Factors influencing "Information Communication Technology (ICT)" Adoption in the Palestinian Blood Banks

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I dedicate my achievement to the one who took care of my steps and strengthened my resolve, to the one who lived for us to live a decent life in a generous home, to the one who I raised my head in pride...to my dear father, may God prolong his life.

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To those who shared my best prayers and wishes, and every companion and friend who wishes me success.

To the souls of those who narrated with their pure blood the soil to the homeland, Righteous martyrs

To the brave prisoners in the occupation prisons.

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Abstract

This cross-sectional research project tackles an essential prerequisite to increase the likelihood of successful implementation of Information Communication Technology (ICT) systems among the Palestinian blood banks. The thesis purpose of uncovering the influencing factors for better adoption of technology within a vital sector as healthcare. Hopefully, this effort guides improving blood donation, transfusion, and storage processes. The importance of this work derives from the vital role of blood management in healthcare settings. Directed by the Technological-Organizational-Environmental (TOE) theory of Tornatzky and Fleischer (1990), we target a population of candidates to empirically collect primary data to test our conceptual framework. The participants include top management, department administrators, doctors, ICT directors, system experts, record keepers, procurement officers, and blood banks/laboratory technicians. A mixed research approach survey (Quantitative and Qualitative) is employed to understand the given research problem better.

Questionnaires and interviews are used as means of data collection. The generated quantitative data are statistically described and tested, while the qualitative data are organized and categorized. Qualitative data helped to structure the proposed influencing factors and explain the quantitative results following a triangulation analysis. The results pinpoint many factors influencing ICT adoption in Palestinian blood banks: environmental, organizational, and technological factors. The qualitative analyses of interviews revealed the complexity and usability factors of the ICT technology, top management's lack of understanding of the need for ICT adoption and the attitude toward technology, and the lack of consistent training on ICT to the healthcare and ICT professionals.

On the other hand, the quantitative results confirmed the significant effects of ICT skills among users, the adequate infrastructure, cooperation with financial donors, and government

support in the form of policies. Therefore, the four key actors, the government, the project donors, management, and users, are called to allocate adequate resources to improve the influencing factors mentioned earlier. Our results are limited to West Bank and hard to generalize. However, further research may investigate blood banks in the Gaza Strip or the role of ICT in information sharing among the Palestinian blood banks.

الملخص

تتناول الرسالة شرطًا أساسيًا مسبقًا لزيادة فرص التنفيذ الناجح لأنظمة تكنولوجيا المعلومات والاتصالات بين بنوك الدم الفلسطينية. الغرض من الأطروحة هو الكشف عن العوامل المؤثرة بعملية تبني التكنولوجيا داخل قطاع حيوي مثل الرعاية الصحية وتحديدا بنوك الدم. نأمل أن يؤدي هذا الجهد إلى تحسين عمليات التبرع بالدم ونقل الدم والتخزين. تنبع أهمية هذا العمل من الدور الحيوي لإدارة الدم في سياق الرعاية الصحية. مسترشدين بالنظرية التكنولوجية–التنظيمية–البيئية (TOE) لتورناتسكي وفلايشر (1990)، استهدفت الدراسة لجمع البيانات الأولية لاختبار النموذج النظري للدراسة تجريبيًا. المشاركون في جمع البيانات هم الإدارة العليا، ومديري الأقسام، والأطباء، ومديري تكنولوجيا المعلومات والاتصالات، وخبراء النظام، وحافظي السجلات، وموظفي المشتريات، وفنيين من بنوك الدم والمختبرات. يتم استخدام مسح نهج البحث المختلط (الكمي والنوعي) لفهم مشكلة البحث المحددة بشكل أفضل. تستخدم الاستبيانات والمقابلات كوسيلة لجمع البيانات. يتم وصف البيانات الكمية الناتجة إحصائيًا واختبارها، في حين يتم تنظيم البيانات النوعية وتصنيفها حسب الموضوع. ساعدت البيانات النوعية في هيكلة العوامل المؤثرة المقترحة وشرح النتائج الكمية بعد التحليل.

حددت النتائج العديد من العوامل التي تؤثر على تبني تكنولوجيا المعلومات والاتصالات في بنوك الدم الفلسطينية. هذه هي العوامل البيئية والتنظيمية والتكنولوجية. كشفت التحليلات النوعية للمقابلات عن عوامل تكنولوجية مثل صعوبة وقابلية الاستخدام لتكنولوجيا تكنولوجيا المعلومات والاتصالات، وافتقار الإدارة العليا إلى فهم الحاجة إلى اعتماد تكنولوجيا المعلومات والاتصالات والموقف تجاه التكنولوجيا، ونقص التدريب المتسق على تكنولوجيا المعلومات والاتصالات لمتخصصي الرعاية الصحية وتكنولوجيا المعلومات والاتصالات. من ناحية أخرى، أكدت النتائج الكمية الآثار الكبيرة لمهارات تكنولوجيا المعلومات والاتصالات بين المستخدمين، والبنية التحتية الملائمة، والتعاون مع المانحين الماليين، والدعم الحكومي في تشكيل السياسات.

لذلك، فإن الجهات الفاعلة الرئيسية الأربعة؛ الحكومة والجهات المانحة للمشروع والإدارة والمستخدمين مدعوون إلى تخصيص موارد مرضية لتحسين العوامل المؤثرة المذكورة سابقًا. نتائجنا مقصورة على الضفة الغربية ويصعب تعميمها. ومع ذلك، فإن المزيد من البحث يساعد في فهم بنوك الدم في سواء الضفة الغربية أأو قطاع غزة، و دور تكنولوجيا المعلومات والاتصالات في تبادل المعلومات بين بنوك الدم وايضا المستشفيات الفلسطينية.

Chapter One

Introduction

1.1. Background of the study

The last few decades are known for technological happenings. These changes are driven mainly by information and Communication Technology (ICT). It has transformed the way people work, communicate, learn, live, and it continues to do so across the board, from computers to robots. This broad concept refers to all technologies and services related to computing, data processing, telecommunications, and the Internet. In some manner, all of these systems are involved with data transmission and receiving.

ICT's importance to economic development and business growth has been so monumental; many managers consider it a success when ICT infrastructure programs are completed on time and within budget. It allows organizations to be more efficient and effective by maintaining production, reducing management positions and unqualified employees, keeping employees more motivated, facilitating the innovation process by automating repetitive tasks, and improving information and decision flows (Platero Jaime et al., 2017). Therefore, organizations will only utilize ICT if they incorporate relevant functions into their everyday operations (Marques et al., 2011).

In the healthcare industry, the deployment of technologies like ICT has assisted in changing the face of healthcare delivery and health education for health professionals in many countries. And health care providers are under pressure to improve efficiency and patient safety against the increasing demand for health services. To do so, the role of these technologies, when effectively utilized, becomes critical to support achieving healthcare improvements.

Information and computer technology have been widely deployed in healthcare to overcome all the challenges facing healthcare. It assisted in changing the face of healthcare delivery and health education for health professionals in many countries. Improvement is driven by; better access, more accessible documentation, enhanced communication of their process, managing, and processing healthcare data, and sharing medical reports over large distances in a fraction of the previously requested time. As a result, more data can be processed quickly, obtaining more accurate data for timely decision-making. This would enhance individual health and patient safety, resulting in higher service quality, lower costs, and greater patient participation in health care processes (Aceto, Persico, and Pescapé 2018; David Blumenthal MD 2010; Nene, Olayemi, and Asamoah-Akuoko 2015; Yamin 2018).

The management of blood units represents an essential component of the healthcare system. The massive demand for blood puts hospitals and emergency care centers under strain. They must provide enough blood units to conduct transfusions and meet the surgical and emergency activities demand. Furthermore, despite developments in healthcare technology, blood remains a scarce commodity that cannot be manufactured like other products. Blood is a highly perishable good (Saad and Christensen 2019); therefore, blood is an exceptional and vital product in health care services.

To sum up, effective management of blood banks is a challenge for healthcare providers. The rising population has made achieving affordable and adequate health services a big challenge in developing countries. Information Systems (IS) and ICT in blood banking facilities can simplify their activities, help to reduce their workload and reduce the number of "wrong blood" incidents (Li, Chao, and Dong 2007). The contribution of ICT to improve the performance of this vital part in healthcare provision is unavoidable. However, better adoption of ICT systems increases the likelihood of achieving the agreed-upon positive impact on

performance. Hence, this thesis investigates the factors influencing ICT adoption in the Palestinian Blood Banks.

1.2. Research Problem.

In the face of the tremendous amount of data and information in a daily interval, various errors inevitably lead to significant risks in the procedure of blood donation, storage, and transfusion service. Blood banks must ensure safety for both the patient and the donor. They have to be careful that blood units are free of infectious diseases by accurately conducting all the necessary medical tests, adopting documented working procedures, and being consistent with the medical protocol's requirements. Blood products have to be controlled adequately by using an established mechanism. The inventory of blood units, their expiration, and the predicted demand need scientific estimation methods to meet patients' blood requirements.

The literature suggests better communication, cooperation, and information exchange (such as inventory data and donors' profiles) between the blood transfusion centers and bridging the gap between blood suppliers and blood users to improve performance (Li et al. 2007; Nene et al. 2015; Tanni et al. 2011). According to Li (2007), the complete documentation and the introduction of ICT in blood banks would increase the performance, relieve workload and reduce the incidence of "wrong blood" episodes.

Many studies provide pieces of evidence on the benefits of using Information and Communication Technology (ICT) to overcome the health sector's challenges, including blood banking services. Ross (2016) emphasized the essential role of communication technology in solving problems facing healthcare systems. The migration to electronic medical records and ICT use are critical drivers in enhancing the services provided to patients in the healthcare sector (Abouzahra 2011; Nyaggah 2015).

Given the life-threatening nature of managing blood and its components, the prevailing management practices in the Blood Banks of the Palestinian hospitals are outdated (Tanni et al., 2011). The Palestinian public healthcare system is burdened and characterized by limited services (Sultan and Crispim 2018a). It is believed that health sector reforms emphasized more on quantity than on quality (Kitaneh and Hamdan 2012). Therefore, despite the available technology and the installed information systems in many Palestinian hospitals, the effective usage of such systems is still questioned. It is a good research area to investigate the factors behind this phenomenon, either supporting or impeding factors for adopting ICT technologies with the aim of changing users' behavior. Particularly, in Palestinian Blood Bank functioning areas, it is the scope of this thesis.

A state that paves the way for the significant contribution of ICT implementation across processes in the Palestinian health sector; however, blood banks are not an exception. In the West Bank and Gaza Strip, Palestinian injuries are frequent for various reasons, including injuries during confrontations with the Israeli occupation forces and the many traffic accidents that occur almost daily, in addition to the sick and injured in hospitals. When an emergency occurs, calls are immediately heard from Palestinian hospitals or radio for a mass need to donate blood in a hospital due to the existing shortage in blood banks due to the almost permanent demand for different blood groups. And in most cases, healthcare providers ask relatives or the public for an immediate donation. This phenomenon questions the probability of harmful incidents occurrence.

Tackling the readiness of these institutions to adopt systems that support ICT is a must preparing step for better performance (Gagnon et al., 2009). The case for a monitoring and measuring mechanism that is institutionalized across the blood banks can serve as a starting point for a modernization project. Therefore, when planning or improving health systems and

service delivery, one must consider an array of factors. Identifying and quantifying the factors affecting the information project's effectiveness are essential to propose solutions that may improve the quality of decisions (LE et al. 2020).

This thesis attempts to identify factors that influence adopting ICT in Palestinian Blood Banks for better performance. We target the relevant actors in hospital settings to collect data to achieve this purpose. The expected results may shed light on the strengths of blood banks operations and uncover areas for potential improvements.

1.3. Research questions

The main research question of the thesis is:

"How well prepared are the Palestinian Blood Banks to acquire the benefits of information and communication technologies ICT?"

The following research questions are proposed to answer this broad question:

RQ1: What is the reality of, and what are the challenges for, ICT adoption in Palestinian Blood Banks?

RQ2: What factors influence the adoption of ICT in Palestinian Blood Banks?

RQ3: How do these factors affect the ICT adoption in Palestinian Blood Banks?

1.4. Purpose of the Study

This study aims to assess/investigate ICT adoption factors in Palestinian Blood Banks. The research will examine the current levels of these factors at the hospitals operating a blood bank department in the West Bank. Then, tests for associations with better adoption of ICT.

Blood banks are not extensively researched in Palestine; therefore, the thesis tries to understand blood bank operations, particularly technology adoption.

1.5. General objectives

The broad objective of this research is to investigate the factors that influence the adoption of ICT in Palestinian Blood Banks.

1.6. Specific objective

The following specific purposes guided the study -:

1. To identify existing ICT infrastructure in the Palestinian Blood Banks.
2. To identify factors that influence ICT adoption in the Palestinian Blood Banks.
3. To identify the main challenges to using ICT for Blood Banks services in Palestine.

1.7. Significance of the Study

The research findings could be used to strengthen ICT utilization in Palestinian Blood Banks for better performance. The results can help all the Blood Banks in Palestine by providing the staff with enhanced information and communication technology and ICT characteristics and integrating efforts on these factors for better ICT adoption.

This research provides a ground for implementing and adopting an ICT-enabled system and helps key actors like hospital managers and policymakers in the Palestinian Ministry of Health (MoH) for more accurate and efficient performance concerning blood needs. Findings stimulate blood bank managers to enhance potential improvements, policymakers to allocate resources, and international donors to focus on the proper adoption of new technology to get better benefits from their considerable investments. The information generated in this study can enable various stakeholders to develop sound plans and formulate policies that can favor ICT

adoption. It is expected that the vendors can use the information from this study to establish ICT packages with desirable characteristics that will increase adoption.

Furthermore, the research shed light on gaps for better ICT adoption in the blood banks for improvement programs. It should also be a stimulus for further research to refine and extend the present study's findings.

1.8. Limitations of the Study

The ongoing Israeli occupation of Palestine imposes restrictions on Palestinians' movement makes daily life harder than the average case in the neighboring countries; this applies to researchers' duties. Therefore, it is almost impossible for a researcher from West Bank to collect primary data from Gaza Strip and very hard to reach East Jerusalem. Therefore, the scope of this thesis is limited to the cities in the West Bank.

Due to the ongoing impacts of the Covid-19 pandemic on hospital operations, constrained reach to blood banks is expected. Consequently, the research results are narrow in the sense that the findings cannot be generalized. The study assumes that participants provide unbiased responses, cooperate, and provide reliable answers.

Finally, the methodology of this thesis tackles the research problem from an organizational perspective (blood banks within hospitals) rather than from a national perspective; thus, our expected results may guide hospital managers and are less relevant to the country's policymakers.

1.9. Definitions

ICT: ICT is defined as a set of tools that facilitate communication, processing, the transmission of information, and the sharing of knowledge by electronic means; this includes

the full range of electronic digital and analogue ICTs, from radio and television to telephones (fixed and mobile), computers, electronic-based media such as digital text and audio-video recording, and the Internet (Zakaria et al. 2010).

Blood bank and blood transfusion service: involves the collection, processing, storage, distribution, and transfusion of blood and blood products to improve health or save lives (Nene et al., 2015).

Factor: One element contributing to a particular result or situation.

Adoption: It is a process of taking up or starting to use, following, and getting the benefits.

E-health: The use of emerging information and communication technology, especially the Internet, to improve or enable health and healthcare (ESENE 2015).

Infrastructure: IT infrastructure includes all Information Technology like hardware, software, networks, facilities, etc., but not the associated people, processes, and documentation. All required to develop, test, deliver, monitor, control, or support IT services. (Laan 2012).

Skill: Skill is the knowledge and ability to do something well (Ansoff et al., 1990)

1.10. Organization of the study

Chapter one of the study contains an introduction, giving a background of the study while putting the topic of study in perspective. It states the problem and outlines the study's objectives, limitations, and assumptions. Chapter two reviews the relevant literature on factors influencing the adoption of ICT. It critically looks at the availability and adoption, ICT Infrastructure, ICT staff attitudes, and theories explaining coping with technology. It also outlines empirical review as well as the conceptual framework for this research. Chapter three

introduces the research methodology. It covers the research design, target population, sample design, data collection, validity and reliability of data collection instruments, data analysis techniques, and ethical considerations. Chapter four consists of data analysis, presentation and interpretations, and discussions. Finally, Chapter five concludes and provides recommendations based on the study.

