSS adoption in the Palestinian e-government program. Low level of awareness of OSS objectives and benefits was one of these issues. Lack of change management plans required when applying the change form proprietary software to OSS was another critical issue. Finally, the most critical issue that may hamper OSS adoption was the general lack of expertise and skilled professionals in OSS applications in Palestine. In contrast, only 17% and 7% of the interviewees considered that the interest in OSS adoption in government agencies were high and very high respectively. Whereas, most of them (about 53%) were very sure that the interest in OSS adoption in the government agencies was low. About 23% of them said that the interest was very low. Therefore, 77% of the people interviewed said that the there was no interest in OSS adoption in the Palestinian government agencies. This contradicts the fact that about most of the people interviewed (about 63% of them) said that the interest in OSS adoption in the Palestinian e-government program was high. This

contradiction led us to conclude that the Palestinian government's attitude was not directed toward full adoption of OSS.

Figure 4.5 explains this contradiction.

About 70% of the interviewees mentioned that the newly developed information systems in the Palestinian government agencies did not use open source technology. This indicates that there was no interest in OSS adoption in the Palestinian government agencies. See Table 4.6.

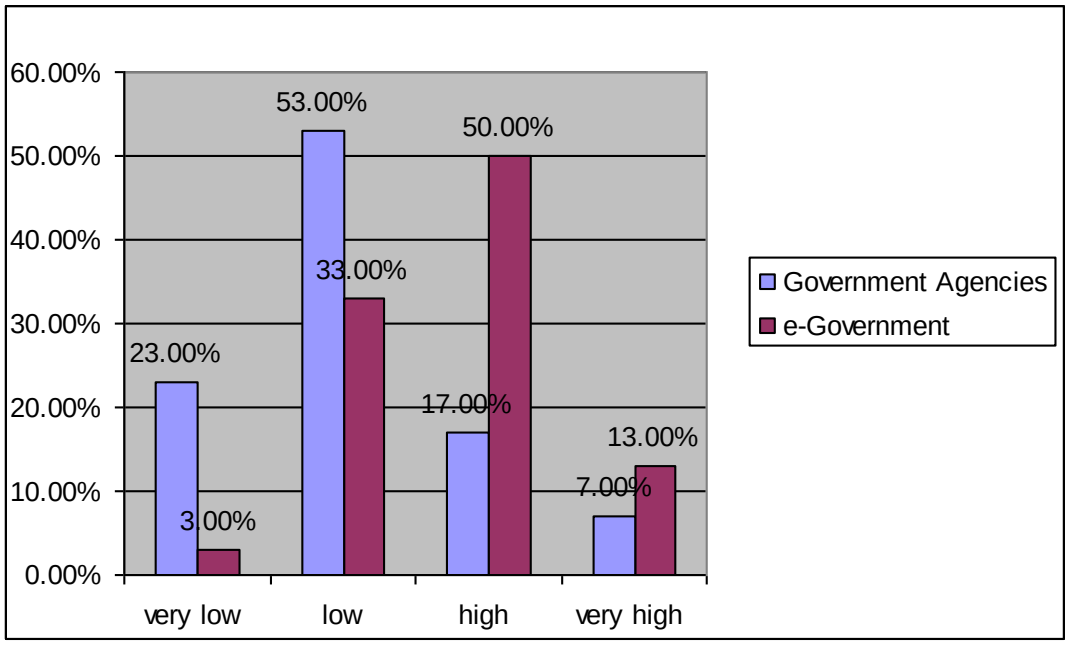

Figure 4.5: Level of interest in both Palestinian government agencies and the e-government program

There was an emphasis on OSS and open standards adoption in the Palestinian e-government strategic plan developed in July 2005(PNA, 2005). This may indicate that there was an inclination to adopt OSS in the Palestinian e-government program. This was agreed upon most interviewees as mentioned before. Yet, encouraging the attitude of OSS adoption in the strategic plan of e-government was inadequate. The

Palestinian e-government team was also interested in OSS adoption and that was also inadequate. About 93% of the people interviewed admitted that the emphasis on OSS adoption on the Palestinian e-government strategic plan was inadequate. What we actually need is a political higher level engagement that enforces the adoption of OSS. Government agencies are also forced to develop a special strategic plan to adopt OSS. This task is not a difficult thing; about 87% of the interviewees said that it will be easy to prepare a strategic plan to adopt OSS. In addition, the Palestinian government has to work on conducting professional training for the IT staff in all government agencies to qualify them to deal with OSS applications. The Palestinian government should also work on preparing change management plans. The researcher asked about the availability of change management plans; most of the interviewees (about 93%) said that the Palestinian government didn't have such plans. The results are explained in Table 4.7.

The results showed that the governmental top level leadership and support was low. Most of the interviewees (90%) emphasized that the Palestinian government didn't evaluate e-government applications that already constructed on open source environment. So, the Palestinian government neither compared between e-government applications that used open source with others that used proprietary software nor made a study or analysis of some case studies for countries that used OSS in their e-government programs. About 80% of the interviewees mentioned that the Palestinian government did not review any case studies of countries that adopted OSS.

Table 4.6: The usage of OSS in newly developed Information Systems in the government agencies

Question	% of Yes	% of No
Are newly developed Information Systems in the government agencies used open source technology?	30	70

Table 4.7: The level of difficulty in developing strategic plan to adopt OSS and the availability of change management plans

Question	%of Yes	% of No
1. Is the emphasis on open source adoption on the Palestinian e-government strategy adequate?	7	**93**
2. Is it easy to prepare a strategic plan to adopt open source?	87	**13**
3. Is there a change management plan that can help in the change to open source?	**7**	**93**

Implementing the e-government program in Palestine requires an enforcement of cooperation among different ministries, institutions and even departments by the Palestinian government. When the interviewees were asked about the existence of such cooperation; about 70% of them said that there was enforcement of cooperation; while 30% said that there was little enforcement. See Table 4.8.

Table 4.8: Governmental enforcement of cooperation among government agencies

Question	% of Yes	% of No
Is there an enforcement of cooperation among different ministries, institutions and even department by the Palestinian government?	70	30

We can conclude that, the Palestinian e-government team needed higher top level leadership and support and more power and authority to enforce cooperation among different government agencies. In addition, the e-government team needed to make a decision to force the public sector agencies to adopt OSS applications. The current governmental leadership and support was very low.

4.2.5 Awareness Measure:

The results showed that just 7% of the interviewees who thought that the level of awareness of the objectives of the adoption of OSS was high. Only 3% thought that the level of this awareness was very high. Thus, a total of just 10% of the interviewees argued that there was an awareness of the objectives of OSS adoption in the government agencies. On the other hand, a total of 90% of those interviewed said that all IT professionals in the Palestinian public sector agencies had no awareness of the objectives of OSS adoption. In addition, a total of 7 % of the interviewees said that the

level of awareness of the benefits of OSS in the government agencies was low. So, most of the interviewees (about 93%) were convinced that there was no actual awareness of the benefits of OSS among the Palestinian public sector agencies. These results are shown in Table 4.9.

In the previous section, we mentioned that the government's interest in OSS adoption in the Palestinian government agencies was low. This low level of interest had its reflections on the awareness of the objectives and benefits of OSS adoption among IT staff in all government agencies. Whereas most of the interviewees (about 63%) had rejected the fact that the Palestinian government continuously holds workshops and conferences to increase the level of awareness of the objectives and benefits of OSS among IT staff in both the public and the private sectors. In addition, 53% of them also rejected the fact that the Palestinian government was always interested in nominating some of its experts to attend local and international workshops and conferences. The other 47% of the interviewees agreed that the government always send some experts to attend local and international workshops and conferences. But, they claimed that the problem was in choosing the suitable experts who deserve to attend such events. They are mostly none technical. Most of those people came back without getting benefits from these workshops and conferences, specially the international ones, since most of the representatives exploited these events for recreation and welfare. Table 4.10 details these results.

Table 4.9: The level of awareness of objectives and benefits of open source

Question	% of Very Low	% of Low	% of High	% of very High
1. What is the level of awareness of the objectives of open source adoption?	13	77	7	3
2. What is the level of awareness of the benefits of open source adoption?	13.34	80	3.33	3.33

Table 4.10: Government interest in holding workshops and conferences and sending experts to attend such workshops and conferences

Question	%of Yes	%of No
1. Does Palestinian government continuously holds workshops and conferences to increase the awareness of the benefits of open source?	37	63
2. Is the government always interested in nominating some of its experts to attend local and international workshops and conferences?	47	53

The lack of awareness of the objectives and benefits of OSS adoption among the Palestinian government agencies formulated one of the major challenges against OSS adoption in both the public sector agencies and the e-government program in Palestine. But, this challenge can be treated by

the Palestinian government in many ways. This will be discussed in details in chapter 5 (Conclusions and Recommendations).

