

E-Readiness Assessment for Incorporating Information Technology

A Master's Thesis submitted for the degree of
“Master of Science”

supervised by
Em.O.Univ.Prof. Dr.h.c.mult. Dipl-Ing. Dr.techn. Peter Kopacek

Zewdi Bitew Gebreegziabher

11837562

Affidavit

I, **ZEWDI BITEW GEBREEGZIABHER**, hereby declare

1. that I am the sole author of the present Master's Thesis, "E-READINESS ASSESSMENT FOR INCORPORATING INFORMATION TECHNOLOGY", 79 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted the topic of this Master's Thesis or parts of it in any form for assessment as an examination paper, either in Austria or abroad.

Vienna, 05.06.2020

Signature

Acknowledgement

First off, I would like to Praise to God for his immeasurable grace love and favor, eternally grateful. I would like to thank Freweini Andemariam who still is showing me the things that seem impossible are possible, her encouragement and inspiration are what keep me going in my daily life, and for shaping me into the kind of person I am today, a heartfelt gratitude to you mother. I would like to give recognition to someone who has walked with me through the ups and down in the preparation of this paper, starting from inputting ideas, brainstorming and structuring the concepts I had, Solomon Tamene Thank you.

To the faculty of Engineering Management, CEC, most importantly to Larry Stapleton for guiding me in the right direction when I started this thesis and for inputting his ideas and helping me focus on the major part of this paper that is the analysis of e-readiness, his guidance on the earlier stages of this research as well as pervious papers, and his advice was an important part that helped me progress my paper in the right direction.

Lastly, I am grateful to all that encouraged me and helped me in making this happen, Thank you.

Abstract

When Understanding the incorporation and the use of Information technology as well as its impact in different sectors across the world one can't help but appreciate and its impact especially at this day and age. Faster processes, accurate information, data encoding, communications and the like are easier and used in a more effective way because of the availability and advancements of technology. In order to understand what kind of technological solution one sector needs it is important to know and understand the sector, following that an e-readiness analysis is required to understand the status of that sector or institution. If one considers a sector that would benefit the most from technology advancements and would require an analysis, the healthcare sector comes to mind, since the field requires great precision and deals with lives it would be an ideal situation to have the most out of technologies and platforms that the world has today.

With similar intention, this research is set out to explore and understand the E-readiness of the National Blood Bank Service of Ethiopia. Upon assessment of the company situation a pre-analysis suggestion was made on what kind of technologies and platforms can help the company move forward its services and work processes it carries out daily. Based on the suggested platforms the research has conducted to understand where the National Blood Bank service of Ethiopia stands using E-readiness analysis models and parameters. These parameters have pointed out where the institution is standing on the technological advancement scale and if it can take in advancements and platforms that can help the company move forward in delivering excellent service. A questioner was designed to discover factors that can affect the e-readiness analysis grouped into four important parameters, each parameter showed a set of important enablers and barriers each parameter carries.

Key words: E-readiness, E-readiness analysis, Blood Bank, Blood Bank information system, Information Communication Technology.

Table of contents

1. Introduction	1
1.1 Statement of the problem	4
1.2 Research Questions	6
1.3 Structure of the thesis	7
2. State of the art	8
2.1 Information Communication and Technology	8
2.2 ICT in health care systems	9
2.3 Elements of an EDI System	12
2.4 Methods of EDI Communication	13
2.5 EDI and Healthcare	14
2.5.1 Three Processes Involved in the Exchange of EDI	15
2.5.2 Electronic Data interchange in developing countries	15
3. Literature Review	17
3.1 Defining E-readiness	17
3.2 Importance of E-readiness assessment	18
3.3 Drawbacks of E-readiness Assessment tools	20
3.4 E-readiness assessment Models and tools	20
3.4.1 Classification of E-readiness assessment tools	21
3.4.2 What is measured by the models?	24
3.5 E-readiness rankings	25
3.6 Blood and Blood Products	28
3.7 Blood Banking	31
3.7.1 ICT in blood banking and Blood donation	34
4. The case study: National Blood Bank of Ethiopia	38
4.1 E-readiness tool selection	39
4.2 The Parameters for this case study	39
4.2.1 The selection of parameters	39
4.2.2 The Important Four Parameters	40
4.3 Sample size	42
4.4 Data collection Plan	43
5. Data Analysis and Implications	45
5.1 Measurement indicators	46

5.2	Parameter Assessment	48
5.3	Findings	49
5.4	Technological infrastructure and Internet penetration category	49
5.4.1	Human resources and Skills	52
5.4.2	Government Support and policies	55
5.5	Implications and meanings	56
5.5.1	Technological Infrastructure and Internet penetration	56
5.5.2	Human Resource Skills	57
6.	Summary and Outlook	58
6.1	Conclusion	58
6.2	Future considerations	58
	Reference	61
	List of Figures	66
	List of Tables	67
	Appendix A	68
	Appendix B	70
	Appendix C	72

1. Introduction

Often, even the use of what some would consider underlying technology is seen as disruption during the process of changing lanes from analog to digital, especially when it comes to moving things to a more high-end technology essential questions like money, skilled human resources, and necessary training becomes the burning question. As a result, it is usually witnessed that moving from analog to digital is not a very smooth transition, especially when the necessary research hasn't been done in order to support the development.

In a country like Ethiopia, where the growth rate and economy are shooting high, the incorporation and use of technology to assist this growth is a necessity, if not a must. There have been several attempts in Ethiopia to incorporate technology, especially when it comes to service, some were successful, and some have failed tremendously. Even when, incorporating technology seems the right step to take in most sectors, and especially in the service sector, to apply the needed and the necessary technology it is essential first to understand the need of that sector to present it with the required technology instead of the perceived need without any research what's so ever.