Chapter two

Literature Review

2.1. Introduction

This chapter covers relevant theories and previous empirical works on ICT adoption factors. The main sections covered in this chapter include reviewing the literature in ICT, factors influencing ICT adoption, and developing the conceptual framework for ICT adoption in blood bank organizations.

2.2. Definition of Information Communication Technology (ICT).

Information Communication Technology (ICT) pervades all aspects of life, allowing individuals to connect, network, seek support, gain knowledge, and learn in different, faster, and more accessible ways. ICTs are electronic tools that promote communication, data processing, transfer of information, and knowledge sharing. However, ICT and Information Technology (IT) are sometimes used synonymously; ICT is a much broader concept encompassing all computer and digital technology than IT. This includes all electronic, digital, and analog ICTs; this consists of the full range of electronic digital and analog ICTs, from radio and television to telephones (fixed and mobile), computers, electronic-based media such as digital text audio-video recording, and the Internet (Zakaria 2010). In the short term, the infrastructure and components enable modern computing. It is used in various ways, from communication infrastructure like networks to sophisticated artificial intelligence and robotics (Abouzahra 2011). Components include data, internet access, cloud computing, software, hardware, and communication technology that transfer raw data into helpful information for speedy retrieval. It also encompasses a combination of application and system of all those various components that facilitate interaction with the digital world. ICT applications such as

electronic commerce (e-commerce) and enterprise resource planning (ERP) that have become indispensable for business to survive and thrive (Jameel, Abdul-Karem, and Mahmood 2017).

ICT can play an essential role in improving health care for individuals and communities. As supported by the World Bank (2006) report, "*Reliable information and effective communication are crucial elements in health practices, the use of appropriate technologies can increase the quality and the reach of both information and communication*." It may be hard to satisfy the community's healthcare needs without integrating technology into the current infrastructure (Omotosho et al., 2019).

The most popular application of ICT is the term electronic health (e-health). It is also increasingly used to refer to ICT in healthcare. It has contributed immensely to health delivery through the provision of high-quality healthcare high- service and ubiquitous access at a lower cost (Omotosho et al. 2019). Gagnon mentioned five broad categories of ICT (2009). They are; (1) Electronic Medical Records (including patient records, clinical administration systems, digital imaging & archiving systems, e-prescribing, e-booking). (2) Telemedicine telecare services. (3) Health Information Networks. (4) Decision Support Tools for healthcare professionals and (5) Internet-based technologies and services. Each category consists of various applications with specific functions in healthcare settings. These can improve data management, healthcare access, care quality and safety, service continuity, and cost containment (Gagnon et al., 2009). Some uses of ICT applications mentioned in (Sharma et al., 2017) research like:

1. Healthcare professionals can share patient records.
2. Access to distributed Electronic Health Records (EHR) from any place and any time.
3. Telemedicine and diagnosis.

4. On-line teleconsultation telemonitoring and assistance.
5. Consultation services between doctors and patients can be affordable.
6. Patients can access their own EHRs.

2.3 Healthcare settings in Palestine.

Healthcare professionals in Palestine, in particular, continue to underrate ICT systems, and there is a lack of understanding about the best ways to implement them into their practices. According to M. Gagnon (2009), it is critical to synthesize knowledge regarding ICT adoption by healthcare professionals so that decision-makers may be informed about effective strategies for integrating these technologies into healthcare systems.

The complex history of the occupied Palestinian territories has dramatically influenced the structure, function, and capacity of the health care system in the country. The occupied Palestine territories include West Bank, East Jerusalem, and Gaza Strip when the peace process in the Middle East was settled. Remarkably, after the Madrid Conference in 1991, the Oslo Accords in 1993, and the foundation of the Palestinian Authority in 1994. it seemed that The never-ending conflict between the Palestinians and the Israelis had come to an end, yet, ground reality suggests otherwise. Unfortunately, the peace process reached a deadlock, and the conflict was not resolved. The Palestinians had limited self-determination and constructed a picture that the two-state solution is unapproachable (Sultan and Crispim 2018b).

The public health care administration was transferred from the Israeli Civil Administration to the Palestinian Ministry of Health (MoH). Yet, the other health care providers, namely, the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA), the Non-Governmental Organizations NGOs, and for-profit private health organizations, continued as they had been before. Later, international aids have mainly

supported ongoing reform efforts to restore the capacity of providers. These external funds are part of the international community's efforts to end the conflict between Palestine-Israel through economic encouragement, with about 8% dedicated to healthcare (Sultan and Crispim 2018a).

The Palestinian territories is a low-middle income country with approximately 5,101,152 inhabitants—with 3.05 million inhabitants (59.9 % of the total population of Palestine) in the West Bank. In comparison, the people of the Gaza Strip were 2.04 million (40.1% of the total population of Palestine) (MoH 2020). According to a World Bank report published in 2018, over 29 percent of Palestinians live in poverty, 2.5 million need humanitarian assistance, and 2.5 million are food insecure. According to the Palestinian Central Bureau of Statistics, total current health expenditures were 1.419 million dollars in 2016 (10.7 percent of GDP). Expenditures are covered by the government (around 37%), private insurance companies (about 3%), households/out-of-pocket (around 41%), non-profit organizations (around 18%), and others (around 1%) (El Jabari, Macedo, and Al-Jabari 2020).

The health care system in the occupied Palestinian territory is burdened and characterized by frequent shortages and severe deficiencies, it's operating under severe pressure due to rapid population growth, lack of economic opportunities and adequate financial resources, shortages in basic supplies, and the inherent limitations of occupation or blockade (Kitaneh and Hamdan 2012; Manenti et al. 2016). To implement restrictions on movement and movement, Israel has established a permit system according to which Palestinian residents of the occupied territories are prevented from entering Israel - including Jerusalem - except with a permit for whatever the purpose of entry - for work, medical treatment, to visit relatives, or otherwise. The Palestinian's application for a permit entails confronting an arbitrary bureaucratic system that lacks transparency. Applicants cannot know the possibilities of accepting or rejecting their application or when they will receive such a response. Many

applications are left without any explanation and without the possibility of objecting to the rejection. Likewise, after it has agreed and granted a permit, Israel can quickly withdraw it, which it also does without any explanation—resulting in delays or even denial. The separation wall is a health barrier, preventing many people from their right to health.

This makes individuals in Palestine have the least access to health services due to those barriers in accessing the needed services. The lack of availability of services also contributes to the unmet needs of patients and families, which illustrates the need for the adoption of technology and ICT in the healthcare sector is a priority. When all stakeholders from the healthcare sector, including government, non-government, and private sectors, come together when they are economically, politically, or socially challenged, a more efficient healthcare delivery system will emerge (El Jabari et al. 2020).

In Palestine, there is many studies and development in various healthcare sectors. A study by (Baidoun, Salem, and Omran 2018) to assess the level of total quality management (TQM) implementation in Gaza hospitals identifies the critical factors and practices for TQM implementation within the Palestinian healthcare organizations to improve performance. In addition, a few studies about the aspect influencing technology adoption in the Palestine context, in general, and in the healthcare sector, in particular, highlight the need for this study. And studies on the Palestinian blood bank have not received this sufficient attention. Especially studies related to blood bank Information systems and the factors influencing ICT adoption, where no prior similar research studies could be found. One research made by (Haneen & Alaa.,2011) called "Assessment & Development of Palestinian Blood Bank System" studied the political and economic conditions of the Tulkram blood bank centre. Therefore, this study contributes to filling this gap in the literature.

Blood banks are an essential, vital, and supportive component of Palestinian health services. There are two types of blood banks in Palestine:

1. Blood banks in Hospitals

According to the MoH, in Palestine, most blood transfusion services are concentrated in hospitals. The MoH is the leading provider of blood transfusion services and supervises the other institutions that provide this service in Palestine. The number of blood donors in MoH hospitals in West Bank was 26,351, of which 11,132 were voluntary donations representing 42.2% of donors, 13,144 donated to relatives or acquaintances, representing 49.9% of donors, and 2,075 were therapeutic donors representing 7.9% of donors. In 2020, the total number of transfused blood units and their components was 53,453 units in MoH hospitals in West Bank (MoH 2020).

Eleven NGOs and private hospitals in the West Bank provide blood transfusion services. The tremendous amount of data and information in a daily interval led to risk in this health service (WHO 2014).

2. The National Blood Bank

The number of blood donors in the National Blood Bank in West Bank was 8,973 donors, of which 3,515 were voluntary donors representing 39.2 % of donors, 4,351 donated to relatives or friends, representing 48.5 % of donors, and 1,107 were Therapeutic donors representing 7.9% of donors. Transfusion-transmitted diseases were screened on all donated blood units. The total number of transfused blood units and their components is expected to reach 15,833. The number of employees of the Central Blood Bank is 28 employees from various fields of work and specializations. They are the Central Blood Bank director, an

administrative director, a secretary, an accountant, a personnel officer, an engineer, and 17 laboratory technicians (MoH 2020).

In the West Bank, 777 cadres are working in the (MoH) with medical laboratory sciences certificates, including technical, specialist, and administrative duties. Between laboratories and blood banks, there is no complete separation. The scientific qualifications of these cadres range from diplomas to doctorates, the vast majority of them bearing bachelor's degrees.

2.4. Benefits of ICT adoption in the blood banks.

ICTs can assist bridge the information gaps in the health sector in developing and new industrial countries. The gaps may exist between health professionals and the people they serve and between the producers of health research and the practitioners who need it by enabling new and more efficient means of accessing, transmitting, and storing information. ICTs also can increase health system efficiency by reducing medical mistakes through databases and other applications, and it can decrease patient data collection costs by about 71% (Omotosho et al., 2019). The application of ICT in the health sector like e-health would improve it if all parties involved could coordinate their efforts to take advantage of new technology.

Blood banks can benefit from ICT in many areas; it can help improve the blood banks' supply chain management, donor management, and the database for blood bags (Omotosho et al. 2019):

First, controlling business accountancy and preparing the inventory to better estimate the situation of the blood bags in stock. ICT tools can make these and other similar tasks much easier, more effective (and even more excellent) to perform. This allows dramatic changes or even modifying core assumptions about the service provider and the patient

(Sharma et al., 2017). When using ICT in blood banks, it means the use of e-health; popular forms include telehealth, mobile health (m-health), electronic health records, healthcare information system domain. The blood bank in charge is getting rid of manual procedures. This will minimize the probability of error. Information retrieval should be precise and effective, inventory control can be properly controlled and managed, reports can be generated and coordination of activities and communication of knowledge using ICT-based administrative tools (Omotosho et al., 2019).

Second, ICT provides several chances for blood donation camp managers and donors to communicate quickly, easily, and effectively (for appointments, camp details, and donor reports). Like the donors can view the blood donation camp organising at the different places, the donor can also check his blood group's medical status whether it is healthy or unhealthy, donor can check the status of the particular blood group just on one click sitting at home (Kulshreshtha and Maheshwari 2012). As a result, the rate of voluntary repeat blood donations will rise. Some examples of ICT implications for donors:

- Using Confidential Unit Exclusion (CUE): This is a method in which a blood donor indicates whether or not their blood is safe for transfusion in a confidential manner. It refers to circumstances in which a person who is not eligible for blood donation due to blood safety concerns is encouraged by others to donate blood and has doubts about the security of their personal information. Because ICT provides a safe and private environment and ICT facilities provide more confidentiality, it is predicted that the use of ICT would improve the efficacy of the CUE system. It is expected to identify a considerable increase in the reinstatement of donors (Jalalian and Mahboobi 2013).

- Using an appointment or reservation system, setting up a streamlined appointment system may potentially allow donors to select time slots in which they are willing to donate. The idea is that by introducing a shared appointment system throughout all blood banks, donors will be able to look at more available time slots and choose their preferred time and location to donate (Saad and Christensen 2019).
- Using a reward programs, donors can be motivated to donate more frequently through many incentives based on the individuals preferred. Various social responsibility organizations can fund this reward program and offer prizes. Blood banks can create loyalty among donors and motivate them to give blood more frequently (Saad and Christensen 2019).
- Mobile Apps for blood donation practices can also be helpful. The donation process becomes automated and more straightforward. Manage blood donor records, find new donors, check the donors' eligibility to donate, schedule donation times, and inform users of donation needs in nearby locations using geo-location services (Saad and Christensen 2019). An application for blood donation in Palestine was published in 2017 called (Palestine Blood Bank) application; the application is free and was published via the "Android" system. It allows blood donors to identify the donors and their places of residence to benefit from the available information according to their requirements. The application divides donors according to their cities and blood type. Hence, the blood requester enters and reaches the people closest to his area of the same blood type and sends a message to each of them, and he can contact them personally if the matter is urgent.

Third, ICT gives the actual-time status of stocks, alerts about near expiry/expired stocks, quarantine management, and inventory sent to satellite canters/ storage canters

to help in better and effective stock utilization and supply chain management. Constant monitoring of blood supply to hospitals will help achieve greater effectiveness in blood inventories at the blood supply centers and improve the storage capacity of a hospital's blood bank (Chapman, Hyam, and Hick 2004).

Finally, better planning and resource allocation/utilization can be done (Wankhede 2013). This may enhance response time and accuracy to fulfill patients' needs, reduce unintended medical errors, and improve the quality of healthcare provision. All this to save the lives of many people. To achieve these features and use ICT properly, preparing for adopting these technologies is a necessary step.

2.5. Information and Communication Technology adoption

The derived improvements in efficiency from ICT use are among the main analyzed topics in the literature. ICT can be considered one of the strategic issues in improving service operations and transforming market roles. For this purpose, the use and management of technologies, specifically ICT, are critical (Platero Jaime et al., 2017). ICT is often seen as having the ability to enable changes in business and other processes, leading to increased performance. It has significant and positive implications for productivity and output growth and lower cost in their operation (Suhartanto and Leo 2018).

In the context of the developed countries, the demand for quality, affordable and accessible healthcare is high, and ICT can deliver significant and persistent improvements in performance for technology adopters. Turning to the developing countries like Palestine, there is a considerable variation in ICT adoption across and within cities and sectors. This variation can be traced to various factors, including differences in pricing and government policy (Basant et al., 2006; Omotosho et al., 2019).

Adopting ICTs opens up new options and reveals previously unimagined application scenarios (Aceto et al., 2018). As a result, the health sector is potentially benefited, as the quality of medical services is expected to be enhanced and healthcare costs are reduced despite the increasing demand due to the aging Population (Aceto et al., 2018). Phichitchaisopa & Naenna (2013) mentioned that if healthcare services do not adopt new information technology for additional support, they will be ineffective and lose credibility among patients.

ICT projects involving either implementing systems and components or transitioning from one system to another are frequently regarded as costly, time-consuming, complicated, need experience, and generally divergent from organization initiatives' core emphasis and aim. Organizations must carefully consider the challenges that arise when implementing ICT, like whether the organizational culture is supportive of ICT adoption and implementation and whether the organization is willing to employ competent human resources to use ICT as tools (Zakaria et al., 2010).

Projects fail when they do not meet their planned objectives. Failed information technology projects are reported despite the consent of the directors. Only 32% of IT projects meet their objectives, while 24% totally fail, and 44% have difficulties meeting their goals (Abouzahra 2011). Therefore, the creation and implementation of ICT projects need preparation and investment with the right mix of resources, including support at the highest levels, leadership, and staff education and empowerment to be successfully implemented to meet their objectives. While no two institutions are alike, there are many common challenges to overcome (Aeris 2020).

So to run such improvement projects, a set of factors affecting the success and failure of ICT should be considered and managed. Projects with a complete list of the factors influencing the adoption and success of information systems will support the project success.

According to the managers and professionals, evaluation provides solutions at every moment (Farzandipur 2016).

Many factors can affect new technology adoption; understanding the adoption rate in contextual settings requires analyzing factors that may facilitate or operate as barriers to adoption (Butler and Sellbom 2002). Previous works show that the factors affecting the acceptance of IT and ICT in the healthcare sector include human, organizational, and technological categories (Farzandipur 2016; Gagnon et al. 2012; Low et al. 2011; Sagiroglu and Ozturan 2006; Yusof et al. 2007; Zakaria et al. 2010; Lynn et al. 2018).

Human Factors are related to Individual factors or healthcare professional characteristics (knowledge and attitude) associated with the human environment, like patients and peers (relations between colleagues). *Organizational factors,* internal like training/lack of or inadequate training and readiness, or external factors like financing of ICT/financial support and health care policies. Finally, *technological aspects* related to ICT like design and technical concerns, innovation characteristics (Triability, usefulness, complexity), interoperability, confidentiality, and evidence regarding IT benefits (Gagnon et al., 2012).