4.2.6 Cross-Agency Cooperation Measure

The results showed that there was no methodology for exchanging data among the Palestinian government agencies. Where most of the interviewees (about 83%) said that there was no methodology for data exchange among different government agencies. But they also said that there will be a new methodology for this purpose in the near future. The governmental unified network that is under construction till this moment may facilitate data exchange among different public sector agencies. The obstacles of cross-agency cooperation were not just technical issues. There are also some managerial issues. As stated before in this chapter, there was no governmental high level policy that forces such cooperation among different agencies.

A qualitative question had been asked in this section. The purpose of this question was to identify the number of shared projects between different ministries. All interviewees mentioned that there were no shared projects among different public sector agencies except Bisan Accounting System which had been bought by the Ministry of Finance and had been generalized to be used at all other public sector agencies. But Dr.Safa Nasser El Din mentioned that there are shared projects between the Ministry of Transport and Interior and police among others. Another shared project is between Ministry of Transport and Interior and Ministry of

Health and e-Government core team (inter ministerial committee) (Dr.Safa' Nasser El Din, 2011).

This led us to conclude that the cross-agency cooperation among different government agencies was good.

We have to understand that; applying an efficient e-government program in Palestine requires high level of cross-agency cooperation and secured data exchange among different government agencies.

4.3 The Impact of Full Open Source Adoption

4.3.1 Introduction

In this section, the impact of OSS adoption on the public sector and the e-government programs in some other countries had been discussed. The researcher had reflected the advantages and benefits of OSS in general and those gained by other countries that already adopted OSS on the Palestinian case in order to inspect the possible impact of OSS adoption on the Palestinian public sector and the e-government program.

4.3.2 The Expected Impact of Open Source Adoption on the Palestinian Public Sector and the e-Government Program

This section is intended to reflect the impact of OSS adoption on the public sector and the e-government program at different countries (according to literature) on the Palestinian case. It is also intended to answer the second research question mentioned in chapter 1. In addition, it aims to achieve the second research objective mentioned also in chapter one.

We can classify the impact of OSS on Palestinian public sector based on the following issues:

1. **Economic impact:** The most important reason for adopting OSS was to save costs on the acquisition of IT. This factor was evident, with varying degrees of importance in most studied organizations (Indian Institute of Management Bangalore, 2009). The economic impact of OSS was measured by three principal mean (Indian Institute of Management Bangalore, 2009):
    - FOSS as a substitute for more expensive desktop operating systems and office productivity applications
    - OSS as a substitute for more expensive server software
    - OSS enabled cost savings from complementary products such as anti-virus software required on Windows desktops

The forecast cost savings in the year 2010 from replacement of proprietary software with OSS in India was about $ 2111 million (Indian Institute of Management Bangalore, 2009).

It can be considered that cost saving is the most important reason for thinking about adopting OSS in the Palestinian public sector agencies and the e-government program.

As mentioned before, OSS adoption saves the government license fees for the major software applications needed for running the government information systems. The most special software applications that need to be fully licensed in order to run the government internal information systems and external websites are the operating systems installed on the servers, the server software applications like mail server application, exchange server application, web application server and the database management systems.

These licenses are too much expensive. They also needed to be upgraded and updated every year which in turn increases the required running costs. But, the Palestinian government tendency for OSS adoption makes it possible to get rid of these costs since the OSS is free-licensed. According to the Palestinian Government Computer Center (GCC) there are a total of about 300 servers at all public sector agencies (Fadi Morganeh , 2011). Table 4.11 shows a comparison between the prices of closed-source software applications versus open source software applications that are needed to be installed on the servers centered in the government agencies.

Table 4.12 shows the needed software applications at all Palestinian government agencies and the expected total cost for the 300 servers available on these government agencies.

As we see in Table 4.12, a total of (5027$) is needed for each server in any government agency in order to run the internal information systems and the external website of that agency. In contrast, it costs nothing when replacing these commercial software applications with OSS applications.

We can conclude that about 5027$/ year can be saved for each server when adopting OSS. So, the Palestinian government can save a total of 1508100$/year at all public sector agencies when adopting free OSS. It is important here to mention that the OSS is not going to be fully adopted. The researcher assumed that the OSS will be adopted at the beginning on the government agencies' servers only. But, if the OSS is going to be fully adopted (i.e. the OSS applications is going to be installed at all servers and clients) there will be a vast cost savings. But, this action requires the

Palestinian government to increase the awareness of OSS applications and disseminate the OSS culture among all public sector employees. This may incurred in additional costs required for training but the total costs remains lower compared with the case of keep using commercial software applications. Furthermore, we have not to forget that when OSS is fully adopted; all office software applications like PDF files readers, Anti-Virus applications, Graphics applications etc… will be installed on the clients for free without costly licenses. But, in our Palestinian case it is known that most software licenses even for Windows operating system installed at all government agencies' PCs are bogus (false). In the case of servers, Windows server operating system should be licensed to be applicable to run the governmental information systems well. We can conclude that the major savings will be clearer in getting rid of the licenses of server-side applications.

Here we can conclude that OSS adoption reduces the purchase costs, yearly license renewing costs, need for regular costly upgrades, and the need for expensive system administrators. In addition, Linux and OSS solutions are easily portable and compressed. It takes lesser hardware power to carry out the same tasks when compared to the hardware power it takes on servers, such as, Solaris, Windows or workstations. With this less hardware power advantage, the governments can even use cheaper or older hardware and still get the desired results.

Table 4.11: Prices of closed-source software applications versus open source software applications

Commercial Choice	Cost ($)	OSS Choice	Cost ($)
Windows server 2008 R2	1209$	Linux (Red Hat, openSUSE, ubuntu etc…)	0$
Windows Web server 2008	469$	Apache HTTP Server and ZServer	0$
Relational Database (Ms. SQL 2000)	1350$	MySQL	0$
Office productivity applications	560$	OpenOffice.org & Abiword	0$
Database Integration Engine	1200$	PHP, Python, & Zope	0$
Graphics applications	600$	Pixia	0$
Windows Server 2008, Client Access License 20-pack	799$	Client Access License	0$

Source(http://www.microsoft.com/windowsserver2008/en/us/pricing.aspx,2011; http://conferences.oreillynet.com/cs/os2002/view/e_sess/2456, 2002)

Table 4.12: The needed software applications at Palestinian government agencies

Commercial Choice	Cost ($)	OSS Choice	Cost ($)
Windows server 2008 R2	1209$	Linux (Red Hat, openSUSE, ubuntu etc…)	0$
Windows Web server 2008	469$	Apache HTTP Server and ZServer	0$
Relational Database (MS. SQL 2000)	1350$	MySQL	0$
Database Integration Engine	1200$	PHP, Python, & Zope	0$
Windows Server 2008, Client Access License 20-pack	799$	Client Access License	0$
Total	5027$	Total	0$

2. Impact on innovation improvement, software quality and software development in Palestine:

Adopting OSS in the Palestinian public sector applications made the code available to be debugged and modified by many IT professionals in the country. This will improve the efficiency of the newly developed governmental information systems, because the code will be free and

available to be reviewed and debugged by all IT professionals in the country. In addition, OSS adoption will encourage the IT professionals in the Palestinian public sector agencies to improve their skills and to look for learning new skills which will have a positive impact on the performance of the internal and external governmental information systems. Adoption of Linux can help to motivate the development of a country's software sector. By promoting the training of programmers that enables them to develop applications that run on the Linux platform (Varian, Shapiro, 2003). OSS, such as Linux, typically uses open interfaces. These open interfaces typically lead to a larger, more robust, and more innovative industry and therefore software with open interfaces should be preferred by public sector officials, as long as it offers comparable quality to proprietary alternatives. The open interface can be defined as: an interface that is fully described in publicly available documents and available for anyone to use freely (Varian, Shapiro, 2003). Open interfaces offer many advantages to users and to software developers. They tend to increase consumer choice and promote competition. They also make it easier for various programs to retain compatibility with each other as they are improved over time (Varian, Shapiro, 2003). In addition, as stated before; OSS is available publicly. So that, large amount of developers globally contribute and analyze the code making it more secure and constantly increasing the quality. Another important issue is that when a bug is spotted in proprietary software, the only people who have the permission and ability to fix it are the original developers, as only they have access to the source code. OSS is

quite different. As a large number of users can access and change the code, bugs tend to be more visible and more rapidly corrected. This will have an important impact on software quality since the bugs are going to be rapidly detected and fixed.