2.6. Factors influencing ICT Adoption in healthcare organizations.

ICT adoption is complex, multi-dimensional, and influenced by various factors at individual and organizational levels (Gagnon et al., 2012). In this section, we are going to review the three sets of factors that influence the adoption of ICT in health organizations which are Human, technology, and organization factors:

2.6.1. Influence of Human factors on ICT Adoption.

Human elements are highly significant and decisive, whether individually or as a group. The leading cause of IS or ICT's failure to fulfill their goals is the neglect or the inadequate

attention to human factors, leading to defects in good communication with users and an inability to build a sense of ownership of the system. One human factor is personal innovativeness, which refers to a person's willingness to try new technology. According to Lynn (2018), a person's perceived level of innovation can influence how they respond to new technologies. As a result, personal innovativeness may be used to predict whether a person will adopt a new technology sooner than others. However, Among individual factors, socio-demographic characteristics (age, gender, etc.) were rarely mentioned to be considered as ICT adoption factors (Gagnon et al., 2012).

An ICT project requires all participants (from the system's developers to the users and beneficiaries) to view the technology as adding value to existing systems. According to Platero Jaime (2017), Managers should focus on the proper implementation of ICT, depending on the players' understanding and acceptance. Because if the people using the system do not like, want, or support it, it will likely fail. A study made by Mass and Eriksson (2006) mentioned a case in which ICT was implemented, and hospital employees were unprepared for the changes due to a lack of proper information from technology providers, the immediate result was a lack of knowledge of the new clinical requirements and users who didn't know how to use the new technology; the larger consequence was a slowed implementation and adoption process. So the managers' satisfaction is not the only factor in successfully implementing these systems.

According to Khalifa's (2016) study, Companies with more educated, trained, and experienced personnel are better able to absorb, and apply new knowledge. Those with more experience in using computers, compared with those with less experience in this field, use hospital information systems more and are motivated to perform computational processes (Farzandipur 2016). So healthcare workers must be digitally literate (computer skills, computer experience). ICT adoption and use are also influenced by learning conditions and

technical knowledge (Awareness of the existence and/or objectives of the ICT, familiarity with ICT, familiarity with technologies in general, ICT experience, and openness to specific technologies).

Lack of familiarity with ICT and time-consuming or increased workload are linked to ICT use and are frequently reported as barriers to individual ICT adoption at the personal level. Familiarity with ICT is related to training issues (organizational factor) and affects time efficiency (Gagnon et al., 2012). Ease of learning how to use technology will lead users to be familiar with the system and save time and cost, which will cause the successful adoption and implementation of systems by end-users (Farzandipur 2016). The research by Farzandipur indicates that the skills, knowledge, and users' understanding of the ease of using the computers and hospital information systems are the main human factors affecting the successful implementation and a higher tendency for users to use the system. This means if employees and the patients have insufficient skills and technical knowledge in dealing with ICT, it will result in resistance to implementing ICT initiatives in healthcare. Furthermore, it has been found that poor skills in IS have negatively impacted staff engagement levels with IS, with insufficient staff involvement significantly influencing patient safety and quality of care (Kuek and Hakkennes 2020).

Staff attitude towards using technology is another human factor that influences the adoption. Attitude is a pattern of shared basic assumptions that groups learn to solve external adaptation and internal integration problems that have worked well enough to be considered valid. Therefore, educating new members is the correct way you perceive, think, and feel about those problems (Kumar 2016). Thus, organizational culture has a broad and profound impact in organizations, manifesting itself in ideas like how things are done or specific rights and rituals of the company, company environment, common practices and norms, and core values

(Nyaggah 2015).The attitude towards the ICT of the developer and the users who adopt or reject the technology employed in an organization impacts the organization's performance. "IS attitude" can be defined as the set of values and practices shared by the members of an organization involved in information activities; this includes people like IT professionals, managers, and end-users (ESSA, 2017). Staff members are generally confident in using ICT and hold positive attitudes towards IS, contributing to the successful implementation of ICT in the health sector. But if the staff have a negative attitude towards IS, this will be a barrier towards ICT adoption (Kuek and Hakkennes 2020).

The deployment of ICT in health care is, to a large extent, customer-driven. The concept of customers in the health sector includes patients, patients' friends and relatives, and citizens in general who use the Internet and innovative ICT technologies to make informed decisions about their health (Bujnowska-Fedak 2015). Factors related to patients and peers may serve as either facilitators or barriers. Factors reported were mainly barriers; they concerned patient/health professional interaction, applicability to patients' characteristics, and attitude of colleagues towards ICT. Patients' attitude towards ICT is also cited in a few previous studies as positive or negative factors (Gagnon et al., 2012).

2.6.2. Influence of Technology factors on ICT Adoption.

Technological context means technical infrastructure like systems, devices, and services that the users have available. The effect of technological factors on the successful implementation ranks second after the human elements (Farzandipur 2016). Having a good ICT infrastructure is a must for improving a country's well-being, and it is critical in the adoption of ICT in the health sector (Mwangi 2017; Nyaggah 2015).

Despite the enormous benefits of ICTs to deliver high-quality health care, health professionals in developing countries haven't yet fully realized their potential. This is due to infrastructure access issues; slow or unreliable Internet connections, lack of gadgets and type of technology (e.g., electronic medical record, telemedicine/telehealth, health information networks, decision support tools, Internet-based technologies, and services), privacy and security issues and others. These issues limit the adoption of ICT applications in developing countries (Omotosho et al., 2019). Finally, the availability of different communication tools at a reasonable price is crucial for ICT adoption in the Palestinian health sector (Tanni et al., 2011).

The system development capability and reliability in the safekeeping of information is another technological factor. Concerns about data privacy, confidentiality, and security have been mentioned as influencing e-health adoption (Furusa and Coleman 2018). Privacy and security should be considered when implementing ICT in the health sector, especially in medical information. ICTs are susceptible to security and privacy breaches, limiting their use in the health sector because users want to be sure that technology in healthcare will not result in unauthorized disclosure of information (Furusa and Coleman 2018). Kavandi & Jaana (2020), in his systematic literature review, found that privacy and security directly impact the behavioral intention to use technology. A study by Tan et al. (2009) found that security continues to be a significant barrier in adopting internet-based ICT. Alsulami & Atkins (2016) found that security represents significant concerns limiting seniors' adoption of assistive technology. On the other hand, another researcher pointed out that health information technology (HIT) might increase privacy/security and improve seniors' attitudes towards HIT adoption (Lu, Chi, and Chen 2014).

Interoperability is another technical concern when implementing ICT (Farzandipur 2016). The IEEE defines it as: "the ability of two or more systems or components to exchange information and to use the information that has been exchanged" (Omotosho et al. 2019). Interoperability means sharing data between different IT systems and facilities, which is a characteristic of a product or system, whose interfaces are completely understood, to work with other products or systems at present and future, in either implementation or access without any restrictions. Because designs are made up of numerous pieces of hardware and software, the various technologies must be interoperable to connect and function together. The interoperability can raise switching costs from training and translation if switching one technology causes changes in how another technology is used.

Backward compatibility is another technical concern; this is critical for adoption, integrating old and new ICTs. The trade-off between better technology and backward compatibility is an example of the general conflict between innovative technologies and network externalities and their associated switching costs (Nyaggah 2015).

The adoption of new technology cannot be simply reversed; ICT adopters must carefully consider the added value of adopting the technology in the long run. When there is uncertainty about the technology's future requirements, ICT users may be reluctant to adopt new technology. Positive examples of ICT adoption were generally characterized by the end-users clear perception of the innovation's benefits (system usefulness). Sheikh Shoaei & Olumi's (2006) study indicates that if an information technology-based system is more beneficial and straightforward to learn, it will be employed more. According to Farzandipur (2016), research findings indicate that the user can easily work with and trust the information technology-based system in numerous studies. Increased data availability will be more accepted, and its implementation will be a success.

Complexity, which refers to the degree to which innovative technology is considered difficult to understand and use, is another influencing factor in adoption. Innovations that make tasks easier are likely to be adopted (Dobbins et al., 2001). Organizations tend to adopt new technologies that are easy to use, as complex technologies decrease ICT adoption (Low et al., 2011). The lack of ICT skills and knowledge among healthcare staff makes its use complex. Information communication technology skills and knowledge are essential in reducing the complexity of technology (Furusa and Coleman 2018). An innovation could be highly complex, making it less likely to be adopted and diffused, but it could also be compatible with a significant advantage over current tools. Despite the learning curve and high knowledge requirements, potential adopters may still choose to use the innovation, and support from prior adopters or other sources that can help enhance adoption chances (Dobbins et al. 2001).

2.6.3 Influence of Organization factors on ICT Adoption.

The organizational factors, whether internal or external, impact the adoption of ICT. Internal environment factors like financial resources, training of users, and project management capabilities. External factors like financing of ICT/financial support and Health care policies greatly influence healthcare professionals' acceptance and successful implementation of ICT (Gagnon et al., 2012).

The financial resource is one organizational factor that plays a crucial role in ICT adoption decisions. Projects involved in either implementing ICT systems or migrating from one system to another are lengthy and complicated projects that require significant investments of money and experience to implement them successfully (Abouzahra 2011). ICT adoption comes at a cost; the high cost of acquiring technology has been identified as a significant barrier. Without the requisite funds, it isn't easy to benefit from the full potential of ICT systems. Financial resources are required to procure technologies, including computers' price, staff

training, operational expenditures, future developments, installation cost, and maintenance fees (Mwangi 2017). Computers limit purchases because of the higher cost of computers and their accessories with limited resources (Nyaggah 2015).

The cost of computerized equipment is typically prohibitive for most hospitals in developing countries. Even for those who can afford it, routine maintenance and servicing are issues that novice computer users cannot easily manage (Terry et al., 2009). And the installation costs include employee training, salaries for the company providing the service, etc. The high cost of installing a modern computer-based health information system is the rationale of using manual medical recording in healthcare institutions. The switching costs from manual to computer-based jobs affect ICT adoption in health care institutions. Switching costs may be so high that users are effectively locked into a specific ICT form. The cost of implementing an ICT healthcare system could be lowered by using existing equipment and infrastructure at the facilities, such as mobile and Internet technology, which has become widely accessible countrywide. Yet, in the long run, if ICT is correctly deployed, it will potentially reduce healthcare costs while also opening up new treatment and welfare options for patients (Arendt 2008).

There's also the question of generalized skills and training. Skill gaps exist in organizations like hospitals, and they include not just technical ability but also managerial skills. In most cases, health care organizations lack specific ICT knowledge and technical skills. Because health care professionals are not ICT specialists, they require as much training and assistance as possible to run the systems. They may be reluctant to accept the systems if they do not receive adequate support. As cited by Mwangi (2017), Simon (2012) similarly noted that "health care professionals struggle to get appropriate technical training and support for the systems from the vendor and if they do get this support it comes at a cost." Nyaggah (2015)

showed that the better the IS capabilities of the staff, the greater the potential for using IS and, as a result, the larger the number of entities adopting IT.

Adequate user training and support are necessary for successful ICT implementation. Health institutions should provide staff with computer education and training courses to support the successful implementation of ICT and minimize adoption failure. Therefore, before implementation, clinicians need to be aware of the system's capabilities, and the training program must focus on influencing participants' attitudes toward the tools (Andre et al., 2008). Employees need to be trained on operating a new system once it has been deployed in an organization. So training is a significant determinant of ICT adoption by the healthcare professions and influences the integration of these technologies into health practices (Gagnon et al., 2012).

Some characteristics of the entrepreneur, such as their training, age, or gender, could affect the decisions making in the company (Platero Jaime et al., 2017). Owner-managers must participate in training programs to learn about the benefits of employing ICT. Most owners-managers are afraid to spend resources on the training of their employees because they are concerned that after completing such training and upgrading their qualifications, these employees may leave for jobs in larger organizations that offer greater salaries (Arendt, 2008).

Training for using a new ICT system could increase short-term costs, mainly because workers are pulled away from their assigned productive tasks. According to Butler & Sellbon (2002), the time it takes to learn new technologies and use them is a big concern. But according to ESSA (2017), there is a significant correlation between the employees' perceived training effectiveness and job motivation, satisfaction, and commitment. If staff members are adequately trained, they are more likely to contribute to the organization's reputation and profits. Training also minimizes staff turnover, motivates staff, boosts room occupancy, and increases

profitability in a highly competitive industry (Mwangi 2017). A study conducted by Devin, Johnson, and Sutherland (2014), found that training interventions lead to positive outcomes for most small-medium enterprises (SMEs), particularly those working in organizations with relatively formalized training practices.

External factors influence the adoption, like donors and government support. Donors can take several steps to ensure that the support they provide to beneficiaries, and the policies and procedures associated with that support, enable hospitals and blood banks to perform their tasks effectively. Donor support is present in providing financial support to acquire the necessary ICT facility in the hospital and if they are helping in providing and implementing new technologies. In addition to providing hospitals with the financial support they need to be effective, donors can also play an important role in bridging the knowledge gap, like arrange regular training on ICT skill building for the hospital staff. Donors can provide practical and contextual support by listening to hospital staff, listening directly to them about the types of support they need, and understanding each organization's unique financial picture (Geo 2009).

The government support represents the required strategies or initiatives that encourage the hospital to ICT adoption. Whether the government has a motivation to facilitate the successful implementation of ICT to the organization, the government creates awareness to the employee on the use of ICT in the hospital, the government gives attention to the hospital's ICT and whether the government is supporting different ICT materials to the healthcare institution (ESSA 2017). If the donor and government support the adoption, this will Increase opportunities for ICT adoption.

The administrative governorate structure in a country makes a difference in the overall level of technology acceptance. For example, healthcare in the capital can have up-to-date technology and support from healthcare administrators. There will be a difference in how

individuals use technology when cultural identity invokes different characteristics for each region and country (Phichitchaisopa and Naenna 2013). It requires a suitable health policy for implementation (Furusa and Coleman 2018).

2.7. Theoretical Framework.

This section introduces the various information system theories to understand the sustainability and implementation of ICT and explains the factors influencing ICT in the health sector. In understanding and resolving the highlighted factors outlined, it is conventionally necessary to review a theoretical perspective that is particularly relevant to the underscored issues in this study. The following views guide the study; technology acceptance theory, diffusion of innovation theory, contingency theory, and technology-organization-environmental theory.

2.7.1. The Innovation- Diffusion Theory (IDT).

Diffusion of innovation theory Introduced in 1962 by Everett Rogers, and it was fine-tuned in 1995. The innovation diffusion theory has been pivotal in studying technology diffusion in the past two decades. The Innovation Diffusion theory takes a contrary approach when it comes to change management theories. It sees change as primarily involving the evolution or "reinvention" of products and behaviors to suit the needs of individuals and groups better, rather than focusing on persuading individuals to change (Robinson 2009; Wani and Ali 2015). The theory focuses on understanding how, why, and at what rate innovative ideas and technologies spread in a social system and why some adopt new products sooner than others.

This theory suggests three main sources influencing the adoption and diffusion of an innovation: perceptions of innovation characteristics, characteristics of the adopter, and contextual factors. Communication is imperative in innovation diffusion theory; the theory sees

innovations as being communicated through specific channels over time and within a particular social system. To assess its success, the usage of mass media or interpersonal communication channels is required. This is evident with the rapid advancement of information technology such as the Internet, smartphones, and social networking. Communication allows information about the innovation to spread throughout the target groups, allowing diffusion to take place. Hence, identifying and strengthening communication networks is critical for effective innovation diffusion (Nyakuma et al., 2016).

The theory found the individuals within any society falling to one of five different adopter groups, based on how early or how quickly they adopted the innovation. Individuals are considered as having varying levels of willingness to adopt new technologies. Thus it is generally observed that the portion of the population adopting innovation is approximately normally distributed over time. Individuals are classified into the following five categories of individual innovativeness after segmenting this normal distribution (from earliest to latest adopters): innovators, early adopters, early majority, late majority, laggards (Wejnert 2002).

Rogers theory identifies five attributes that are used to judge an innovation. These are relative advantage, complexity, compatibility, triability and observability. The adoption rate of innovation is predicted by the individuals' perceptions of these five characteristics: *Relative advantage* refers to the degree to which an innovation is perceived as better than the practice it replaces. If potential adopters perceive the advantage of the innovation, its adoption rate is high. *Compatibility* refers to the degree to which potential adopters perceive an innovation to be consistent with their existing values and practices which mean adopting the innovation is compatible with what people do. Compatibility with what is currently in place makes the new practice appear less uncertain, more familiar, and easier to adopt. *Complexity* refers to how innovation is regarded as challenging to understand and use. The adoption rate of innovation is

low if the potential adaptor perceives it as complex. *Triability* It is the degree of examining or testing a new innovation before actually adopting it, it gives the prospective users a sense of sureness to adapt to a new invention. Finally, *observability* refers to the degree to which the results of an innovation are visible to others, which means the extent to which the innovation provides tangible results. The factors are generally positively correlated with the rate of adoption, while the complexity factor is generally negatively correlated with the rate of adoption.

However, research has consistently found that technical compatibility, technical complexity, and relative advantage (perceived need) are important antecedents to adopting innovations. Leading to the generalized model presented in Figure 2.1:

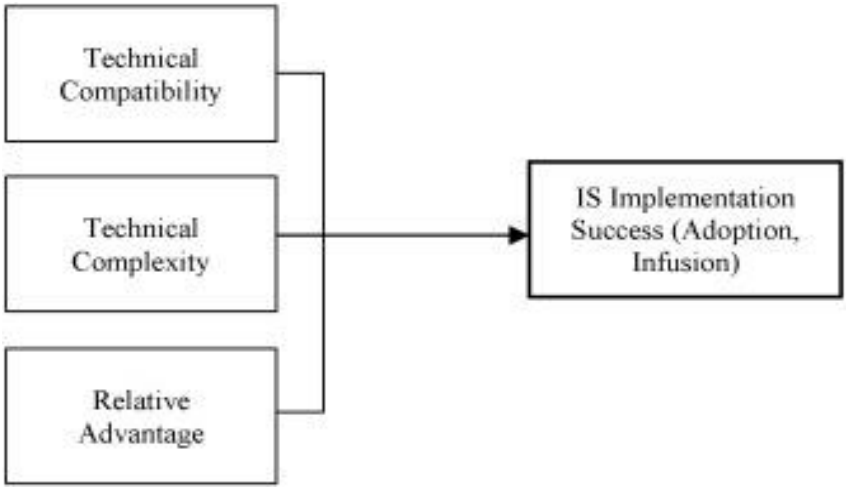

Figure 2.1: IS implementation.
source: (Bradford and Florin 2003; Crum, Premkumar, and Ramamurthy 1996)

This theory has been a widespread theoretical basis for investigating the adoption of various IT and ICT (Arpaci et al., 2012). However, it does not provide information on how to assess innovation characteristics. The process of innovation in organizations is more complicated. It usually involves individuals, sometimes including both supporters and opponents of the new idea, who all have a role in the innovation decision. This theory posits

that innovation spreads gradually over time and among people resulting in various adopter categories. It doesn't consider an individual's resources or social support to adopt the new behavior (or innovation). Complementary to the diffusion framework, behavioral models such as the Technology acceptance model (TAM) is frequently used to understand individual technology adoption decisions in greater detail.

2.7.2. The Technology Acceptance Theory.

The Technology Acceptance Model (TAM model) is based on Fred Davis's research completed in 1989. The technology acceptance model is widely used in information technology and applied to many industries such as healthcare (Phichitchaisopa and Naenna 2013). The theory talks a bit about the technology itself, and it says a lot about what we believe or perceive this technology to be. In other words, whether the technology is helpful or easy to use is not a matter of the technology but an important of all perceptions. And this may change obviously. So, depending on your experience, how old you are, what gender you are, etc. In other words, a person will adopt a technology if they are confident that the technology is beneficial, easy to operate and use, and affordable (Suhartanto and Leo 2018).

The theory's purpose is to provide a general explanation of the factors that influence computer acceptance, describe user behavior across a broad range of end-user computing technologies and user populations while remaining parsimonious and theoretically justified. Ideally, a model would be helpful for prediction and explanation, allowing researchers and practitioners to determine why a system may be unacceptable and take appropriate corrective steps. Therefore, a key purpose of the theory is to provide a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions. Technology acceptance theory was formulated to achieve these goals by identifying a few fundamental variables suggested by

previous research dealing with computer acceptance's cognitive and affective determinants (Davis 1989).

Attitude → Intention to use → Actual use of a system

In general, the TAM model focuses on the individual 'user' of a computer, with the concept of perceived usefulness. The technology acceptance theory explains why a particular system may or may not be acceptable by the users. It hypothesizes that there are two beliefs, perceiving usefulness (PU) and perceiving ease of use (PEU), which are variables that primarily affect the user's acceptance. According to Davis's theory: "Perceived Usefulness is defined as to improve job performance while using the application, the user should trust that application framework." While "Perceived Ease of Use is how much a user trusts that using a specific technology is free of exertion.". So the key to the TAM model is (PU) and (PEU) variables that impact attitude in the TAM (Park and Park 2020), as shown in Figure 2.2:

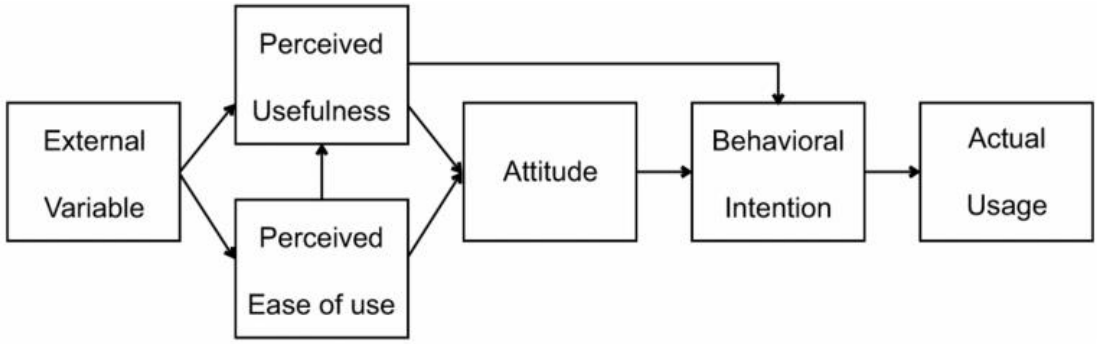

Figure 2.2: Technology Acceptance Model (TAM) by *(Davis 1989)*

ITs perceived usefulness indicates how users believe that using some system improves their task achievement ability. Perceived ease of use suggests how much they think a specific system is easy to use.

A series of studies found that this theory is the best model in examining Physicians' acceptance of telemedicine and communication technology because it is specialized in information technology, is well-researched, uses psychometric measurements, and is a dominant model for investigating user technology acceptance (Nyaggah 2015). This theory is relevant to the study because it suggests that external variables indirectly affect individuals' attitudes toward adopting information communication technology acceptance by influencing perceived usefulness and ease of use. External variables are related to their job tasks. To measure the external variable, we are going to use usability testing.

2.7.2.1 Usability testing Elements

International Standards Organization (ISO) defines usability as ''the extent to which user easily used the specific interface to achieve the targeted goal with success, proficiency, and contentment in an identified circumstance of use''. Holzinger (2005) states fundamental usability elements, which are "efficiency, learnability, memorability, and error." A study by Burney(2017) used these core attributes to measure the usability of any product, as shown in Figure 2.3:

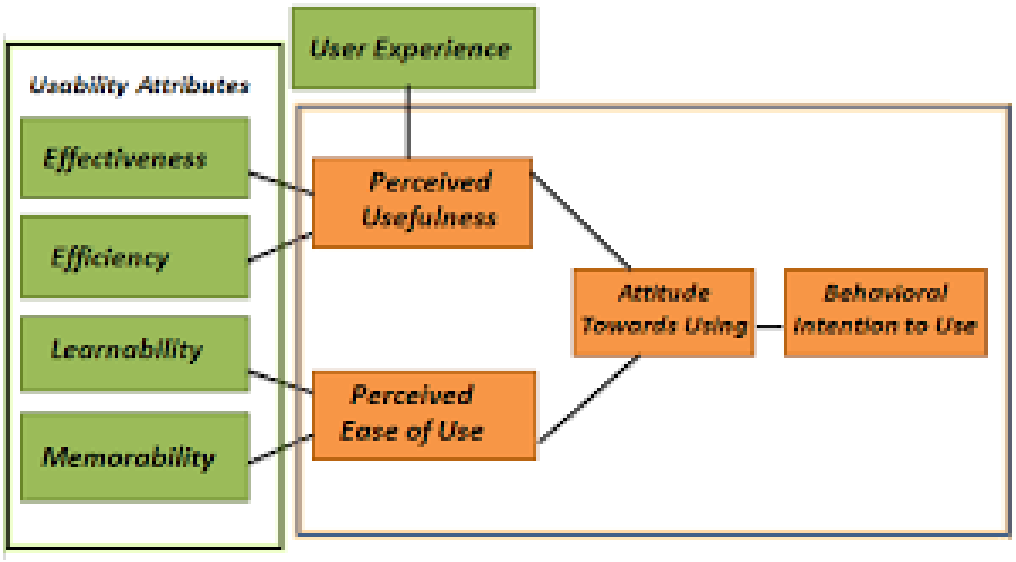

Figure 2.3: Usability factor for TAM model *(Burney et al. 2017)*

1. Effectiveness: “the accurateness and comprehensiveness of task with which users accomplish stated goals’’.
2. efficiency, which is characterized as by using the technology how quick users can achieve a task
3. Learnability concentrates on how users can complete a task without much of a stretch when utilizing an application surprisingly.
4. Memorability related to the simplicity of application with which users can review how to use it after not using it for quite a while or it mainly depend upon while using the technology how successfully a user can restore his aptitude.

2.7.3. Contingency Theory

A contingency theory is an organizational theory that postulates that an effective organization should have a consistent structure with its environmental needs (Arpaci et al., 2012). There is no best way to organize to lead a firm, corporation, or making choices, and instead, it is contingent (dependent) upon the internal and external situation. Contingent leaders are flexible in choosing and adapting strategies to suit the change in the status at a particular period in time in the running of the organization. Contingency theory's main idea is that organizational viability is dependent on a good fit between the organization and its environment. An organization is considered an open system, emphasizing the complexity and variety of individual parts, participants, and subgroups and the looseness of their connections. The organization must be able to visualize and incorporate the contingencies of its environment into its premises to be viable (Damanpour and Schneider 2006). Furthermore, in a continuously changing and dynamic environment, the organization must be flexible, internally active, and renew and innovate.

The theory applies to this study because blood banks institutions in Palestine operate in different markets, have different management styles, and have individual compositions. As a result, to follow the concept of contingency theory, each organization must monitor its own environment and recognize that different situations need different responses. To study organizational adoption of IT, we should consider technological, organizational, and environmental contexts (Arpaci et al., 2012). The technology-organization-environment framework has been adapted in IT adoption studies. It provides a practical analytical framework for examining the adoption and assimilation of various types of information technology innovation (Oliveira and Fraga 2011).

2.7.3.1. Technology - Organization-Environment theory (TOE).

Tornatzky and Fleischer (1990), developed a framework called Technology-organization-environment (TOE) for organizational adoption based on contingency theory of organizations (Arpaci et al. 2012). It discusses the factors that influence and impact the likelihood of technology adoption. According to this theory, an influential organization should have a structure that is consistent with its environmental needs (Tornatzky et al., 1990). An organization's effectiveness is determined by its ability to deal with internal and external aspects such as the environment, organization size, strategy, and technological factors. The TOE framework, used in IT adoption studies, is a useful analytical framework for studying the adoption and assimilation of various types of IT innovation (Oliveira and Fraga 2011). Therefore, decision-makers should consider technology, organization, and environmental factors that affect technology adoption.

Using the TOE framework to develop ICT adoption models can provide an understanding of healthcare organizations' innovation adoption behaviors. The TOE framework acts as a solid theoretical lens for understanding ICT adoption, and it looks at how

organizations adopt technology while considering technological developments and employees' reactions. The organizational factors that drive the behaviour and environmental factors that influence adoption behaviour are also considered (Tornatzky et al., 1990).

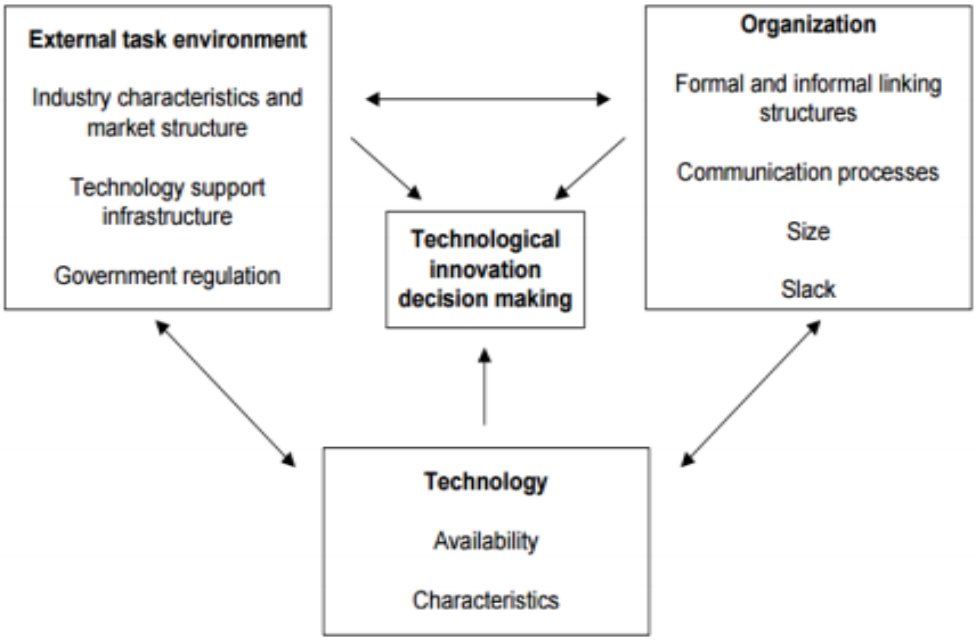

Figure 2.4: Technology-Organization-Environment framework.

Source: ((Tornatzky et al. 1990)

1. **Technological context**: includes the internal and external technologies that are relevant to the firm. Technologies may consist of both processes as well as equipment.
2. **The organizational context** refers to the characteristics and resources of the firm. Such as the company's size, the degree of centralization, the degree of formalization, the managerial structure, human resources, the amount of slack resources, and employee links.
3. **The environmental context**: The environmental context is the arena surrounding a firm, consisting of multiple stakeholders such as industry members, competitors, suppliers, customers, the government, the community, etc. They can impact how a

company views the need for innovation, its ability to acquire the resources needed to pursue it, and its capacity to implement it.

These three elements present both constraints and opportunities for technological innovation (Tornatzky et al., 1990). As a result, these three elements impact how an organization views the need for new technology searches for it, and uses it (Damanpour and Schneider 2006).

TOE framework can be combined with other theories to explain IT better adoption (Arpaci et al. 2012). This framework is consistent with the contingency theory and Rogers theory that emphasized individual characteristics and the organization's internal and external characteristics as drivers for organizational innovativeness. The TOE framework makes Rogers' innovation diffusion theory better explain intra-firm innovation diffusion because the TOE framework includes an environmental context that presents both constraints and opportunities for technological innovation (Oliveira and Fraga 2011). This research study integrates several TOE factors in a generalized model to understand the factors that influence an organization: blood banks' inclination to adopt the technology.

2.8 Conceptual framework and research hypotheses:

To better understand the complex new technology adoption, it's important to combine more than one theoretical model (Oliveira and Fraga 2011). This study use the TAM model and IDT theoretical model because they are two of the most widely used theories for understanding and forecasting system utilization and innovation adoption (Al-Rahmi et al. 2019; Choe and Noh 2018; LADIPO et al. 2021; Ying-Hui and Sheng-Yuan 2010). This study combines the IDT and TAM with TOE theory to develop the conceptual framework and the proposed hypotheses (Figure 2.5). And this study draws on TOE because we consider this model to be

more complete, as TOE framework includes the environmental context, that become better able to explain innovation adoption. The TOE framework also has a strong theoretical basis, Consistent empirical support, as well as the possibility for use in ICT adoption (Oliveira and Fraga 2011; Sulaiman and Magaireah 2014). And for this reason, TOE framework was undertaken and combine this model with IDT and TAM theories. The analysis produces 12 distinct codes or concepts that are further categorized into three major themes: Technology, organization, and environmental factors. The emerged organized themes provided a structure to examine the participants' views on the central research question.