3. **Impact on performance of the Palestinian governmental information systems**

The performance in the government agencies that adopted OSS had got improved. This includes aspects of stability, interoperability, operational ease, maintenance, and reliability (Indian Institute of Management Bangalore, 2009).

OSS adoption can improve the system reliability in the Palestinian government agencies. Since all kinds of bugs in the system will be addressed with speedy fixes wherever possible. Severe defects tend to be fixed within hours of their being detected. The pattern with closed-source software is typically that a defect report needs to be filed and then there will be a delay before the vendor determines when or whether to issue an updated release. So, the OSS adoption leads to more reliable systems. In addition, OSS adoption is going to increase system stability since OSS adoption mitigates the worst effects of vendor-push. As we all know, software always changes to meet new requirements of the government. A choice to use OSS can provide a counter to the pressures to upgrade for the vendor's commercial purposes but cannot protect every user from any change. Having access to the source code can allow the Palestinian government to choose to support itself on an old version where necessary

and we believe that in general it gives more options and choice to the users. This system stability also helped in achieving internal and external operational ease in the overall system. Another issue of improved performance is the maintenance. As mentioned before OSS support is mostly freely available and can be easily accessed through online communities. There are also many software companies that provide free online help and also varied levels of paid support. So, the maintenance for OSS is easier compared with closed-source software applications. We can conclude that the Palestinian government can gain better operational performance in its internal information systems and e-government program when OSS is being adopted.

4. **Impact on security of the Palestinian government information systems:** OSS products attracted some private and public sector organizations because of security features integrated on these products (Indian Institute of Management Bangalore, 2009). These security features also helped the organizations that adopted OSS in administration. Security of government systems is vital. Properly configured OSS can be at least as secure as proprietary systems. But, OSS is currently subject to fewer Internet attacks. A balance needs to be struck between the availability of security administration skills and the advantages of many diverse systems (Office of Government Commerce, 2003). In addition, the structure of the Linux/Unix operating system is regarded by many as inherently more secure than that of proprietary operating systems. OSS is likely to be attacked by fewer viruses than

proprietary software (Office of Government Commerce, 2003). The open source code is available for all users. So, when a problem occurs; the worldwide Linux community of practice can act to resolve any issue with urgency. Governments around the world had deployed Linux to meet highly secure needs. Military and defense organizations for example have been quick to seize on this particular advantage of Linux (Office of Government Commerce, 2003; European Commission, DG Enterprise, 2001). OSS has until now been less exposed to attack from hackers; it also possible to look down the kernel to provide a highly robust and secure platform (Office of Government Commerce, 2003).

5. **The impact on employment in the Palestinian government agencies:** OSS may enhance employability given the training and life-long learning environment of the OSS community (Ghosh, 2006). Employment in ICT makes use of a wide range of skill levels and skill specializations. ICT in turn drives the demand for a wider range of skill sets in the labor force. It is important to consider the OSS impact on direct and indirect employment (Ghosh, 2006). It is clear that the governments especially in developing countries like Palestine are always looking for adopting new cheaper technologies. This requires employing fresh IT graduates with high skills in these technologies. So, adopting OSS will open new employment opportunities for a lot of fresh IT graduates in Palestine. This will also encourage the IT professionals and fresh developers in Palestine to develop their skills. OSS, like other ICTs, drives demand for particular skill sets such as those related to software development.

However OSS asks for skills from the formal infrastructure (e.g. computer software engineer) and also for skills related to OSS community actions including project management, copyright law and entrepreneurship (Ghosh, 2006).

6. **The impact on sustainability of government ICT processes and systems:** OSS supports the sustainability of government ICT processes and systems through the following (Ghosh, Glott, Boujraf, Schmitz,2010):
   - Transparency: OSS is available along with its source code which can be studied and modified. This can ensure the security of the software as its processes can be examined and reviewed in detail. It also allows appropriate stakeholders to understand and monitor the functioning of government processes that are implemented precisely in the software like voting systems for example. This emphasizes on the transparency among those stakeholders.
   - Interoperability: Whether implemented in open source or proprietary software, open standards ensure interoperability, the ability of systems from different vendors to function fully with each other without technical or legal obstacles. OSS, in particular, provides additional support for interoperability, as its processes can be studied and adapted to work with other systems.
   - Independence: Transparency and interoperability allow current and future vendors to work with, adapt and maintain the software, eliminating the dependence of purchasers or third party support and

service providers on the vendors of the original version of the software.

- Flexibility: OSS allows systems to be adapted and extended as user needs evolve. It does this without requiring that the user go back to the original vendor. So, new suppliers can be selected on a competitive basis.

These four properties ensure the sustainability of government ICT processes and systems. Sustainability implies lower costs over the longer term, but more importantly, reduces the users' reliance on the original vendors of the software. Other important issues in the sustainability of government ICT processes and systems can be usability and customizability. In terms of usability; it is known that Linux unlike Windows allows the user to customize the user environment. So, different users can use different environments. It is also possible to configure standard Linux operating environments to look and operate a lot like Windows, making it relatively easy for users to migrate from one system to another. In addition, OSS applications unlike closed-source applications may be customized by anyone with the required skill. Thus, OSS can be readily adapted to meet specific user needs. We can conclude that when any Palestinian government agency would like something added or customized it can asks its IT staff, or Government Computer Center or it can pay an appropriately skilled software developer to do this for this agency.

7. **The Impact on Interoperability among Public Sector Agencies:** Part of the Palestinian e-government team is still working in establishing interoperability standards to be used in data exchange among different government agencies. Interoperability and respect of standards of the OSS are the main reasons for using OSS in the public sector. The main strength of OSS is that it is constructed for interoperability and closely associated to open standards. OSS is more convenient for long-term interoperability (European Commission, DG Enterprise, 2001). OSS, in particular, provides additional support for interoperability, as its processes can be studied and adapted to work with other systems (Ghosh, Glott, Boujraf, Schmitz, 2010). So, it is going to be more convenient for the Palestinian e-government team to consider OSS in interoperability standards establishment.
8. **The impact on national development:** There are many perceived OSS benefits that align with national development goals. There are major five pillars in the national development framework (Vital Wave Consulting, 2006):
    - Increased competitiveness
    - More local and foreign investment
    - Improved access to and participation in economic advancement
    - Greater contribution to regional and international development
    - Increased capacity to deliver education, health, housing and other government services

Increasing competitiveness in the global marketplace will require a concerted effort by the public and private sectors to raise skill levels and keep costs low. Some software developers claimed that the country can best competes by exploiting the low cost and flexibility of OSS to improve science, technology, math and entrepreneurial skills (Vital Wave Consulting, 2006). In addition, Because OSS encourages and allows for more local software development and support; it is going to help in increased investment in the local economy and broader participation by the Palestinian's companies in domestic and regional economy. Money that would normally be spent on proprietary licenses is retained and re-invested internally (Vital Wave Consulting, 2006). Furthermore, OSS can also help to improve government services by lowering costs and making education, health and vocational services more accessible through localization (Vital Wave Consulting, 2006). So, users who lack the means to buy proprietary software also benefit from an ever-increasing catalog of freely-distributed OSS for school administration, curriculum support, professional development, multimedia skills, etc. (Vital Wave Consulting, 2006). Finally, an OSS adoption can improve the opportunities for Public-Private-Partnership (PPP).

4.4 The Risks of OSS Adoption and the Risks Mitigation in Palestine

As OSS has many benefits it also has some drawbacks that may negatively affect the decision to adopt OSS in the Palestinian public sector agencies and then in the e-government program. There are no papers that explicitly

focus on potential risks of OSS adoption, but the literature mentioned several possible drawbacks of OSS adoption.

4.4.1 The Risks of OSS Adoption in Palestine

The following are some of the major expected risks:

1. There will be a fear that support can be fragmented or difficult to obtain. That fear may be misplaced. Public sector agencies should note that many large suppliers such as IBM, Sun and HP are investing considerable effort and providing support for GNU/Linux operating system (OGC, 2003).
2. There will be some difficulties in identifying appropriate OSS applications for particular business problems in the Palestinian public sector agencies. Because OSS is not well advertised in quite the same way as is proprietary software, public sector decision makers may not be aware that a particular OSS product is available to meet their needs (OGC, 2003). The lack of a professional provider is not necessarily a problem. However, the lack of support and expert advice, in particular for complex problems, was considered as one of the major challenges with OSS.
3. There is a lack of real world experience and support for migration from closed proprietary software installations to OSS. Public sector agencies in Palestine must be able to integrate OSS with their existing installed base and must understand how to migrate from a single supplier set to a more diverse product set. This can be performed by studying the best practices of some other countries

that already adopted OSS like UK, France, India and Denmark. In addition, the Palestinian government can make some cooperative relationships with some external OSS experts and start working in developing a qualified Palestinian team by offering the needed level of training for public sector IT specialists in Palestine.