Using TOE that describes the process by which a firm adopts and implements technological innovations is influenced by three elements: technological context, organization context, and environmental context: F*irst,* using the useability test and IDT three attributes: technical compatibility, technical complexity, and relative advantage. These four attributes present the technical factors. *Second*, top management support, ICT skills and knowledge, and ICT infrastructure were considered organizational factors. *Finally*, financial donor support and government support present the environmental factors. All these factors affect and influence the level of ICT adoption in the blood banks.

2.8.1. Conceptual Framework.

The conceptual framework is a diagrammatic presentation of variables in this study. It illustrates the proposed relationships between dependent (DV) and independent variables (IV).

The DV represents the level of adoption of ICT. While, The IVs of the study are factors influencing the adoption of ICT: relative advantage, compatibility, complexity, usability, management support, ICT infrastructure, ICT skill, donor support, and government support.

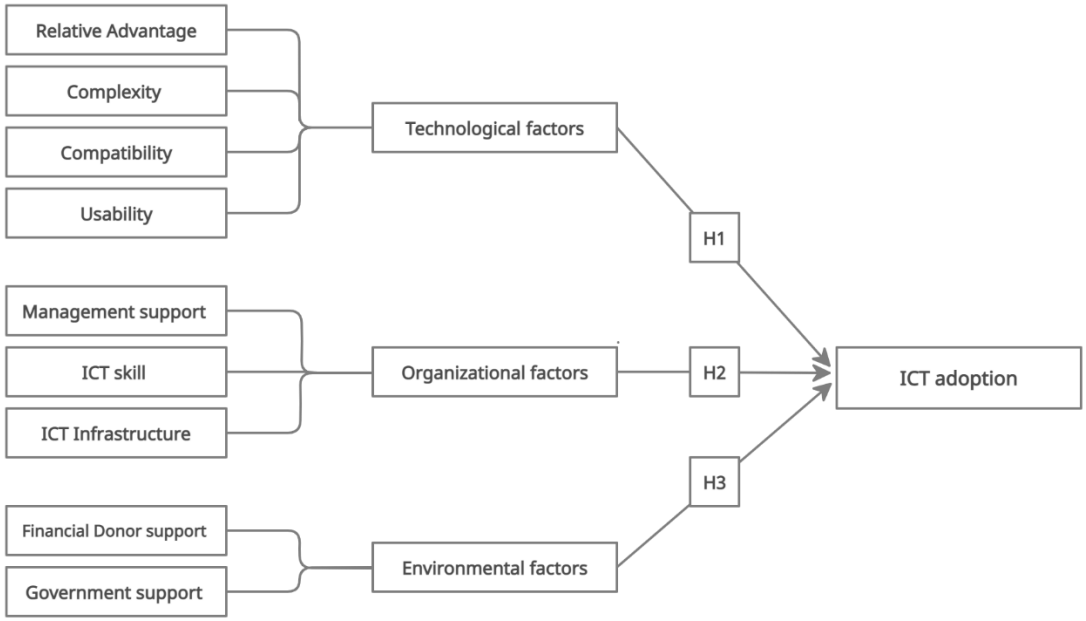

Figure 2.5*:* Conceptual Framework.

2.8.2. Research hypotheses.

Based on the conceptual framework, the researcher formulates three alternative hypotheses to be tested. The thesis examines the null hypothesis of each alternative one. The independent variables are the proposed influencing factors; the dependent variable is ICT adoption in Blood Banks.

H1: Technological dimensions influence the adoption of ICT at Palestinian Blood Banks.

H2: Organization settings influence the adoption of ICT at Palestinian Blood Banks.

H3: Environmental dimensions influence the adoption of ICT at Palestinian Blood Banks.

Chapter Three

Research Methodology

3.1 Introduction

This chapter details the employed methodologies in the thesis to achieve the research objective. The chapter introduces research design, study population, sampling procedures, data collection methods, research procedures, method of data analysis, and ethical considerations.

3.2 Research Design

This cross-sectional descriptive research focuses on and investigates factors influencing ICT adoption in Palestinian Blood Banks. According to Ngechu (2004), descriptive is the collection of information from the relevant group through interviews or questionnaires to a representative sample. Descriptive studies are often designed to collect data describing the phenomenon's characteristics under investigation. Therefore, it is justified that descriptive design is the most suited and justifiably method for this study.

The study used mixed methods research employing the combination of qualitative and quantitative approaches to collect data. Surveys help describe the characteristics of a large population. Furthermore, great reliability can be achieved by presenting all individuals with a standardized stimulus, which eliminates observer subjectivity.

3.3 Research procedure.

This study aims to explore the factors that influence ICT adoption in Palestinian Blood Banks. The study examines the potential forces for better ICT adoption to increase the likelihood of achieving quality healthcare service. The researcher purposely selected The researcher believes that employees who currently work in blood banks are appropriate people

to provide useful information and answer the research questions. Figure 3.1 shows the Methodological framework for this study.

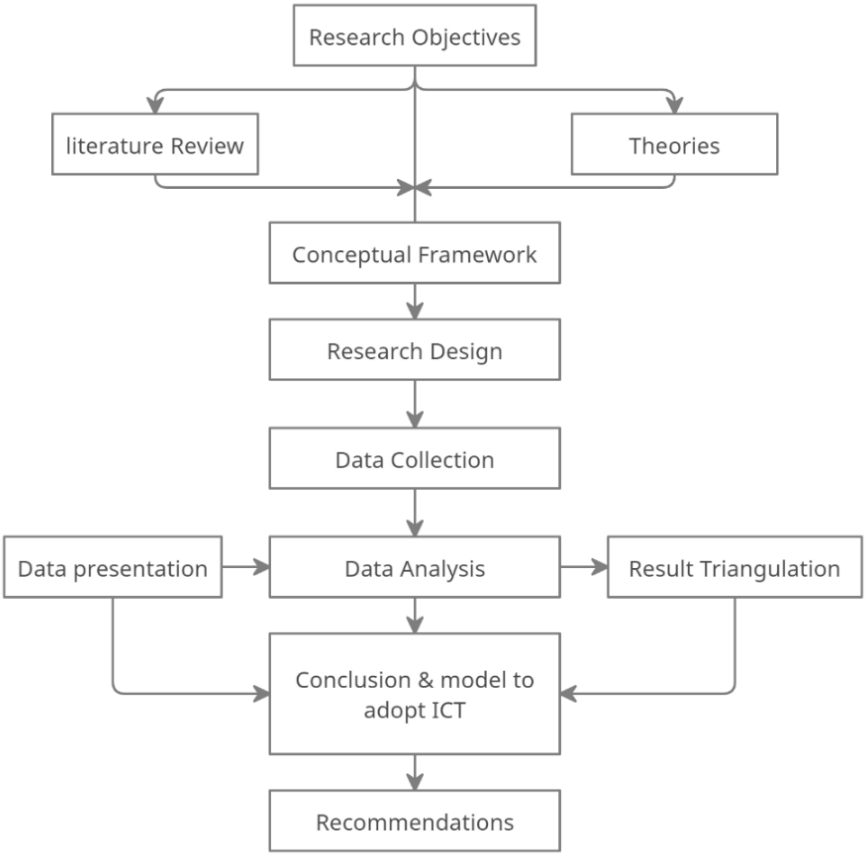

Figure 3 1: Methodological framework.

3.4 Target Population.

A study population refers to the entire group of people, events, or things of interest that the researcher wishes to investigate, draw conclusions, and information required to be established (Banerjee and Chaudhury 2010; Lundberg 2003). The study's target population is employees of the blood banks (IT and ICT directors, managers, doctors, nurses, blood bank and laboratory technicians, system administrator, record keeper). To get a better understanding of the context and the phenomenon under investigation, the researcher conducted 13 semi-structured interviews. Table 3.1 demonstrates the demographic characteristics of interviewees

Table 3.1: Interview respondents' demographic characteristics.

	Job title	**Education**	**Experience < or > than 20 years**
P1	Head of laboratories and blood bank department	More than 6 years	More than 20 years
P2	Head of Computer and Technology department	More than 6 years	More than 20 years
P3	Laboratory and blood bank technician	less than 6 years	less than 20 years
P4	Head of laboratories and blood bank department	More than 6 years	More than 20 years
P5	Head of blood bank department	More than 6 years	More than 20 years
P6	System Administrator	More than 6 years	Less than 20 years
P7	Head of Computer and Technology department	More than 6 years	less than 20 years
P8	Head of laboratories and blood bank department	More than 6 years	More than 20 years
P9	Head of blood bank department	More than 6 years	More than 20 years
P10	Laboratory and blood bank technician	less than 6 years	Less than 20 years
P11	Paramedical services director	More than 6 years	More than 20 years
P12	Head of blood bank department	More than 6 years	Less than 20 years
P13	Laboratory and blood bank technician	less than 6 years	Less than 20 years

3.5. Sample size and sampling procedure.

Stratified sampling method, a probabilistic method, is used to highlight differences between groups in a population, as opposed to simple random selection, which treats all the subjects of a population equally, with an equal likelihood of being sampled. It further helped in the process of identifying the respondents for data collection. The convenient sample size was established, the following subsections entail establishing a quantitative data collection process.

3.5.1. Sample size.

A total of 44 respondents participated. 13 for the interview and 31 for the questionnaire. The interview sample comprises the directors of blood banks and laboratory departments, head of the computer department, record keepers, nurses, doctors, laboratory and blood bank technicians, and system administrator.

3.5.2. Sampling procedure.

The study uses nonprobability purposes sampling techniques and convenient sample size. The sampling procedure refers to the researcher's method or designs in selecting subjects to participate. It is the process of laying down the number of items to be included in the sample, for instance, the size of the sample, given that this study required specific information from confident respondents.

The purposive sampling technique is used to select various staff in the different blood banks that influence ICT adoption as they are considered competent in providing the required information. According to (Etikan, Musa, and Alkassim 2016), the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience. Purposive sampling begins with a purpose in mind, and the sample is then chosen to include people who are relevant to the goal while excluding those who do not. The researcher deliberately includes respondents in the sample if they have the information required. The researcher purposively selected administrators and senior managers from departments that would provide the required information.

Convenient sampling was used to select blood bank and laboratories technicians, doctors, and some administrators. According to (Etikan et al. 2016), convenient sampling select members of the target population who meet certain practical criteria, such as easy accessibility, geographical

proximity, availability at a specific time, or willingness to participate, are included in the research.

The qualitative research method was most appropriate for part of this study because this method involves collecting and analyzing qualitative narrative data to explore a specific research question (Stentz et al., 2012). In qualitative research, the sample size is not as significant as in quantitative analysis; however, a sample size between five and 25 is ideal for qualitative research data collection (Draper and Swift 2011). For this case study where 13 participants were selected from blood banks in different sectors and were in different positions.

A total of 13 participants were interviewed for the study. The interviewees were blood banks and laboratories managers, Computer department managers, system administrators, and blood bank technicians who have at least eight years of experience. Each participant received an agreement form explaining the purpose of the study, the procedures, and the nature of the study. Each individual consented to participate in the study before starting the interviews. Each interview was conducted with one participant at a time in a private setting at their respective work site. When the researcher conducted the interview, the digital audio record was used, and later the Microsoft Word was used to transcribe the data collected from interviews and observations.

3.6. Research instruments.

The study is mainly based on the primary data source, that is, one in which the researcher collects the data. The research instruments were designed based on the previous empirical literature, and its consistency was pre-tested. The semi-structured interview was conducted to top management, ICT administrators, and system experts. Questions attempt to explore ideas

on ICT adoption. The responses may provide insight into the studding factors influencing ICT among Palestinian Blood Banks.

Furthermore, to triangulate, a qualitative result questionnaire was distributed to respondents working in the selected blood banks (nurses, blood bank and laboratory technician, record keeper, system administrator). The questionnaires contained both structured and unstructured questions. The questionnaires were used in this study because respondents are assumed to be literate and able to answer questions asked adequately. According to (Kothari 2004) the questionnaire as the most appropriate instrument due to its ability to collect a large amount of information in a reasonably short period. It guarantees the confidentiality of the source of information through anonymity while ensuring standardization (Lundberg 2003). The factors influencing ICT adoption in the blood bank items were measured on Likert- scale ranging from 4 (strongly agree) to 0 (strongly disagree). The research respondents were asked to indicate the degree of agreement or disagreement on ICT adoption factors. Some demographic questions were also forwarded. Every questionnaire is personally handed and instructions were given to each participant before completing the questionnaire.

3.6.1. Pre-test

The research instruments were subjected to pre-testing. Pre-testing aims to enhance the validity and reliability of our survey evidence (GAO 2009). Respondents were allowed to provide qualitative comments about the instrument items and to suggest ways to improve them. Ambiguous questionnaire items were identified and clarified i.e., unclear statements were rephrased. Although items were added for some variables and deleted for others, total number of questionnaire items was reduced as the questionnaire was regarded as too long. Minor changes were made to the design, structuring, and ordering of the questionnaire.

3.7. Data Collection

Triangulation has been used in this research, which is a qualitative research strategy of verification that increases validity by incorporating several viewpoints and methods (Carter et al., 2014). The purpose of triangulation is to secure an in-depth understanding of a research question by confirming data accuracy and completeness. In a case study, the four types of triangulation are data triangulation, investigational, theories, and methodological triangulation (Carter et al., 2014). Methodological triangulation has been found to be helpful in confirming findings, obtaining more comprehensive data, increasing validity, and gaining a better knowledge of the phenomena under investigation (Bekhet and Zauszniewski 2012). The researcher applied the methodological triangulation method in this study by using more than one method to study the phenomenon and brought in data collected from interviews, member checking, and direct observations with document review (Aberdeen 2013).

3.8. Validity of instrument.

Validity has been defined by "the extent to which a test measures what it claims to measure" (Lakshmi and Mohideen 2013), which is the accuracy and meaningfulness of inferences, which are based on research results. The content validity of a test is determined by whether the items accurately reflect the theoretical domain of the latent construct that it claims to measure (Lakshmi and Mohideen 2013). So It refers to how well a measuring instrument covers the topic under study. Its determination is primarily judgmental and intuitive. It can also be determined by using a panel of persons to judge how well the measuring instrument meets the standards, but there is no numerical way to express it (Kothari 2004). The validity of these research instruments are improved through expert judgment. The researcher instruments in close consultation with the supervisor who gave an expert judgment to ensure content validity. Academic Doctors also reviewed the instrument.

3.9. Data collection Procedure.

Permission to collect data from blood banks was required after the approval letter from the university to carry out the research. Each questionnaire came with a transmittal letter from the researcher The researcher will visit Blood Banks at different times and seek permission to collect data pertaining to the different ways discussed above.

3.10. Method of data analysis.

The technique of organizing research data is important, particularly in a case study. Microsoft Word was the tool used to transcribe the data collected from interviews and observations. Using codes to replace names of participants or the organization they represented ensured participant's confidentiality. Using codes and terms also helps identify common themes in collected data. Grouping the codes that emerge based on constructs that reflect different views expressed by the participants ensured the proper categorization of these themes. Codes such as P1, P2, P3, and so forth represented individual participants. Other codes identified characteristics within the data such as the different factors that influence ICT adoption decisions, T for technology factors, TR for Relative Advantages, TX for Complexity, TC for Compatibility, TU for Usability. And O for Organizational factors, OM for Management support, OS for ICT skill, OI for ICT Infrastructure. And E for Environmental factors, ED Financial Donor support, and EG for Government support. These codes allowed for easy categorization, analysis, and interpretation of the data. The data collected helped provide a snapshot of the cases studied, and from this data, the researcher identified themes that emerged to answer the central research question.

In this study, the researcher asked semi-structured interview questions (see Appendix B) to obtain in-depth information to address the central research question. The researcher

analyzed the data using Thematic analysis to identify, analyze, and report patterns (themes) within data. It minimally organizes and defines the data set in (rich) detail.

3.11. Ethical consideration.

The researcher strived to adhere to ethical research considerations and professional guidelines throughout this study. This involved avoiding acts of misconduct in research, such as data fabrication, falsification, and plagiarism. Permission to conduct the study was obtained from the relevant authorities before the commencement of data collection. The researcher ensured that the research ethics were considered. The respondents were informed that participation in this study was voluntary. Confidentiality and privacy was also observed. This was done by not revealing the identities of the respondents. The researcher also respected the respondents' choices of which details to provide. In this case, the researcher did not coerce the respondents to give any information or feedback. The study's objective was explained that it was for academic use only.

Chapter Four

Result and Discussion

4.1 Introduction

This chapter presents the study's findings on the factors influencing ICT adoption in Palestinian blood Banks. Data were collected through two types of data collection instruments; interview and questionnaire. The data was collected using qualitative and quantitative data collection methods. To answer the research questions, both qualitative and quantitative data were analyzed and triangulated one data source's findings with another data source's findings. The quantitative data collected were examined by the Statistical Package for Social Sciences (SPSS) version 20.

4.2. Demographic information:

First, analyze blood bank staff demographic information of the questionnaires:

Gender distribution: The study established the gender distribution of the respondents; from the research findings, the study revealed that the majority of the respondents, as shown by 71%, were females, whereas 29% of the respondents were males.

Table 4.1: Gender Distribution

		Frequency	Percent
Valid	male	9	29.0
	female	22	71.0
	Total	31	100.0

Age of respondent

The study established the age distribution of the respondents; from the research findings, the study revealed that the majority of the respondents are less than 35 years, as shown by a percent of 54.8%. In comparison, 45.2% of the respondents were more than 35 years.

Table 4.2: Age Distribution

		Frequency	Percent
Valid	less than 35 years	17	54.8
	more than 35 years	14	45.2
	Total	31	100.0

Level of Education

The study establishes to what level the respondents were educated (Table 4.3). The study revealed that all of the respondents were more than four years educated about education status. The majority of them have a bachelor's degree, and the others have a master's degree. This implies that the respondents had a high level of education. Thus, they were able to give credible information rating to this research.

Table 4.3: Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more than 4 years	31	100.0	100.0	100.0

Level of experience

The study sought to determine the level of expertise of blood bank and laboratory staff (see Table 4.4)

Table 4.4: Level of experience

		Frequency	Percent
Valid	more than 4 years	27	87.1
	less than 4 years	4	12.9
	Total	31	100.0

The research findings revealed that most of the respondents, as shown by 87.1%, have more than five years of experience, and 12.9% have less than five years of experience. This

implies that most of the respondents had served the institution for a considerable period. Thus, they were in a position to give credible information rating to this research.

Institution

Questionnaires were distributed to different settings of blood banks. Concerning the blood bank settings, the study revealed that most of the respondents, as shown by 35.5%, were from public hospitals, whereas 32.3% were private hospitals, and 32.3% were NGOs.

Table 4.5: Institution type

		Frequency	Percent
Valid	Public	11	35.5
	Private	10	32.3
	NGOs	10	32.3
	Total	31	100.0

4.3. Factors that influence ICT adoption

Eleven interviewees (P1, P2, P3, …, P11) participated in a semi-structured interview and openly answered the interview questions (Appendix A). This part has been answering how respondents perceive the different factors influencing the ICT adoption in the blood banks. The analysis produces 12 distinct codes or concepts; these codes are categorized into three major themes: Technology, organization, and environmental factors. The emerged themes provided a structure to examine the participants' views on the central research question. Figure 4.1 shows the coded framework for the theme ICT adoption factors.

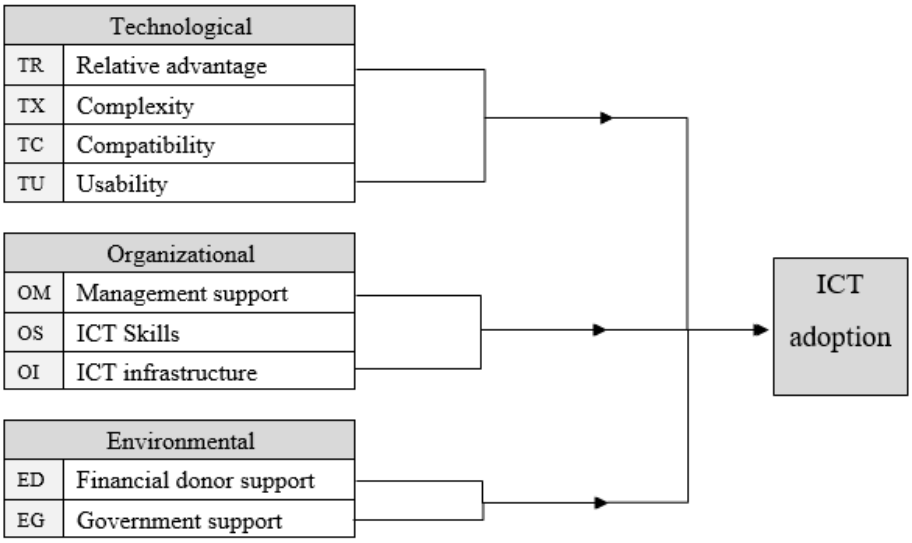

Figure 4.1*:* The coded Technological Organizational and Environmental dimensions (as given by the conceptual framework in Figure 2.5).

The researcher identifies the following dependent variable ICT adoption. This construct comprises the following six objects:

(1) Administrators regularly analyze the generated data of our ICT.

(2) Professionals regularly analyze the generated data of our ICT.

(3) Decision-making process during the transfusion services is built on ICT data.

(4) ICT helps blood donation and transfusion services to be delivered on time.

(5) Our blood bank screen is shared with relevant departments (e.g., surgery, Laboratories, emergency).

(6) Blood donors can reach out to blood bank information using ICT tools, can store and access the donor's information and inventory stock level from the system.

4.3.1. Technological factors that influence ICT adoption.

This part has been answering on how the technological factors influence the ICT adoption in the blood banks. Researchers in this section analyzed the participant's perceptions and made some points about the proposed technology theme including: Relative advantage, compatibility, complexity, and usability of the technology. These are the sub-themes. The codes constitute the significant theme of so-called technology (see Figure 4.1). Adoption is the dependent variable and other factors as the independent variable.

The findings of the unstructured interview response were presented in the following manner. Participants' answers to Interview Questions 3, 4, 8, 10, and 11 (Appendix A) provided the framework for the theme technology factors.

1. **Relative Advantage:**

All the participants from the different institutions (public, private, and NGOs) agree that ICT adoption in the blood banks is motivated by the relative advantages of newly deployed technologies. All participants emphasized that ICT adoption influences service delivery and leads to increased quality and efficiency within their respective department satisfactory healthcare delivery. Most participants indicated that the perceived benefits of ICT adoption also played a critical role in their decision to adopt ICT. As interviewees (P1, P2, P5, and P9) explained the ICT benefit on the blood bank:

> *"The blood bank benefits from ICT in documenting all the blood bank procedures, transfusion services, and laboratory tests. That makes the procedure and day-to-day operation much easier. That increase the performance and efficiency of service provided".* **(P1)**

"We believe in the importance of ICT in blood bank department, especially in emergencies, and we hope that ICT will help save lives in difficult times. In this hospital, we are aware of the need to employ technological capabilities to advance all departments, not just for the blood bank department". **(P2)**

" HIS help blood banks to store the donor information in a database so that authorized ones can access it. In addition, it makes the patient history being confidential and protects it from loss of data. The system makes tasks semi-automated. Those systems make the blood banks delivery systems contemporary and helps to give fast efficient and effective". **(P5)**

"The use of ICT allows data to be shared between blood bank departments in public hospitals. The blood donor has a file shared among government hospitals, it contains all of his test results, and if the donor has a health condition, an alert appears on his file, and any blood bank can see the warning. This greatly facilitates the procedures and also reduces the cost. As the patients or the blood bank don't need to repeat all the tests that have been performed in another blood bank". **(P9)**

Other participants expressed the importance of ICT adoption for data access and its relevance for smooth hospital management. As respondent (P11 and P12):

"It is also important for management because the system can manage employee's data centrally.". **(P11)**

"ICT assists the blood bank in managing human resources and staff information. By recording working days and holidays...etc.". **(P12)**

The triangulate quantitative findings support the respondents positively perceive that using ICT achieves a relative advantage for the blood bank and that ICT adoption brings better

and efficient healthcare delivery, facilitates information access and communication, and supports decision-making that improves medical care quality. On average, their response touches the agree score (average mean equal 3.2). However, the score varies among respondents mainly on the second and the third items (SD= 0.7 and SD=0.9). Please note that the max response = 4.0, min = 0.0, Table 4.6.

Table 4.6: Relative Advantage.

	N	Mean	Std. Deviation
ICT improves efficiency of Blood Bank services	31	3.6774	.47519
Communication among stakeholders is faster when I use ICTs	31	3.0968	.78972
ICT tools facilitate information access for blood donors	31	2.9355	.96386
ICT supports medical professionals in their decision-making leading to improved medical care quality	31	3.3871	.66720
Valid N (listwise)	31		
Average mean		3.2742	

2. Compatibility:

Technology compatibility with the existing system is a determinant factor that influences ICT adoption. All participants emphasized the necessity of using ICT tools and their compatibility with the tasks of the blood bank to improve performance. The participants back up their claims with examples such as:

"All Palestinian blood banks must implement information and communication technology, which has accelerated and facilitated blood bank services. That's because ICT is compatible with the blood bank services." **(P5, P8, P12, and P13)**

"The employment of ICT systems aids in the protection of data privacy and security. Blood banks manually recorded all the information related to the donor, bloodstock, and

transfusion service operations. These old procedures led to many incidents, such as loss of information, inability to track the blood unit and so on.". **(P4)**

Few respondents (e.g., P6 and P7) explained some compatibility problems with the system, which are:

"The incompleteness of the implemented ICT features limits the usage of the system's full potential. Failure to make optimal use of the computerized system with all the features available in it as a source of correct information that enables future planning arising from the actual need." **(P6)**

*"Information systems and technology have been purchased and activated in hospitals without analyzing the current system, resulting in the technology itself sometimes not being compatible with the current system and procedures. "***(P7)**

The respondents' quantitative findings agree that they need ICT in their tasks by a mean of 3.1, and it speeds up blood bank services by a mean of 3.0. ICT increases information privacy touches the agree score by mean 2.96. Finally, the respondents moderately agree about the ICT compatibility with the system by mean 2.8, Table 4.7

Table 4.7: Compatibility:

	N	Mean	Std. Deviation
I need ICT tools in my job	31	3.1935	.79244
ICT tools speed up blood bank services	31	3.0323	.79515
ICT increases information privacy	31	2.9677	.79515
ICT tools compatible with the current system	31	2.8387	.86011
Valid N (listwise)	31		
Average mean		3.0080	

3. Complexity

Complexity is one of the factors influencing the ICT adoption in the theme of technology. As interviewees (P3, P9, and P13) explained:

"There is complexity in dealing with ICT systems. One of the challenges, when wrong data is entered. It's difficult to modify and correct the mistakes. This may take time and cause some problems as there may be cases where it cannot tolerate any delay." **(P3)**

"There is a tendency of resist to accept new technologies as they introduced by the organization. User's resistance to adopt new technology because they are not familiar with it, and afraid from the complexity of the ICT tools". **(P9)**

"Implementing ICT is difficult; for example, the (HIS) system utilized in most hospitals is foreign. This makes the adoption process difficult and expensive". **(P13)**

"It is challenging to integrate new blood bank information technology. It needs interoperability between the department's system and with the hospital digital data.". **(p7)**

Table 4.8: Complexity:

	N	Mean	Std. Deviation
I face difficulty when I use ICT tools that are related to Blood bank tasks	31	2.9032	.78972
I face difficulty to understand information and report generated by ICT tools	31	3.1613	.77875
Practically, the ICT tools are that used in Blood Bank are complicated	31	3.0323	.91228
Valid N (listwise)	31		
Average mean		3.0322	

Similarly, the questionnaire survey concerning the complexity of the technology showed a relatively agree level about the complexity of adopting ICT—their response in the agreement

on the score (average mean equal 3.0). Respondents moderately agree that they face difficulty using ICT tools related to blood bank tasks, as shown by a mean of 2.9. And agree that they face problems understanding information and reports generated by ICT tools by mean of 3.1. And agree that (a mean of 3.0) complicates the ICT tools that are used in a blood bank. See (Table 4.8):

4. Usability:

Usability is the fourth factor for ICT adoption in this study. The quantitative result from the respondents mentioned the usability challenges of ICT. As the interviewees explained:

" Because the systems are foreign and deployed by outside professionals, we can't easily learn it". **(P10).**

"At the beginning of using the program, it is difficult to memorize all the functions because it contains many features, but the user gets used to it". **(P12)**

" ICT technologies, which range from hardware to software, have undoubtedly aided in the resolution of blood bank challenges and increased the efficacy and efficiency of blood bank operations ". **(P1) (P6) (P5) (P11)**

" *Turkey provided the program currently in use in government hospitals; however, it was not created to meet our demands, resulting in some issues in its use.. "***(P6)**

Considering the quantitative data, the research employs the usability dimension to examine the user's perception of the ease of use and usefulness of the technology, which are variables that primarily affect the user's acceptance (Davis 1989). The first two questions for the ease of use, third and fourth questions for usefulness (Burney et al. 2017). The questionnaire respondents show a relatively moderately agree level scoring a mean of 2.9 about the system usability. This means they find the system not very easy to use. They moderately agree about the learnability and memorability of the ICT system. The results show learnability by a mean

of 2.1. Then, the memorability of the employed system by a mean of 2.7. Finally, they agree that the system improve their performance by a mean of 3.5 (Table 4.9):

Table 4.9: Usability

	N	Mean	Std. Deviation
It's simple to learn using ICT systems related to blood bank.	31	2.1935	1.04624
when I use ICT again, I can easily recognize its features.	31	2.7419	1.03175
Using ICT would empower me to finish tasks rapidly.	31	3.4516	.62390
Using ICT would improve my effectiveness on the performance.	31	3.5484	.56796
Ease of dealing with the system interfaces, such as the ease of searching for blood type and recording donor data ... etc.	31	2.9355	.81386
Valid N (listwise)	31		
Average mean		2.9741	

Triangulation result for the technology dimension:

Respondents perceive that the technology is very important and has many advantages in improving blood bank performance. This means that the respondents know the added value of using a system effectively and know the potential benefits of using ICT in blood banks. According to the Innovation-Diffusion theory (IDT), if potential adopters perceive the advantage of the innovation, its adoption rate is high. And according to Sheikh Shoaei and Olumi (2006), if the user have clear perception of the innovation's benefits. The innovation actions will be more likely to occur. This means that relative advantage work as a positive factor for ICT adoption in the Palestinian blood banks.

Concerning complexity, the respondents see ICT as complex; according to Low and Chen (2011), complex technologies decrease ICT adoption. And according to IDT, the adoption

rate of innovation is low if potential adaptor perceives it as complex. That means the complexity work as a negative factor and making the ICT less likely to be adopted and diffused.

Concerning compatibility, the respondent's results were positive and agreed that ICT is compatible with blood bank tasks. According to the IDT, compatibility with what is currently in place makes the new practice appear less uncertain, more familiar, and easier to adopt. So compatibility raises the level of ICT adaptability in the Palestinian blood banks. And According to Dobbins and Cockerill (2001), when respondents have a positive perception about the relative advantage and the compatibility of the ICT even if they see it as complex, potential adopters may still choose to use the innovation.

Finally, for usability, the interviewees generally agreed with the usability of the ICT. The perception of ease of use was low; the result shows that they face difficulty learning and memorizing the ICT tools. According to the TAM model (Davis 1989), this low level of perceived ease negatively affects the user's acceptance. And according to Low (2011), Organizations tend to adopt new technologies that are easy to use. This makes the ease of use perception as a negative factor for ICT adoption in blood banks. But the usefulness perception was high, that they believe ICT can improve the effectiveness and efficacy of their performance. According to (Davis 1989; Gagnon et al. 2012), the high level of use makes the ICT more likely to be adopted.

The effect of the technology factors on ICT adoption. Regression model and hypotheses testing

The regression model examines the significant effects of each technology factor (IV) on the level of ICT adoption (DV). Despite being significant, surprisingly, non of the technological factors significantly influence ICT adoption ($P > 0.05$). Therefore, there is no evidence to reject the null hypothesis of no effects of technology on ICT adoption. Yet, the usability (TU) factor

shows the highest impact on ICT adoption (P = 0.07). This goes in line with the low levels of perceived ease of use among the interviewees.