4. There will be high short-term costs of switching to OSS: Although the long-term costs for OSS have been found consistently lower than those of proprietary software, the short-term costs can be high during the transition. The software needs to be acquired, installed, customized and then staff may require training (Vaughan-Nichols, 2004a, b). Additionally, if organizations lack the resources and talent to manage the software it could easily become costly to maintain (Coffee, 2003).
5. Training for Linux was more robust, more costly (Giera, 2004): the investments in the Palestinian public sector agencies has to make in training for their IT employees will significantly higher for Linux than Windows. The main reason for this is that training materials for Linux were less available than for Windows, limiting the choices the Palestinian government had for courses and locations. Public sector agencies will feel that because they already had several years' worth of experience on Windows, they would need to schedule more training to overcompensate for the lack of internal Linux knowledge.
6. Adoption of OSS products is not without costs: It may be time-

consuming to evaluate them (Tiangco ,Stockwell ,Sapsford ,Rainer, 2005). Adoption may involve user training and configuration (Tiangco ,Stockwell ,Sapsford ,Rainer, 2005; Morgan, Finnegan , 2010). We might need to spend resources on community participation. Many organizations would need premium professional support (Fitzgerald, Kenny, 2004; Ven ,Verelst,Mannaert , 2008).

7. The variety of OSS licenses available is confusing, as there is a lack of guidance on how to interpret them (Tiangco ,Stockwell ,Sapsford ,Rainer, 2005).When adopting OSS and in particular when integrating OSS into derivative software systems, it may be challenging to combine code under an OSS licenses with proprietary licenses and Application Programming Interfaces (APIs) (Jaaksi, 2007).
8. There will be Potential interoperability problems for the hardware installed. This may be a reason for the public sector not to work with OSS. Printers, scanners, video cards and other hardware require drivers to be supported (recognized by the operating system). It may take much longer for OSS systems to obtain these drivers and support (European Commission, DG Enterprise, 2001).
9. The number of available commercial applications that can run on OSS operating systems is relatively small compared to those available for Windows and for the proprietary UNIX (European Commission, DG Enterprise, 2001). This is more a limitation than a risk. There are a great professional teams all around the world

continuously develop new competitive OSS application products. We can conclude that this risk will be easily mitigated over time.

4.4.2 Mitigating Risks Related to OSS Adoption

As mentioned in the previous section, there are some risks that may hamper OSS adoption in Palestine. But, most of these risks can be mitigated by performing some actions by the Palestinian government. The Palestinian government needs to review some best practices and case studies for some countries that were successful in OSS adoption. The following are some recommendations for mitigating the previously mentioned risks of OSS adoption in the Palestinian public sector agencies and the e-government program:

1. If the Palestinian government has taken a decision to adopt OSS, it should communicate directly with the large suppliers who are always providing support for GNU/Linux operating system like IBM, Sun and HP.
2. OSS applications should be well advertised to the Palestinian government. Here is the role of the Palestinian open source community of practice is clear. This community of practice should have a key role in advertising OSS applications, its objectives and benefits and how these applications can be supported. This will help the Palestinian government to identify the OSS applications that well suit the Palestinian government needs.
3. The Palestinian government must understand how to migrate from a

single supplier set to a more diverse product set. This can be performed by studying the best practices of some other countries that already adopted OSS like UK, France, India and Denmark.

4. There are some OSS experts in the Palestinian Government Computer Center (GCC). So, free in-house OSS training courses can be held for all IT employees working in the Palestinian public sector agencies. In addition, there are some governments that had volunteered to technically and financially support the Palestinian e-government program like the Estonian government. So, the Palestinian government can save the training costs. We can conclude that the risks of additional costs of OSS adoption can be easily mitigated.
5. The external resources like Printers, scanners, video cards and other hardware that require drivers to be supported can be connected to other servers that have an operating system that supports their drivers.

4.5 Data Analysis

Data analysis is statistically based on some hypotheses. These hypotheses were mentioned in chapter 1. Statistical analysis tools will be used to analyze data and getting the results. The researched had used SPSS program for analyzing data and achieving the results.

4.5.1 The Technical Infrastructure Readiness for OSS Adoption in Palestine

The first tested hypothesis as stated in chapter 1 claimed that the technical infrastructure in the Palestinian government agencies is well ready when the change to adopt OSS is going to happen.

In order to test the validity of this hypothesis, the researcher used the Chi square analysis tool. This tool always used to check the relations between two different questions or factors and see whether it is dependent or independent. The researcher used SPSS to calculate the value of chi-square. In order to prove this hypothesis; two major questions already included in the structured interview were selected and studied carefully by the researcher to check the relation between them. The researcher aimed to test the validity of this hypothesis according to the result of chi square test that had conducted on these selected two questions. Table 4.13 shows the cross tabulation table for the two variables (factors) that had been tested together to test the validity of hypothesis 1.

Table 4.13: Cross Tabulation for infrastructure readiness for OSS adoption testing factors

X1 * X2 Cross Tabulation				
		X2		Total
		NO	YES	
X1	NO	1	3	4
	YES	22	4	26
Total		23	7	30

Table 4.14 shows the result of chi square test for hypothesis 1 stated in chapter 1. The criteria that had been used in this test were as the following: If the pairs of variables are dependent, there is a relation to prove that the technical infrastructure in the Palestinian government agencies is well ready to adopt OSS. Whereas, if the pairs of variables are independent that leads us to conclude that the infrastructure is not well ready to adopt OSS in Palestine.

The two variables that the chi square test had been conducted on were:

X1: Is the current technical infrastructure in the government agencies support open source?

X2: Are there technical problems that hamper the adoption of open source?

According to Table 4.14, the two variables were dependent; that led the researcher to conclude that the technical infrastructure in the Palestinian government agencies is well ready to adopt OSS. So, this chi square test affirms the validity of the researcher’s first hypothesis (hypothesis 1)

Table 4.14: The Technical Infrastructure Readiness for OSS Adoption in Palestine Test

The Technical Infrastructure Readiness for OSS Adoption in Palestine Test	
First Variable (X1)	Is the current technical infrastructure in the government agencies support open source?
Second Variable (X2)	Are there technical problems that hamper the adoption of open source?
Null Hypothesis	Two variables are independent
Adverse Hypothesis	Two variables are dependent
Alpha Level of Significance	0.05
Degrees of Freedom	1
Critical Value for Alpha	3.84
Chi Square	6.887
Conclusion	As chi square value (6.887) exceeds alpha critical value (3.84), then the null hypothesis can be rejected, so we can say that there is a dependency between the answers of two questions and that leads to say that the technical infrastructure is well ready for OSS adoption in Palestine

4.5.2 Government Support for OSS Adoption in Palestine

The second tested hypothesis as stated in chapter 1 claimed that there was no enough support or decisions made by the Palestinian government that encourages the Palestinian government agencies to adopt OSS.

In order to test the validity of this hypothesis, the researcher used also the Chi square analysis tool. In order to check the validity of this hypothesis; two major questions included in the structured interview were selected and studied carefully by the researcher to check the relation between them. The researcher aimed to test the validity of this hypothesis (hypothesis 2) according to the result of chi square test that had conducted on these selected two questions.

The two variables that the chi square test had been conducted on were:

Y1: Is the emphasis on open source adoption on the Palestinian e-government strategic plan adequate?

Y2: Is there a change management plan that can be needed when open source adopted?

Table 4.15 shows the cross tabulation table for the two variables (Y1, Y2) that had been tested together to test the validity of hypothesis.