Table 4.10: ANOVA for Technology factors

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.809	4	3.202	5.573	.002[b]
	Residual	14.939	26	.575		
	Total	27.749	30			

a. Dependent Variable: ICT

b. Predictors: (Constant), TU, TC, TR, TX

Table 4.11: Coefficients for Technology factors

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.576	1.760		.327	.746
	TC	-.121	.270	-.075	-.446	.659
	TR	.242	.388	.122	.623	.539
	TX	-.376	.265	-.286	-1.422	.167
	TU	.718	.380	.402	1.890	.070

a. Dependent Variable: ICT

4.3.2. Organizational factors that influence ICT adoption.

We analyzed the participant's perception and made some points about the proposed organizational factors; top management support, ICT skills, and ICT infrastructure—these codes constitute the major themes of the so-called organization dimension.

Participants' responses to Interview Questions 1, 2, 7, and 9 (see Appendix A) provided organization factors for ICT adoption. The codes were Top management characteristics, quality of human resources, and resource availability (Figure 4.1). To triangulate the qualitative

finding, the researcher collected quantitative data on management support, ICT skill, and ICT infrastructure as an organizational factors influencing ICT adoption.

1. Top management support

Top management support is one of the organizational factors that influence technology adoption. First, from the demographic information in the interview, the result revealed that 92.3% of the top manager are computer literate, they have at least 15 years of experience, 84.6% Own PC at home, 76.9% have access to the shared screen with other departments, and all of them reply to every email.

Second, as interviewees (P3, P4, and P13) explained top management role:

"Managers have different attitudes toward technology adoption. The majority encourage the use of technology in blood banks, but small group consider it a waste of resources." **(P3)**

"many of the top management do not recognize the relevance of ICT, and lack of knowledge and understanding the value of ICT specialists" **(P4)**

"Top managements are stacked on the manual or traditional task processing system. Generally, they are following the traditional way of perception about the ICT adoption". ***(P13)***

The questionnaire results show a moderately agree about the management support on ICT adoption by average mean (2.6) as shown in (Table 4.12). The respondents agree that blood bank vision support ICT adoption by mean (3.0). But moderately agree about the commitment of top management to acquire ICT, management know how to implement ICT, and in providing the training needed for the staff by mean (2.9). Finally, the respondents disagree with management support purchase ICT and delivered it in the right time by mean (1.5).

Table 4.12: Top management support.

	N	Mean	Std. Deviation
Our blood bank vision supports the adoption of ICT.	31	3.0968	.83086
Top managers are committed to acquire and use ICT technologies.	31	2.9032	.87005
ICT tools are purchased and delivered as per the request at the right time.	31	1.5161	.76902
blood bank management knows how to implement ICT.	31	2.9355	.77182
The organization has qualified personnel that provides the training needed in the use of ICT.	31	2.9355	.85383
Valid N (listwise)	31		
Average mean		2.61742	

ICT Skills among employees

One of the major and frequently identified factors that influence ICT adoption is the availability of the quality of human resources. This is recognized as one of the organizational themes from the empirical studies. Having ICT skills means understanding and using a range of computer programs, software, and other applications are essential ICT skills. Word processing, spreadsheets, databases, PowerPoint presentations, and search engines are just a few examples. Associated skills and technical skills include creative and analytical skills for applying the appropriate ICT skill to an activity. Interviewees (P1) (P4) (P7) (P8) (P9) mentioned:

"To make the Hospital competent, contemporary, efficient and effective there should be ICT skill-building training given at the right time.". **(P4)**

"Their colleagues train new blood bank employees. Anyone who wants to gain skills and experience in the field of blood banking can volunteer for free to work in the blood bank" **(P1) (P4) (P8) (P9)**

"Top management are not dedicating to provide the skill-building training to the low-level employees" **(P7)**

"Ministry of Health (MoH) scheduled training program (continues training) for the health sector, but this skill-building training does not always reach to the right person" **(P13)**

"The absence of well-trained human resource in the field of ICT is even the frustration issue for future ICT adoption." **(P5)**

The quantitative study shows a moderately agree about the ICT skill they have by average mean (2.6). They agree that they can use the core computer programs by mean (3.1). But all the other basic ICT skills are moderately agreeing by mean (less than 3.0). These skills that employees need to have to adopt ICT are weak (Table 4.13).

Table 4.13: ICT skills

	N	Mean	Std. Deviation
I am able to confidently use core computer programs such as Word documents and PowerPoint presentations.	31	3.1290	.76341
I am able to use computer operating systems to access software programs and manage basic software functions.	31	2.8710	.95715
I can organize and analyse information with the help of computer spreadsheet and database software.	31	2.2581	1.12451
I can troubleshoot the problems I face in using the computers.	31	2.4839	1.02862
I am able to communicate and interact with other ICT users through the use of the internet and email.	31	3.3871	.71542
I can create and engage with digital information for a specific task.	31	2.3871	.88232
I need more technical know-how before I can use ICT tools.	31	2.5161	1.06053
Language (English) hinders my capabilities.	31	2.3548	1.08162
Valid N (listwise)	31		
Average mean		2.6789	

2. ICT Infrastructure

Another organizational factor for ICT adoption is resources availability (ICT skilled staffing, ICT devices, and computers). Interviewees (P6) (P7) and (P8) explain:

"To make the hospital competent, contemporary, efficient and effective there should adequate computers must be purchased. But in our blood bank, for example, there are not enough computers available for employees" **(P7).**

" The most difficult and significant issue is the complicated purchasing process chain and obtaining the necessary equipment" **(P6).**

"The main obstacle to adopting ICT is the cost of equipment, and the inability to provide the complete infrastructure". **(P8)**

Table 4.14: ICT Infrastructure

	N	Mean	Std. Deviation
The blood bank has a fully functional website.	31	1.0645	1.20928
The blood bank has good internet connectivity.	31	2.6774	.90874
All the blood bank processes are software supported.	31	2.0000	1.43759
I do not have access to recent ICT tools	31	2.5161	.85131
Technical personnel are available to help to face ICT malfunctioning when needed.	31	2.9677	.94812
Valid N (listwise)	31		
Average mean		2.2451	

Interviews summarize the weaknesses in the ICT infrastructure. Whether because of lack of interest from managers or lack of funds. The study's quantitative results also show a similar result. Respondents moderately agree about the availability of infrastructure. They

disagree that the blood bank has a website by a mean of 1.2 and moderately agree about the availability of other infrastructure like good internet, software supported access to recent ICT tools. The availability of technical personal moderately agree but is close to agreeing on level by a mean of 2.9677 scores.

Triangulation result for the Organizational them:

Most participants agree that some of the top management had common characteristics on ICT adoption in a healthcare organization, and these characteristics may negatively influence ICT adoption in blood banks. And a participant mentioned that there is no common understanding on ICT between the top management and employees. Many of the top management do not give weight to the importance of ICT, and the top management also has a deficiency of understanding and giving value to ICT professionals. Gagnon (2012) indicates the role of top management in adopting ICT and influences acceptance and successful implementation of ICT. (Abouzahra 2011) the creation and implementation of ICT projects need support from the highest levels and leadership. Kuek and Hakkennes (2020) mentioned that if top managers hold positive attitudes towards IS, contributing to the successful implementation of ICT in the blood bank department. The study results show that top management is not very supportive of ICT adoption. This makes the top management factor negatively affect the adoption of ICT in Palestinian blood banks.

The second organizational factor is ICT skills. ICT adoption is influenced by learning conditions, technical knowledge, and basic ICT skills required in any position. The qualitative finding shows a lack of ICT skills with top managers and employees. Similarly, the quantitative result revealed a weakness in troubleshooting the problem they face in using the computer. The employees are not skillful in operating the computers, many of them do not understand how to use the IT service in the blood bank. According to Farzandipur (2016) and Kuek and Hakkennes

(2020), if employees and patients have insufficient skills and technical knowledge in dealing with ICT, they will resist implementing ICT initiatives in healthcare. That means that the lack of ICT skill factor negatively affects ICT adoption in Palestinian blood banks.

The third factor is ICT Infrastructure. It is critical to look at the availability and adoption of ICT Infrastructure. Because having a good ICT infrastructure is a must in adopting ICT in the health sector (Mwangi 2017; Nyaggah 2015). Infrastructure access issues, slow or unreliable Internet connections, lack of gadgets and type of technology, etc., limit the ICT adoption in the healthcare sector (Omotosho et al., 2019). The data show that managers are not concerned about ICT infrastructure and could not build a convenient environment for ICT infrastructure. Limited and unreliable internet service, wired and Wi-Fi networks, and other infrastructural services are not readily available. That means the ICT infrastructure factor limits the ICT adoption in a blood bank in Palestine

In line with the qualitative data, the regression analysis provides evidence to reject the two null hypotheses of no effect of ICT skills or ICT infrastructure on ICT adoption as given by (P=0.012) and (P=0.014), respectively. The regression model is significant to predict the level of ICT adoption (P=0.00) and (F=25.77).

Table 4.15: ANOVA for Organizational factors.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.566	3	6.855	25.770	.000[b]
	Residual	7.182	27	.266		
	Total	27.749	30			

a. Dependent Variable: ICT

b. Predictors: (Constant), OI, OS, OM

Table 4.16: Coefficients for Organizational factors.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.001	.431		-2.320	.028
	OM	.365	.215	.242	1.698	.101
	OS	.561	.208	.377	2.692	.012
	OI	.424	.162	.363	2.621	.014

a. Dependent Variable: ICT

4.3.3. Environmental factors that influence ICT adoption.

1. Government support

Interview Questions 5, 6, 7, 8, and 9 (see Appendix A) explain the role of environmental factors that facilitate ICT adoption. Government support and donor financial support are considered environmental factors that influence ICT adoption in health care.

Several interviewees described the government regulation as playing the leading role in ICT adoption in a public hospital:

"Furthermore, the government provides skill-building training, but exclusively for the public health sector." **(P7).**

"The government relies on donations and grants from other countries. this effect our government performance that it cannot cover all the need for all the healthcare facilities, different NGO's and private hospitals don't get much support to meet ICT needs". **(P1) (P3) (P8)**

"One of the factors preventing the merging of government and non-government hospital systems is government policies". **(P1)**

" The Ministry of Health encourages adoption in the health-care industry by establishing policies and training programs such as (Continuing Education Program) But it focuses on the public sector and doesn't give too much attention to the other institution. This limits the full potential of the system." **(P13)**

The quantitative finding also strengthens the qualitative data Table 4.17. the respondents moderately agree that the government encourages blood banks to adopt ICT and support the digitalization transition of blood banks by mean (more than 2). and disagree that the government policies facilitate the successful implementation of ICT and pay attention to blood bank ICT by mean (less than 2).

Table 4.17: Government support

	N	Mean	Std. Deviation
The government encourages blood banks to adopt ICT.	31	2.7419	1.03175
Government policies facilitate the successful implementation of ICT.	31	1.4194	1.11876
The government policies pay individual attention to your blood bank's ICT.	31	1.8065	.94585
The government is supporting the digitalization transition of blood banks.	31	2.0645	1.26321
Valid N (listwise)	31		
Average mean		2.0080	

2. Financial donor support

Donor financial support is mentioned as an environmental factor in the literature that influences ICT adoption. Donor support help acquiring the necessary ICT systems in the hospital. Donors can also play an important role in bridging the knowledge gap

by arranging regular training on ICT skill building for the hospital staff. Interviewees said:

"It is difficult to purchase ICT tools and deliver them on time. Because the health sector relies on donations from external parties to meet the needs of the health sector, and this could take a lot of time to get the needed support". **(P10)**

"Donors can contribute both effective and contextual support by listening to hospital employees and learning about each organization's particular financial picture". **(P5)**

*"The health sector relies heavily on donations and financial support, and this has an impact in not meeting all its needs or in developing systems".***(P10)**

The quantitative findings confirm the qualitative information as well. See (Table 4.18). Respondents moderately agree that donors provide financial supports to purchase ICT in blood banks by mean (2.5). And disagree that the donor provides training courses on ICT.

Table 4.18: Financial donor support

	N	Mean	Std. Deviation
Donors provide financial support to purchase ICT equipment in the Hospital.	31	2.5806	.76482
financial donors subsidize training courses on ICT	31	1.2258	1.08657
Valid N (listwise)	31		
Average mean		1.9032	

Triangulation result for the environmental them:

First, government support is one of the environmental factors that influence ICT adoption. According to TOE theory (Tornatzky et al., 1990), the government can impact how a company views the need for innovation, its ability to acquire the resources needed to pursue it,

and its capacity to implement it. According to the respondents, the government's attention focuses on public hospitals, as private hospitals and NGOs do not receive this support from the government. And from the quantitative data, the score varies among respondents due to the different institutions' responses. So the government support affects ICT adoption significantly.

The second factor is a financial donation. Donors provide financial support to acquire the necessary ICT infrastructure in the hospital, helping in providing and implementing new technologies. It can also play an essential role in bridging the knowledge gap. The respondents pointed out the significant role of financial donors, as the Palestinian health sector depends heavily on donations. According to the quantitative, there is a shortage in donation support, whether financial or knowledge support. That means donor financial support negatively affects the ICT adoption in Palestinian blood banks.

In line with the qualitative data, the regression analysis provides evidence to reject the two null hypotheses of no effect of financial support (aids) or the supportive governmental role on ICT adoption as given by (P=0.001) and (P=0.00), respectively. The regression model is significant to predict the level of ICT adoption (P=0.00) and (F=38.93).

Table 4.19: ANOVA for Environmental factors

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.409	2	10.204	38.930	.000[b]
	Residual	7.340	28	.262		
	Total	27.749	30			

a. Dependent Variable: ICT

b. Predictors: (Constant), EG, ED

Table 4.20: Coefficients for Environmental factors.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.383	.291		4.745	.000
	ED	-.486	.127	-.388	-3.832	.001
	EG	.949	.109	.881	8.704	.000

a. Dependent Variable: ICT

4.4. Discussion

4.4.1. Technological factors on adoption of ICT

This research has been answering how the technological factors that influence the ICT adoption in Palestinian blood banks. The triangulation analysis using qualitative and quantitative data show that the four technology factor: relative advantage, compatibility, complexly and usability have a different effect on the ICT adoption in the blood banks. Most of the respondents revealed that ICT delivery can create better and efficient healthcare services. The respondents agree that the ICT has a relative advantage and is compatible with the blood bank system. This means that the employees have a good perception and positive attitude toward ICT. According to IDT, these factors are generally positively correlated with the rate of adoption, which increases the adoption rate.

And the study revealed that among the factors influencing the adoption of ICT in blood banks, usability is the main factor of the technological aspects. The usability of the system represents the external variables that indirectly affect individuals' attitudes toward adoption of ICT acceptance by influencing perceived usefulness and perceived ease of use. The study shows that the perceived ease of use is weak, the staff clarified that they face difficulty learning and memorizing the system, and the system's interface is not very easy to use. But they perceive the

ICT as beneficial, which they believe ICT can improve their and blood bank performance. According to the TAM model (Davis 1989), if the user perceives the technology as complex and not easy to use he will not adopt the technology. This means that usability is a barrier to adopting ICT in blood banks.

This also can explain why employees have a perception that the system is complex. From the results, perceived complexity comes after the usability as a technological barrier that affects ICT adoption. According to IDT (Robinson 2009; Wani and Ali 2015), the complexity factor generally negatively correlates with the adoption rate. So the problem of being unable to be familiar with the system makes the ICT adoption unsuccessful in the Palestinian blood banks and hinders the technology from value-adding tasks. To increase the rate of adoption, they need to focus on solving the complexity and usability factors.

4.4.2. Organizational factors on adopting ICT

In line with the literature, interviewees stated that organizational factors influence ICT adoption in the organization. The study revealed that top management support, availability of ICT infrastructure, and ICT skill are identified as a dimension of organizational factor that influences ICT adoption in blood banks. The study revealed that the top management initiative, encouragement, and motivation were not so strong to promote ICT adoption for the blood bank, as shown by the mean (2.6). The study underlined that based on the quantitative research, top management particular weakness brings a consequence of making employees too worried to operate the computers and other ICT technologies,

The second organizational factor that influences ICT adoption is ICT skills. Employees of blood banks lack specialized ICT knowledge, as shown by a mean of (2.6). Therefore, training should focus on specific technical expertise in ICT to improve the blood bank service delivery. Lack of knowledge on ICT tools and programs is the determinant factor that influences

ICT adoption. This calls top management to seek something to overcome the problem related to the user's ICT knowledge.