Table 4.15: Cross Tabulation Table for Government Support for OSS adoption in Palestine

Y1 * Y2 Cross tabulation				
		Y2		Total
		NO	YES	
Y1	NO	26	2	28
	YES	2	0	2
	Total	28	2	30

Table 4.16: Government Support for OSS Adoption in Palestine Test

Government Support for OSS Adoption in Palestine Test	
First Variable (Y1)	Is the emphasis on open source adoption on the Palestinian e-government strategic plan adequate?
Second Variable (Y2)	Is there a change management plan that can be needed when open source adopted?
Null Hypothesis	Two variables are independent
Adverse Hypothesis	Two variables are dependent
Alpha Level of Significance	0.05
Degrees of Freedom	1
Critical Value for Alpha	3.84
Chi Square	0.153
Conclusion	As chi square value (0.153) does not exceed alpha critical value (3.84), then the null hypothesis cannot be rejected, so we can say that there is a conflict between the answers of two questions and that leads to say that the Palestinian government doesn't support and encourages the government agencies to adopt OSS but it supports verbally

Table 4.16 shows the result of chi square test for hypothesis 2 stated in chapter 1. The criteria that had been used in this test were as the following: If the pairs of variables are independent, there is no relation between the two questions which prove that there was no enough support or decisions made by the Palestinian government that encourages the Palestinian government agencies to adopt OSS. Whereas, if the pairs of variables are dependent that leads us to conclude that there was an adequate support by the Palestinian government to adopt OSS in the Palestinian government agencies and the e-government program.

According to the result of chi square test for the two indicated variables (Table 4.15), the researcher had ensured that his hypothesis was also valid since the two variables were independent. The researcher had concluded that the Palestinian government has to make some decisions that force the Palestinian government agencies to adopt OSS; also, the Palestinian government should prepare OSS strategic plan and a change management plan to lead the process of the change from proprietary software to OSS.

4.6 Findings and Conclusions

This section was intended to gather the findings and conclusions of the feasibility assessment of OSS adoption in the Palestinian public sector agencies and the e-government program. This was the first research objective as indicated in chapter 1. In addition, the first research question stated in chapter 1 was: Is open source feasible in the Palestinian e-government context?

This chapter was also intended to answer this research question. In addition, the main opportunities and challenges of OSS adoption in the Palestinian public sector agencies and the e-government program were also listed in details.

4.6.1 The Key Findings and Conclusions

Based on the data collected from the structured interviews conducted with Palestinian e-government team members and the heads of IT departments at most ministries and public sector agencies in Palestine, the key findings the researcher gained were as the following:

1. There is an available adequate budget to change from proprietary software to OSS in the Palestinian public sector agencies and then in the e-government program since the cost of OSS is low, but there is no special budget for software in government
2. The lower costs of OSS compared with proprietary software will be the key reason for OSS adoption in the Palestinian public sector agencies. Because the financial factor is the most important factor in Palestine as it is a developing country and its economy relies heavily on the European financial support. In addition, other factors like better reliability, vendor lock-in avoidance, possible customizability, more stability, more flexibility and freedom, better support and accountability, better software quality, and better security were also important for OSS adoption in the Palestinian public sector agencies and the e-government program. But, the awareness of these benefits

of OSS among the IT specialists in the Palestinian public sector agencies was low

3. There will be additional needed costs for upgrading the current internal technical infrastructure in the Palestinian public sector agencies to be suitable for OSS adoption.
4. There wasn't a dedicated budget neither for software development and maintenance nor for IT training. But, if any Palestinian government agency needs financial resources for these issues it can relies on some European countries aid like GIZ, UK, Sweden, Estonia, Malta, OECD…etc. In addition, most of the Palestinian public sector agencies had already employed qualified IT professionals who are responsible for software development and maintenance. The Government Computer Center (GCC) is also responsible for developing the needed software applications (information systems) and websites to meet the public sector agencies' needs. That led the researcher to conclude that there is a need for dedicating a part of the total budget for software development and maintenance. In addition, there should be outsourcing, and the public sector should be responsible for policy making.
5. We can consider that the current technical IT infrastructure at all public sector agencies in Palestine is ready for OSS adoption. Where there are no technical problems that may hamper OSS adoption. In addition, many Palestinian public sector agencies had already

adopted OSS in some of their applications. This fact assured that the current technical IT infrastructure in the Palestinian public sector agencies supports OSS. But, the problem was that the current IT infrastructure doesn't support the open standards. Another problem was that there is neither unified ontology nor interoperability standards among the Palestinian public sector agencies yet. The good news is that the Palestinian e-government team is working on establishing a unified ontology and interoperability standards to be used in the near future for data exchange among all public sector agencies in Palestine (Zinnar.ps) (Dr.Safa' Nasser El Din, 2011). The e-government team is also studying to upgrade the current technical infrastructure to suit open standards adoption (Dr.Safa' Nasser El Din, Omar Al-Maslamani, 2011)

6. The number of trained professionals and experts on OSS in both public and private sectors in Palestine is inadequate to organize and perform shared projects with the government. This will also complicate the activities done to adopt OSS in the Palestinian public sector agencies and the e-government program. On the other hand, the number of the Palestinian IT corporations can be considered inadequate to organize and perform OSS IT projects coordinated and cooperated with the government. This problem can be easily treated since there is cooperation between the Palestinian government and some outside experts that continuously being enhanced for knowledge exchange. In addition, there are some governments that

had volunteered to help the Palestinian government in applying its e-government program. These governments can provide the Palestinian government with administrative and technical support. So, when the Palestinian e-government team decides to adopt OSS in the e-government program; theses donor governments can provide the Palestinian e-government team with the needed experts on OSS.

7. There is a special community of practice in Palestine. This community includes many volunteers interested in OSS development. This community can help the Palestinian government and provide it with detailed information and experiences when the decision to adopt OSS in the Palestinian public sector agencies and the e-government program is being made
8. The seriousness in applying the e-government program in Palestine is high. But, the governmental support was inadequate. Applying e-government program requires more and more support (resources, cooperation enforcement, administrative and political decisions)
9. The Palestinian government is interested in OSS adoption in the e-government program
10. The Palestinian government didn't make a study and analysis of some case studies for other countries that had already adopted OSS in their e-government programs
11. The Palestinian government continuously enforces the cooperation among different ministries, institutions, and even departments. But,

this enforcement is inadequate. What we need is a strict decision that abides all Palestinian public sector agencies to cooperate

12. The Palestinian government has not been interested in performing some activities that may raise the awareness of OSS adoption objectives and benefits among the IT staff in both public and private sectors. Such activities are like holding in-house workshops and conferences and nominating some experts to attend local and international workshops and conferences
13. The lack of the awareness of the objectives and benefits of OSS adoption among the Palestinian public sector agencies formulated one of the major challenges against OSS adoption in the public sector agencies and the e-government program in Palestine. But, this challenge can be treated by the Palestinian government in many ways. This will be explained in details in chapter 5
14. There is no methodology for exchanging information among the Palestinian government agencies. But, the Palestinian e-government team is currently working on establishing governmental unified network that will facilitate data exchange among different public sector agencies in Palestine
15. There are some shared projects among different Palestinian public sector agencies like Bisan Accounting System which had been purchased by the Ministry of Finance. This application had been generalized to be used at all Palestinian public sector agencies. This application is used for performing and organizing the internal

operations in each agency in a shared manner with other agencies. In addition, there are shared projects between the Ministry of Transport and Interior and police among others. Another shared project is between Ministry of Transport and Interior and Ministry of Health and e-Government core team (inter ministerial committee) (Dr.Safa' Nasser El Din, 2011)

16. There needs to be a study to check the compatibility of installed hardware like printers with OSS (availability of drivers)

4.6.2 Opportunities and Challenges of OSS Adoption in Palestine

Adopting OSS in the Palestinian public sector agencies and the e government program has the following opportunities:

1. OSS adoption will decrease the Total Cost of Ownership
2. Any additional budget needed for IT training when the decision of adopting OSS is being made will be covered by the donor countries
3. The current IT technical infrastructure at all public sector agencies supports OSS
4. The current IT technical infrastructure at all Palestinian public sector agencies is ready to change to OSS at anytime.
5. The Palestinian e-government team is currently working on establishing special open standards to be used in the e-government program

6. The Palestinian government is currently working on developing a unified ontology to be used among all public sector agencies aiming to resolve inconsistency during data exchange
7. The Palestinian e-government team is currently working on establishing interoperability standards that are also needed for data exchange among different public sector agencies in Palestine
8. There is a high cooperation between the Palestinian government and outside experts. This can help in knowledge exchange
9. There are an inadequate number of IT corporations to organize and perform shared projects coordinated with the Palestinian government
10. We have a special OSS community of practice in Palestine. The members of this community have a good willingness to help the Palestinian government to change its systems to OSS
11. Some OSS applications are already being used in some public sector agencies in Palestine

Adopting OSS in the Palestinian public sector agencies and the e-government program has also some challenges. The following are the major challenges that may hamper OSS adoption:

1. The Palestinian government did not dedicate special budget neither for software development and maintenance nor for IT training in the Palestinian public sector agencies
2. There were inadequate Palestinian OSS experts in Palestine
3. The Palestinian government interest in OSS adoption in the public sector agencies is good but the enforcement for doing this is low

4. The Palestinian government does not have a policy to enforce all Palestinian public sector agencies to cooperate
5. The Palestinian e-government strategic plan included the idea and the principle of OSS adoption in the Palestinian e-government program. But, there were no actual action plans to achieve this
6. The Palestinian e-government team is not so interested in studying and comparing e-government applications in countries that fully adopted OSS with others that did not at all
7. Most newly developed information systems at the Palestinian public sector agencies have not used OSS applications and programming languages before
8. The attitude toward using open standards in the Palestinian public sector agencies is low
9. The level of Palestinian government's interest in OSS adoption in the Palestinian public sector agencies is low
10. The level of awareness of the objectives and benefits of OSS adoption among the Palestinian public sector decision makers and employees is low
11. The Palestinian government hadn't performed special activities aimed to raise the awareness of OSS adoption objectives and benefits among public sector decision makers and employees. That led us to conclude that the Palestinian government is not so interested in OSS adoption in Palestine

12. There is no facility for exchanging data among different public sector agencies in Palestine

4.6.3 Feasibility of OSS Adoption in the Palestinian Public Sector Agencies and the e-Government Program

In our case the word feasible means: capable of being carried out, achievable, practicable, appropriate, and profitable.

The first research objective (as indicated in chapter 1) was to assess the feasibility of OSS adoption in the Palestinian e-government program. In addition, the first research question was also aimed to check whether the OSS is feasible to be adopted in the Palestinian e-government context or not.

The researcher had concluded that the OSS is feasible to be adopted in the Palestinian public sector agencies and the e-government program. This conclusion had been drawn based on the findings listed in the previous sub-section. Where OSS decreases the total costs and enhances the Public-Private-Partnership (PPP) which has a positive impact on the Palestinian economic development. So, it is a profitable choice when compared with proprietary software, also it will be an appropriate choice for decision makers. In addition, the current IT technical infrastructure in the Palestinian public sector agencies fully supports OSS and is ready to change to OSS without any expected technical problems. This leads the researcher to conclude that OSS is a practicable and achievable choice. The high degree of cooperation between the Palestinian government and some

donor governments that volunteered to help in developing the Palestinian e-government program like Estonian government had raised the needed experience to adopt OSS in the Palestinian e-government program. These makes OSS achievable and capable of being carried out.

All of the above had led the researcher to conclude that OSS is feasible to be adopted in the Palestinian public sector agencies and the e-government program.

Chapter 5

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Thesis Conclusions Summary

The researcher started his thesis by introducing research objectives, and defining the problem. He aimed to assess the feasibility of OSS adoption in the Palestinian e-government program after identifying the opportunities, challenges and the expected impact of OSS adoption on the Palestinian e-government context.

Inductive researching approach had been used, and the data was collected using structured interviews with the Palestinian e-government team members and heads of IT departments in all public sector agencies including ministries. The sample consisted of 30 persons. The researcher developed six main measures to be checked for identifying the major opportunities and challenges of OSS adoption in the Palestinian e-government program. In addition, the researcher reviewed the literature to draw the expected impact of OSS adoption on the Palestinian e-government program. Based on these studied measures which are: financial resources availability, infrastructure readiness, experience and support availability, available leadership and support, OSS awareness, and cross-agency cooperation among Palestinian public sector agencies; the researcher had been ready to devise conclusions.

It can be concluded that the expected cost savings when adopting OSS will be the major driver that may lead the Palestinian government to adopt OSS

in the public sector and the e-government program because our economy extremely depends on the external financial support. So, there were no financial limitations that may hamper OSS adoption in the Palestinian e-government program. Studying the current IT technical infrastructure in the Palestinian public sector agencies showed that there is a good opportunity for OSS adoption in the future with no technical problems. No worries about the unified ontology and interoperability standards because the progress of constructing a proper ontology and efficient interoperability standards is going well.

The availability of needed expertise and support in Palestine had been carefully studied. There is some experience in OSS among IT professionals working in the Palestinian public sector agencies but it is inadequate. Where there is a shortage in the number of OSS experts in both public and private sectors. So, there is a problem in the needed experience and little internal technical support will be available when OSS is being adopted in the Palestinian public sector agencies and the e-government program. This may be a big challenge against OSS adoption in the Palestinian e-government program.

It is clear that the Palestinian government is so serious in implementing the e-government program. But, this seriousness also requires more and more support and actions in order to achieve the purpose of having an e-government program. The Palestinian e-government team needs a higher top level governmental leadership and support, more power and more authority. This is intended to enforce cooperation among different

government agencies. In addition, the e-government team needs to be authorized to make a decision that forces all public sector agencies to adopt OSS applications. That is because the current governmental leadership and support for the Palestinian e-government team is low; where the Palestinian government's attitude is not directed toward full adoption of OSS. Another challenge that comes against OSS adoption in the Palestinian e-government program is that there is a lack of awareness of the objectives and benefits of OSS adoption among the Palestinian government agencies which may decrease the Palestinian government attitude toward OSS adoption. Furthermore, both technical and managerial issues can be considered as obstacles of cross-agency cooperation since the current network technical infrastructure in the Palestinian public sector agencies doesn't support data exchange among different agencies. As mentioned before there is also no governmental high level policy that forces such needed cooperation among different public sector agencies. This will lead to difficulty in exchanging data among the Palestinian public sector agencies and formulate a big challenge against the e-government program itself.

OSS adoption has a good economic impact on the Palestinian public sector agencies and the e-government program; where it can help the Palestinian government to save a total of 1508100$/year at all public sector agencies. OSS adoption has also a positive impact on innovation, software quality, and the overall software development in Palestine. Since, the code is available to be debugged and modified by many IT professionals in the country. OSS adoption also has a positive impact on the performance of the

Palestinian government information systems. Since OSS can improve systems reliability, stability, interoperability and it can lead to operational ease. In addition, OSS adoption has a positive impact on the security of the Palestinian government information systems. OSS adoption in Palestine has a positive impact on the employment in Palestine. OSS adoption can improve the interoperability which helps in facilitating data exchange among different public sector agencies in Palestine. Finally, OSS adoption has a positive impact on the national development; where it encourages and allows for more local software development and support; it is also going to help in increased investment in the local economy and broader participation by the Palestinians' companies in the domestic and regional economy.

The previous conclusions can be summarized as: Full adoption of OSS in the Palestinian e-government program has a positive impact on: Palestinian economy, innovation, software quality, software development in Palestine, performance of the Palestinian government information systems, security of the Palestinian government information systems, employment in the Palestinian public sector agencies, interoperability among public sector agencies and national development. There are no problems on both financial resources availability and the infrastructure readiness to adopt OSS in the Palestinian e-government program. But, there are some problems in the current OSS experience, the governmental top level leadership and support, the awareness of OSS objectives and benefits and cross-agency cooperation. In addition, there is no special budget for software in government. These problems may hamper OSS adoption in the

Palestinian e-government program. But, if the Palestinian government become aware of the objectives and benefits they will gain when adopted OSS they can resolve all of these problems.

5.2 Recommendations

After the efforts which have been made in order to study and assess the current attitude toward OSS adoption in the Palestinian e-government program, and after presenting the above conclusions, the researcher had suggested the following recommendation that can help the Palestinian government to adopt OSS and develop a strategic plan for this purpose, when a decision for OSS adoption is being made by the Palestinian e-government program:

1. Every Palestinian public sector agency should dedicate specific budget for IT training to develop the skills of the IT professionals working in its IT department
2. The Palestinian government needs to measure the size of the workforce in the activities of information and communication technology. In addition, a special categorization model based on the disciplines of information and communication technology should be adopted in the Palestinian public sector agencies
3. The Palestinian government should encourage Public- Private-Partnership (PPP) through supporting the current IT corporations and by supporting the establishment of new IT corporations in Palestine

4. The Palestinian e-government team should be authorized to have higher privileges to make a higher level decision that force all Palestinian sector agencies to adopt OSS
5. The Palestinian e-government team members should work in studying, analyzing and evaluating of the best practices of many countries that had already adopted OSS in the e-government program
6. Both public and private sector organizations have to create facilities, such as laboratories or workshops, where employees and users can sample and test OSS technologies. This will help in demonstrating the potential of OSS and convince users about its viability. It will also counter un-founded notions about OSS products and their usability. This will also develop the capabilities and skills of the employees working in the Palestinian public sector agencies
7. The Palestinian government should encourage and support the Palestinian open source community of practice. The Palestinian government should also continuously cooperate with this community of practice
8. The Palestinian e-government team should work on increasing the interest of OSS adoption in the Palestinian public sector agencies, and make a decision that force public sector agencies to adopt OSS. Because it is impossible to adopt OSS in the e-government program without having OSS being adopted in the Palestinian public sector agencies before

9. The Palestinian government should create a supportive OSS environment by building knowledge, supporting broad OSS Research and Development initiatives, enforcing and giving preference to the use of OSS, and encouraging the trial use of OSS
10. The Palestinian public sector agencies should work together to develop a special strategic plan for OSS adoption, when the decision is being made by the government
11. The Palestinian public sector agencies should work together to prepare a change management plan before the decision to adopt OSS is being made. This plan can help in managing the change from proprietary software to OSS and managing the resistance to change
12. The Palestinian government should work in improving the awareness of OSS adoption objectives and benefits among IT staff at all public and private sector agencies. This can be achieved by holding local workshops and conferences talking about OSS, conducting in-house professional training courses about OSS for all IT employees working in the public sector, and participating in the international workshops and conferences by choosing the best suitable professionals and sending them to attend such events in order to develop their experience. This can be reflected on the whole public sector performance when deciding to adopt OSS
13. The Palestinian government should make a decision that enforces cross-agency cooperation among the public sector agencies. This

decision should be binding for public sector agencies to cooperate with each other

14. The Government Computer Center (GCC) should improve the construction of the under-construction unified governmental network to support cross-agency cooperation to facilitate data exchange among different agencies and saves time and efforts
15. The Palestinian government should develop the current e-government team to be multi-functional team. In addition, the chiefs of all IT departments at all public sector agencies should be included in the team, since every one of them is more aware of the requirements of his/her agency

Appendices

Appendix A

Interview Questions –English Version

Interviewee Name: **……..**
Interviewee administrative position: ……
Place of the interview……
Interview Date: **……**

Questions:

1) Feasibility of open source in Palestinian e-government context.
    a) Monetary Resources:

    1. Do you think that the cheap or free license feature of open source will have a positive impact on open source adoption?(Yes/No)
    2. If open source is being adopted, do you think that the low cost of this technology will be the major reason for adoption? (Yes/No)
    3. If the infrastructures in the government agencies need to be upgraded to suit the adoption of open source software, is the cost of this upgrade high? (Yes/ No)
    4. Do you think that there is an available budget for new open source projects? (Yes/No).
    5. What is the percentage of the budget dedicated for software development and maintenance related to the overall budget annually?
    6. Is there an annual budget for IT training? (Yes/No)
    7. In case there is an annul budget for IT training, what is the percentage of this budget related to the overall budget annually?

    b) infrastructure:
    1. Is open source already being used in some government agencies in Palestine? (Yes/No)

2. Are there any technical problems that hamper the adoption of open source? (Yes/ No)
3. What is the level of government agencies technical readiness to change to open source? (very low/ low/ very high/ high)
4. Does the current technical infrastructure in the government agencies support open source? (Yes/No)
5. Does the current technical infrastructure in the government agencies support open standards? (Yes/No)
6. In case there is an open-standards support in the government agencies, what are there?
7. Have the government agencies a particular ontology? (Yes/No)
8. Are there interoperability standards among different ministries and government agencies? (Yes/No)
9. Are you convinced that the open source environment is more secure than proprietary software environment? (Yes/No)

c) <u>experience and support:</u>

1. Are there enough trained experts on open source in the public sector agencies? (Yes/No)
2. How Palestinian open source communities of practice in open source can help the government to adopt open source in the government agencies?
3. Is there cooperation between the Palestinian government and outside experts to exchange knowledge?(Yes/No)
4. Does the Palestinian government have benefited form the experience of other governments on open source adoption on their e-government program? (Yes/No)
5. Is the number of companies adequate to organize and perform projects coordinated with government? (Yes/No)
6. Is the number of open source experts adequate to organize and perform projects coordinated with government? (Yes/No)

d) <u>Leadership Support:</u>

1. Is the emphasis on open source adoption on the Palestinian e-government strategy adequate? (Yes/No)
2. What is the level of interest in open source adoption in the government agencies? (very Low/ Low/ very High/ High/None)

3. What is the level of interest in open source adoption in Palestinian e-government program? (very Low/ Low/ very High/ High)
4. Is it easy to prepare a strategic plan to adopt open source? (Yes/No)?
5. Is there a change management plan that can be needed when open source adopted? (Yes/ No)

6. Did the government evaluate e-government applications developed using open source with other applications developed using proprietary software? (Yes/No)
7. Did the government make a study and analysis of some case studies for countries that use open source in their e-government programs? (Yes/No)
8. Are newly developed Information Systems in the government agencies used open source technology? (Yes/No)
9. Is there an reinforcement for using open standards in government agencies?(Yes/No)
10. How serious is the Palestinian government in applying e-government program? (very low/ low/very high/high)
11. Is there an enforcement of cooperation among different ministries, institutions and even departments by the Palestinian government? (Yes/No)
12. What is the level of support offered by the government to perform e-government program (Resources, cooperation enforcement, etc…)? (very low/low/very high/high)

e) Awareness:

1. Does Palestinian government continuously holds workshops and conferences to increase the awareness of the benefits of open source? (Yes/No)
2. What is the level of awareness of the objectives of open source adoption of? (very low/ low/ very high /high)
3. What is the level of awareness of the benefits of open source adoption? (very low/ low/ very high /high)
4. Is the Palestinian government always interested in nominating some of its experts to attend local and international workshops and conferences? (Yes/No)

f) Cross-agency Cooperation:

1. What is the number of projects that are shared among different ministries?
2. Is there a methodology for data exchange among different Palestinian government agencies? (Yes/No)

Appendix B

Interview Questions –Arabic Version

اسم الشخص المقابل:.....
الموقع الإداري للشخص المقابل:.....
مكان المقابلة.....
تاريخ المقابلة.....

أسئلة المقابلة

القسم الأول: المصادر المالية:

1) هل تعتقد أن ميزه رخص ثمن أو عدم وجود رخصه مدفوعة الثمن للبرمجيات المفتوحة المصدر له أثر ايجابي على تبني البرمجيات المفتوحة المصدر؟ (نعم/لا)
2) هل تعتقد أن السبب الرئيس لتبني البرمجيات المفتوحة المصدر هو التكلفة المنخفضة لهذه التكنولوجيا ؟ (نعم/لا)
3) في حال ترقيه البنية التحتية التقنية للمؤسسات الحكومية لكي تلاءم تبني البرمجيات المفتوحة المصدر، هل تعتبر تكلفه هذه الترقية عاليه نسبيا؟ (نعم/لا)
4) هل تعتقد توفر ميزانية كافية لدى الحكومة لتنفيذ مشاريع جديدة تستخدم البرمجيات المفتوحة المصدر؟ (نعم/لا)
5) كم هي نسبة الميزانية المخصصة لتطوير وصيانة البرمجيات بالنسبة للميزانية الكلية سنويا ؟
6) هل يوجد ميزانيه سنوية في المؤسسات الحكومية لتطوير وتدريب الكوادر على النظم والبرمجيات الحديثة؟ (نعم/لا)
7) في حال وجود ميزانيه سنوية في المؤسسات الحكومية لتطوير وتدريب الكوادر على النظم والبرمجيات الحديثة، كم هي نسبه هذه الميزانية بالنسبة للميزانية السنوية الكلية؟

القسم الثاني: البنية التحتية:

1) هل تستخدم البرمجيات المفتوحة المصدر في المؤسسات الحكومية في الوقت الراهن؟ (نعم/لا)
2) هل يوجد بعض المشاكل التقنية التي من الممكن أن تعوق تبني واستخدام البرمجيات المفتوحة المصدر؟ (نعم/لا)
3) ما هو مدى الجاهزية التقنية للتحول إلى البرمجيات المفتوحة المصدر؟ (منخفض جدا/منخفض/مرتفع جدا/مرتفع)
4) هل تدعم البنية التحتية التقنية الحالية للمؤسسات الحكومية استخدام البرمجيات المفتوحة المصدر؟ (نعم/لا)
5) هل تدعم البنية التحتية التقنية الحالية للمؤسسات الحكومية استخدام ال (open standards) ؟ (نعم/لا)
6) ما هي ال (open standards) التي تدعمها البنية التحتية التقنية الحالية للمؤسسات الحكومية؟