The third organizational factor that influences the ICT adoption in Palestinian blood banks is the availability of ICT infrastructure in the blood bank like full internet connectivity, computers, ICT expert and ICT consultant, functional websites, and different accessories. The research revealed that there is a shortage of ICT infrastructure. As we explained before, this may be due to the managers' lack of interest in adopting information technology. And also due to (environmental factors) and the lack of funds to develop the infrastructure.

4.4.3. Environmental factors on adoption of ICT

The study revealed that the most significant factor influencing ICT adoption in Palestinian Blood Banks is the donor support category. First, Donors provide financial support to purchase ICT equipment for blood banks or subsidize training courses on ICT by mean (1.9). Even though the donor offers different funds for the hospital, the lack of interest in developing blood banks makes the donor support less essential factors for blood banks. This is due to a lack of effective communication and relationship with outside donors to determine the type support that blood bank need. And also the main reason is the hospital administration's lack of interest in developing blood banks.

The study result shows that government support is the most factor that affects ICT adoption in the Palestinian blood bank. Government facilitates and supports ICT adoption in blood banks by mean (2.0). This is because the government only supports and pays attention to the public sector. And government policies impede the integration between the government sectors and private or non-governmental sectors. This limit to take the entire benefits from ICT systems.

Chapter Five

Conclusion and Recommendations

This chapter concludes by building on research findings and hopefully provides relevant recommendations to guide Palestinian decision-makers in improving ICT adoption in the Palestinian blood banks. The chapter also suggests future research to extend this research effort in the next step.

5.1. Conclusion

This research work tackles an essential prerequisite to increase the likelihood of successful implementation of ICT systems among the Palestinian blood banks. The thesis aimed to promote awareness toward ICT adoption and uncover the influencing factors to identify the strengths and weaknesses to formulate new strategic responses for better technology adoption. With the attempt to improve quality of and performance, blood donation, transfusion, and storage processes are important. The importance of this work derives from the vital role of blood management in the context of healthcare. Both qualitative and quantitative data feed many exciting findings within the thesis and improve the robustness of its findings. The findings have several practical implications and recommendations for blood banks, healthcare management, and decision-makers.

Despite the wide use of ICT in Palestinian hospitals, little attention has been paid to the application of ICT in the blood bank departments. Most of them still used manual procedure and if there are ICT tools, not all features are activated, limiting the full advantages of using ICT. The result of the study tackled exploring and testing many different factors that influence ICT adoption in Palestinian blood banks, and these are environmental, organizational, and technological factors. The qualitative analyses of interviews revealed the complexity and

usability of the ICT technology, top management's lack of understanding of the need for ICT adoption and the attitude toward technology, and the lack of consistent training on ICT to the healthcare and ICT professionals. In addition to the lack of reliable ICT infrastructure, poor ICT-skilled personnel, policies, and government role are also identified as the main factors influencing ICT adoption in the Palestinian blood banks.

The researcher triangulated the qualitative and quantitative data to make the qualitative findings more acceptable and reliable. The study's conclusions triangulated reveal that the significant factors influencing ICT adoption in Palestinian blood banks are as follows: The environmental factors, which are government support and financial donor support, are the key barriers to ICT adoption in Palestinian blood banks. The government can impact how the blood bank views the need for innovation, its ability to acquire the resources needed to pursue it, and its capacity to implement it. Government can take several steps to ensure that the support they provide to beneficiaries, the policies and procedures associated with that support, enable hospitals and blood banks to perform their tasks effectively. Government can help blood banks to share information like donor's records and inventory data altogether, blood banks can share their data by establishing a centralized relational database that is controlled by (MoH) that can be accessed through shared health web portal by internet. The study suggests system integration between different sectors to empower resource sharing. One of the procedures is using a networked computerized system, especially interoperability in healthcare information and management systems between the different sector (governments and non-governments) hospitals and blood banks. To share data between programs, databases, and other computer systems in an automatic and efficient manner. This can be accomplished by establishing interoperability, which entails using a standard data format and common data structure protocols that are managed by a central authority (MoH). Therefore, health care centres in Palestine have to look for standards when developing their systems to avoid the conflicts

between distributed systems so they can interact and exchange data among the others efficiently and without errors. The adoption of these common standards enables the transmission of meaningful information independent of any information system, such as electronic medical records and electronic donor's records. This will increase productivity, reduce costs, and reduce errors.

The other environmental factor is the financial donor support. The financial donors can offer support to acquire the necessary ICT facility in the blood banks, helping offer and implement new technologies, and bridging the knowledge gap, like arranging regular training on ICT skill building for the hospital staff. The problem lies in the Palestinian blood banks is the lack of good communication with financial donors. As a result, the financial support offered by donors is insufficient to meet the blood bank's needs. Financial donors can provide adequate and contextual support by listening to blood bank staff, listening directly to them about the types of support they need, and understanding each organization's unique financial picture.

The need to invest in employees is another implication. Because one of the most crucial issues when preparing to implement ICT in any healthcare sector is the training and education of users for successful implementation. Results show that staff ICT skills are relatively weak because healthcare personnel aren't ICT experts, they'll need as much training and help as possible to use the systems. To strengthen their competencies, decision-makers should invest in employee training and development. It's important to provide ICT skills development and quality training courses to improve their performance.

Furthermore, comprehensive performance appraisal systems must be developed to analyze staff performance and link the results to a clear and equitable incentive system. The results also show that the managers have a passive attitude towards the adoption, providing pieces of evidence of the benefits ICT will help them change. As a result, managers must

participate in training programs to learn about the advantages of using ICT and consult external knowledge sources to keep up to date on the latest developments. Besides that , hospitals and blood banks require qualified personnel to provide ICT training to implement appropriate ICT practices, and training will help the technical staff offer the required proof. Familiar blood banks with ICT may share knowledge for mutual learning benefits (the system usability will improve, and complexity will decline). This will guarantee that staff understands how information systems work and will help to eliminate ICT implementation resistance.

Regarding the influence of ICT infrastructure on ICT adoption, the study uncovered that ICT infrastructure is another critical barrier to ICT adoption. The survey also discovered that the hospital's shortage of ICT infrastructure had affected effective and proper ICT services delivery. Managers need to give more attention to support infrastructures, such as connectivity, software development support, the assembly of ICT equipment and accessories, and incentives for the deployment of ICT infrastructure in hospitals. And the ICT system should be adopted in full functionalities to get the highest beneficial impact. Building on the findings of this research work, the author recommends adopting internet connectivity in health institutions to empower resource sharing among the Hospitals. (MoH) and the hospitals may reconsider ensuring all hospitals have and use ICT tools and internet access. This could be demonstrated by utilizing powerful and effective servers capable of transferring data at high speeds or using the internet via fiber optic connections to improve connectivity efficiency and learning.

As a theoretical implication, this study highlights the role of adopting ICT in healthcare organizations especially in blood banks to improve the performance. The study used a framework to determine the influencing factors in other functional areas within the health sector. It can also be used in various organizations by adding and modifying the appropriate

elements mentioned in the research and integrating efforts on these factors for better ICT adoption for developing the organization's performance.

5.2. Recommendation

Based on the research finding, and after exploring the factor that influences ICT adoption and defining the obstacle facing the Palestinian blood banks with implementing or using ICT. The researcher has seen to set the following recommendations:

- (MoH) Palestine must develop and adopt a national system shared between all healthcare sectors and blood banks (government and non-government).
- Before ICT to have a significant impact on performance, it must be recognized and acknowledged by both healthcare administrators and practitioners.
- Blood banks that want to implement ICT must have a solid plan in place to ensure that the process is successful. In addition, to address any potential barriers to ICT adoption, a risk management strategy should be in place. Elements of this strategy may include:
    - Ensure that the source application, hardware infrastructure, and implementation resources are adequately funded, with a financial management plan that considers future needs.
    - Ensure that sufficient skilled resources, including both human and technical, are available to provide program management and give going support.
    - Develop and implement a strategy to promote the benefits of using ICT to healthcare providers to keep personnel up to date with developments.
- (MoH) need to make quality assurance for the ICT used by evaluating plan to ensure that the system is adopted correctly and according to define standards.
- The blood bank has to maintain an educational program to increase awareness between users and managers.

- Blood bank that doesn't have ICT and does not intend to adopt it yet, its time to begin intention and plan to adopt it. And to whom they implement ICT. Having to activate all of ICT features and more additional training program would be helpful for them to increase the efficacy obtained from it.
- Improvement in ICT infrastructure should be maintained in blood banks to get the highest efficiency and quality of care.
- These hospitals and blood banks should work hard to develop their financial and human resources, which may necessitate facility improvements to provide better healthcare services, improve decision-making, and implement more sustainable financing methods.
- Researcher in Palestine should increase the research effort in ICT in healthcare.

5.3. Limitation of the study

The research data was collected from blood banks in the West Bank to investigate the factors influencing ICT adoption in Palestinian Blood Banks. The limitations of this study might arise from: (1) Ongoing Israeli occupation of Palestine imposes restrictions; therefore, it is almost impossible for a researcher from West Bank to collect primary data from Gaza Strip and very hard to reach East Jerusalem. Thus, the analyzed data is limited to the cities in the West Bank. (2) Respondents' unwillingness to provide information was not insignificant; their suspicion was easily observed, thus a relatively small sample size responded (3) The researcher's decision to conduct a purposive sample could produce bias in data. (4) The relatively small sample size limits the results' ability to generalize.

5.4. Further Studies

The study focused on factors influencing ICT adoption in Palestinian blood banks. More research into other mechanisms would help understand the full scope of factors that influence ICT adoption in blood banks. A good research topic is the potential synergic benefits of a national information system linking blood banks. This research recommends that future research look into quantitative surveys to involve more blood banks from different sectors in Palestine to improve the generalizability of this research findings further.

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Appendixes

Appendix A: Interview question/data collection instrument

This section consists of a semi-structured interview. Questions attempt to explore ideas on ICT adoption. The responses may provide insight into the studding factors influencing ICT among Palestinian Blood Banks.

Demographic information

1. What is your job title?
2. How long have you been working in this institution?
3. Are your skills managerial or medical? ……
4. Computer literate: yes □ no □
5. I own a PC at home: yes □ no □
6. Access to the shared screen with other departments: yes □ no □
7. I reply to every email: yes □ no □
8. I Encourage the use of ICT in blood banks: yes □ no □

How is ICT adopted in the Hospital?

1. What ICT Infrastructure is used in Blood Bank?
2. When was ICT infrastructure introduced?
3. In what way do Blood Banks benefit from ICT adoption?
4. How ICT adoption helps employees in the Blood Bank (e.g., accuracy, speed, fewer errors…)?
5. What role can government play in promoting, introducing, and maintaining the system?
6. Are donors being approached to identify what types of support you need (whether financial support, training programmes, equipment and tools…)?

7. How would you see the support of top management for ICT System implementation and sustainability?
8. What challenges encounter introducing and using ICT technologies?
9. Does Blood Bank provide training on the use of the ICT system, and how?
10. Does Blood Bank share data with other Blood Banks, and how is data shared?
11. What do you recommend for better ICT adoption?

Appendix B: Covering letter accompanying questionnaire

Dear Respondent,

I am a post-graduate student at Hebron University, currently working on thesis research to be submitted to a joint master's program of Hebron University (Palestine) and Atlantica University (Portugal) in partial fulfillment of the master's degree requirements. The title of my thesis is: "Factors influencing Information Communication Technology (ICT) Adoption in the Palestinian Blood Banks."

This self-administered questionnaire aims to collect data to investigate the factors influencing ICT adoption in a selected group of Palestinian Blood Banks. Your voluntary and anonymous responses will be kept confidential. Would you please fill this questionnaire carefully? The information you provide would be of paramount importance to my research, hopefully to your organization.

Thank you in advance for taking some of your valuable time to complete the questionnaire. Don't hesitate to get in touch with me for further explanations. Email: 21819094@students.hebron.edu

Sincerely,
Enas Shawar

Kindly answer the following questions fully by ticking the appropriate response in one of the boxes provided. Do not write your names anywhere in this questionnaire, and please be as honest as possible.

Appendix D: Questionnaire

Kindly answer the following questions fully by ticking the appropriate response in one of the boxes provided. Do not write your names anywhere in this questionnaire, and please be as honest as possible.

Section A: Demographic information

1. **Gender:** ☐ Male ☐ Female

2. **Age:** ☐ Less than 35 Year ☐ More than 35 years

3. **Education:** ☐ University (≥ 4 years) ☐ College (two years)

4. **Experience:** ☐ less than 5 year ☐ more than 5 years

5. **Your institution**: ☐ Public (governmental)

☐ Private (non-governmental)

☐ NGOs

Section B: factors influencing adoption of ICT

Please indicate your level of agreement with the following statements on a scale of 1-5, where:

5 = strongly agree
4 = agree
3 = moderately agree
2=disagree
1=strongly disagree

	Technological factors

	Relative advantages	1 1	2 2	3 3	4 4	5 5
TR1	ICT improves efficiency of Blood Bank services.					
TR2	Communication among stakeholders is faster when I use ICTs.					
TR3	-ICT tools facilitate information access for blood donors					
TR4	ICT can supports medical professionals in their decision-making leading to improved medical care quality.					
	Complexity					
TX1	I face difficulty when I use ICT tools that are related to Blood bank tasks.					
TX2	I face difficulty to understand information and report generated by ICT tools.					
TX3	Practically, the ICT tools are that used in Blood Bank are complicated					
	Compatibility					
TC1	I need ICT tools in my job					
TC2	ICT tools speed up blood bank services					
TC3	ICT increases information privacy					
TC4	ICT tools compatible with the current system					
	Usability					
TU1	It's simple to learn using ICT systems related to blood bank.					
TU2	when I use ICT again, I can easily recognize its features.					
TU3	Using ICT would empower me to finish tasks rapidly.					
TU4	Using ICT would improve my effectiveness on the performance.					
TU5	Ease of dealing with the system interfaces, such as (searching for blood type and recording donor data ... etc).					

	Organizational factors					
	Management support	1	2	3	4	5
OM1	Our blood bank vision supports the adoption of ICT.					
OM2	Top managers are committed to acquire and use ICT technologies.					
OM3	ICT tools are purchased and delivered as per the request at the right time.					
OM4	blood bank management knows how to implement ICT.					
OM5	The organization has qualified personnel that provides the training needed in the use of ICT.					
	ICT skill					
OS1	I am able to confidently use core computer programs such as Word documents and PowerPoint presentations.					

OS2	I am able to use computer operating systems to access software programs and manage basic software functions.					
OS3	I can organize and analyse information with the help of computer spreadsheet and database software.					
OS4	I can troubleshoot the problems I face in using the computers.					
OS5	I am able to communicate and interact with other ICT users through the use of the internet and email.					
OS6	I can create and engage with digital information for a specific task.					
OS7	I need don't more technical know-how before I can use ICT tools.					
OS8	Language (English) does not hinders my capabilities.					
	ICT Infrastructure					
OI1	The blood bank has a fully functional website.					
OI2	The blood bank has good internet connectivity.					
OI3	All the blood bank processes are software supported.					
OI4	I have access to recent ICT tools					
OI5	Technical personnel are available to help to face ICT malfunctioning when needed.					

Environmental factors						
	Financial Donor support	1	2	3	4	5
ED1	Donors provide financial support to purchase ICT equipment in the Hospital.					
ED2	financial donors subsidize training courses on ICT					
	Government support					
EG1	The government encourages blood banks to adopt ICT.					
EG2	Government policies facilitate the successful implementation of ICT.					
EG3	The government policies pay individual attention to your blood bank's ICT.					
EG4	The government is supporting the digitalization transition of blood banks.					

Section C: Indicators of ICT adoption

Indicators of ICT adoption

Indicate your level of agreement with the following statements relating to indicators of ICT adoption Key Use a scale of 1-5, where:

5= Strongly Agree
4= Agree

3= Moderately agree
2= Disagree
1= Strongly disagree

	ICT Adoption	1	2	3	4	5
Q1	Administrators regularly analyse the generated data of our ICT.					
Q2	Professionals regularly analyse the generated data of our ICT					
Q3	Decision making during transfusion services builds on ICT data					
Q4	ICT helps blood donation and transfusion services to be delivered on time.					
Q5	Our blood bank screen is shared with relevant departments (e.g., surgery, Laboratories, emergency ...)					
Q6	Blood donors can reach out to blood bank information using ICT tools.					
Q7	store and access of donor information and inventory stock level from the system.					