7) هل تمتلك المؤسسات الحكومة (ontology) موحدا خاصا بها؟ (نعم/لا)
8) هل يوجد معايير للتوافقية (**interoperability standards**) بين الوزارات والمؤسسات الحكومية المختلفة؟ (نعم/لا)
9) هل أنت مقتنع أن بيئة البرمجيات المفتوحة المصدر أكثر أمانا من بيئة البرمجيات التجارية الاحتكارية؟ (نعم/لا)

القسم الثالث: الخبرة والدعم الفني:

1) هل يتوافر عدد كافي من الخبراء المدربين في مجال البرمجيات المفتوحة المصدر في مؤسسات القطاع العام؟ (نعم/لا)
2) ما هي المساعدة التي يمكن أن تقدمها مجتمعات وتجمعات المهتمين بالبرمجيات المفتوحة المصدر لأجل تبني هذه البرمجيات في مؤسسات الحكومة الفلسطينية؟
3) هل يوجد علاقات تعاون بين مؤسسات الحكومة الفلسطينية وجهات خارجية من الخبراء لتبادل المعرفة؟ (نعم/لا)
4) هل استفادت الحكومة الفلسطينية من خبرة الحكومات الأخرى التي تبنت البرمجيات المفتوحة المصدر في برامج الحكومة الالكترونية الخاصة بها؟ (نعم/لا)
5) هل يعتبر عدد شركات تكنولوجيا المعلومات في فلسطين كافي لتنفيذ مشاريع مشتركة مع الحكومة؟ (نعم/لا)
6) هل يعتبر عدد الخبراء في البرمجيات المفتوحة المصدر كافي لتنفيذ مشاريع مشتركة مع الحكومة؟ (نعم/لا)

القسم الرابع: الدعم الإداري:

1) هل التأكيد على استخدام البرمجيات المفتوحة المصدر في الخطة الإستراتيجية للحكومة الالكترونية الفلسطينية يعد كافيا؟ (نعم/لا)
2) ما هي درجة اهتمام الحكومة بتبني البرمجيات المفتوحة المصدر في المؤسسات الحكومية؟ (منخفض جدا/منخفض/مرتفع جدا/مرتفع)
3) ما هي درجة اهتمام الحكومة بتبني البرمجيات المفتوحة المصدر في برنامج الحكومة الالكترونية الخاص بها؟ (منخفض جدا/منخفض/مرتفع جدا/مرتفع)
4) هل من السهل إعداد خطة إستراتيجية لتبني البرمجيات المفتوحة المصدر؟ (نعم/لا)
5) هل يتوفر لدى الحكومة خطة لإدارة التغيير لكي تساعد في التغيير إلى البرمجيات المفتوحة المصدر؟ (نعم/لا)
6) هل قامت الحكومة بإجراء تقييم ومقارنات بين برامج الحكومة الالكترونية التي استخدمت البرمجيات المفتوحة المصدر وبين التي استخدمت البرامج التجارية الاحتكارية؟ (نعم/لا)
7) هل قامت الحكومة بدراسة وتحليل بعض تجارب الدول التي استخدمت البرمجيات المفتوحة المصدر في برامج الحكومة الالكترونية الخاصة بها؟ (نعم/لا)
8) هل تستخدم البرامج التي يتم تطويرها حديثا في المؤسسات الحكومية البرمجيات المفتوحة المصدر؟ (نعم/لا)
9) هل هنالك توجه لاستخدام ال(open standards) في المؤسسات الحكومية؟ (نعم/لا)
10) ما هو مدى جدية الحكومة الفلسطينية في تطبيق برنامج الحكومة الالكترونية في فلسطين؟ (منخفض جدا/منخفض/مرتفع جدا/مرتفع)
11) هل هنالك تشجيع من قبل الحكومة على التعاون بين الوزارات، المؤسسات وحتى الدوائر والأقسام؟ (نعم/لا)

12) ما هو مدى الدعم الذي تقدمه الحكومة الفلسطينية لتنفيذ برنامج الحكومة الالكترونية من حيث توفير الموارد وتشجيع التعاون بين المؤسسات وغيرها؟ (منخفض جدا/منخفض/مرتفع جدا/مرتفع)

القسم الخامس: الإدراك:

1) هل تعقد الحكومة الفلسطينية مجموعة من ورشات العمل،الدورات والمؤتمرات العلمية بشكل مستمر لزيادة وعي وإدارك كافة كوادرها لفوائد وميزات البرمجيات المفتوحة المصدر؟(نعم/لا)
2) ما هي درجة الإدراك لأهداف استخدام البرمجيات المفتوحة المصدر لدى مؤسسات القطاع العام؟ (منخفض جدا/منخفض/مرتفع جدا/مرتفع)
3) ما هو مستوى إدراك مؤسسات القطاع العام لفوائد وأهمية تبني البرمجيات المفتوحة المصدر؟ (منخفض جدا/منخفض/مرتفع جدا/مرتفع)
4) هل يوجد اهتمام لدى الحكومة الفلسطينية لترشيح وإبتعاث بعض خبرائها لحضور ورشات عمل ومؤتمرات داخلية وخارجية لزيادة المعرفة لديهم؟ (نعم/لا)

القسم السادس: التعاون الداخلي بين المؤسسات المختلفة:

1) ما هو عدد المشاريع المشتركة بين الوزارات المختلفة؟
2) هل يوجد طريقة لتبادل المعلومات بسهولة بين مختلف مؤسسات القطاع العام؟ (نعم/لا)

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جامعة النجاح الوطنية

كلية الدراسات العليا

فرص وتحديات مبادرة البرمجيات المفتوحة المصدر في برنامج الحكومة الإلكترونية الفلسطينية

إعداد

فادي حسام سوقية

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قدمت هذه الأطروحة استكمالاً لمتطلبات درجة الماجستير في الإدارة الهندسية بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين

2011

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الملخص

يهدف هذا البحث إلى اكتشاف فرص وتحديات تبني البرمجيات المفتوحة المصدر في برنامج الحكومة الإلكترونية الفلسطينية. بالإضافة إلى ذلك، فان هذه الدراسة هدفت إلى تقييم جدوى تبني البرمجيات المفتوحة المصدر في برنامج الحكومة الإلكترونية الفلسطينية. هدفت هذه الدراسة أيضا إلى دراسة وذكر الأثر المتوقع لتبني البرمجيات المفتوحة المصدر في برنامج الحكومة الإلكترونية الفلسطيني بشكل كامل.

استخدم الباحث منهج البحث الاستنباطي لإدارة هذا البحث النوعي. تم استخدام المقابلات كوسيلة لجمع المعلومات حيث أن مجتمع الدراسة صغير الحجم. تم إجراء ما مجموعه ثلاثون مقابلة مع أعضاء فريق الحكومة الإلكترونية الفلسطينية ومدراء دوائر تكنولوجيا المعلومات في جميع مؤسسات القطاع العام الفلسطينية.

كشفت نتائج المقابلات أنه لا يوجد أي معوقات مالية ولا مشاكل تقنيه في البنية التحتية التكنولوجية الداخلية لمؤسسات القطاع الفلسطيني العام والتي من الممكن أن تعوق تبني البرمجيات المفتوحة

المصدر. من ناحية أخرى هنالك بعض المشاكل في مستوى إدراك أهداف وفوائد البرمجيات المفتوحة المصدر، الخبرة اللازمة، مستوى القيادة العليا والدعم من قبل الحكومة، و التعاون فيما بين المؤسسات الحكومية المختلفة، طرح الباحث بعض الاقتراحات والتوصيات لحل المشاكل الأنفة

الذكر والتي من الممكن أن تعوق تبني البرمجيات المفتوحة المصدر في برنامج الحكومة الإلكترونية الفلسطينية.

إذا قررت الحكومة الفلسطينية تبني البرمجيات المفتوحة المصدر في مؤسسات القطاع العام وبرنامج الحكومة الإلكترونية الخاص بها، فإن عملية التحول نحو البرمجيات المفتوحة المصدر سوف تكون أسهل مما هو متوقع. وذلك إذا أخذت الحكومة الفلسطينية التوصيات المذكورة في هذه الدراسة بعين الاعتبار.

يجب على الحكومة الفلسطينية بعد ذلك أن تعمل على تطوير خطة إستراتيجية لتبني البرمجيات المفتوحة المصدر في مؤسسات القطاع العام الفلسطيني وبعدها في برنامج الحكومة الإلكترونية الفلسطيني.