Through literature review it is found that there has been a few other researches that focused on the National Blood Bank. The research that dates back to a few years ago, suggests and formulates a hypothesis that the institution is in need of an official website, while proposing a possible new website. At this point in time the website has been implemented and is functional. However, it was and is still essential to go into the details of why the platform is needed and if it is the right approach, which in other words is an e-readiness analysis.

The research done on the National Blood Bank of Ethiopia went into the detailed idea that the company should perhaps follow a Web-based blood bank information management, it mentions that it is a smart way of utilizing processes and an effective way of accomplishing things within the organization. The usage of IT and related technologies can bring undeniable great results as seen in other parts of the world where the use of Web-based information management was incorporated, as can be infer through literature reviews, web-based information management is something widely used across the world at the moment. The Use of a web-based information management does not only incorporate online and desktop versions of information

managements across the organization, the extension of such system can go as far as apps that have direct relations with voluntary blood donors.

The online blood bank system is useful for different factors, these include for online storage of information, donor management, stock inventory, smart maintenance ticketing system which includes history saving and smart predictions on future maintenance needs as well as report generating. However, these functions and technological solutions and functions are not implemented.

The major issues the investigator of this paper was able to see within the organization overlap with the major issues addressed on the basic research taken form this paper. Five major issues have been identified. Two of the issue which can also be considered major issues are addressed in a governmental level. The two matters involve issues of purchase of medical equipment's which is drafted by the blood bank of Ethiopia but not conducted by the organization itself. The organization is only responsible for drafting and writing the specification of the medical equipment's, however the purchase of the equipment is not conducted by the National blood bank but by an external governmental institution which is responsible for the purchase of all materials and equipment's once they have been drafted and forwarded to it.

Considering that the company handles all purchases, problems arising on quality of the equipment's and issues as such appears to be a major problem by itself. In addition to that, one of the major issues the national blood bank faces is timely calibration for the equipment's that require calibration in the organization. The organization is not responsible for handling its own calibration, calibration of any equipment is done through a different governmental organization, again. The company which handles the calibration, just is also responsible and handles all calibration for the whole nation, since there is only one of it in the country and it is run directly by the government. This in turn puts the calibration center at a strain because of the demand for service form hundreds and thousands of other companies. This strain from the calibrating body is also reflected on various health care institutions the nation depends on, including the National Blood Bank of Ethiopia, directly suffering from the timely services it needs to receive. The effect of this is also observed on the National blood bank of Ethiopia, the consequence of this includes in different working equipment's having the need for calibration and not functioning by just queuing for the next calibration date, the calibration queue can take anywhere from three months to nine months as inferred from the company employees. These two factors described

above alone put the National bank of Ethiopia in a position where its effectiveness and organizational efficiency can be compromised.

Other issues persist throughout the company such as, the lack of proper documentation in the maintenance department. Since the department has a manual logging for maintenance issues (both preventive and curative), files get lost and it gets difficult to track maintenance issues that have occurred in the past, in addition to that since the purchase is done through a separate governmental body usually from abroad and not inland, the problem of spare parts is a problem that persists just as much as the purchase issue that re-occurs throughout the organization.

In addition to these issues, personals, even though qualified are not properly trained first arrival in the National Blood, even though initial inductions must be conducted for Engineers and technicians joining the company it is however not done. The use of carrying out inductions and introduction sessions is necessary for two reasons: one being since the institution is unique in its services and workings form other healthcare organizations it will give the necessary and needed introductions, second: since most of the equipment's that are used in the Blood Bank are again uniquely used just in the organization the trainings would be necessary as an introduction to the organizational equipment and work process, this in-turn will enable personals to know about the content and the working process of the organization as opposed to learning through try and error.

The abovementioned issues apart from the first two major problems, which can be overseen as a governmental problem can easily be solved through an information management system that is mainly web-based. A web-based information management system is useful not only for an in-company information management but also for the organization to have a platform to keep a track of its voluntary donors, it can also enable the organization to communicate and or send messages through such a platform. If we consider the use of a web-based application in the organization it includes uses such as processing data that is fed into it and analyzing it as well, if we consider systems such as smart ticketing, such systems can simplify process as well as well as make smart predictions. It can also allow the users to manage the information overflow they could be facing from time to time.

If developed, the system could also easily be used to communicate to other governmental bodies that work closely with the National Blood Bank. The platform

can simplify the correspondence between institutions and can keep a digital log or track of the list of things that has been forwarded from the national blood bank. This will reduce the issues regarding lost files and perhaps an improved queue.

The process of constructing a web based online information management system is discussed in great depth on the paper this analysis is heavily dependent on (By Gadissa Kebede - "Designing a web-based blood bank information management system for the national blood bank of Ethiopia"). As the proposed platform is a great base to start with, it can also be found a necessity that before the implementation of this technology that a proper analysis is conducted. This analysis is an analysis on the institution studying if the institution is perhaps fit and ready for a platform as such, the ideal platform being more complex than a website, if we consider other options and take experiences from similar institutions from other countries that follow state of the art technologies, surely processes will be simplified.

However, the main idea is not in following a trendy ICT/IT system but rather that fits the case study and the one that benefits most the institution. So, how do we achieve that?

An essential part of applying technology or using the aid from IT in any sector lies in understanding what exactly that sector needs and studying what that sector has. This is a simple action that should be applied before taking additional measures since is what prevents further complications and unwanted results. If not carried out however it can easily be the cause of an entire system.

1.1 Statement of the problem

At a time where the use of IT systems and information technology is not an option but a requirement it is often times seen that organizations use automated systems to provide effective, transparent and very quick services and products in their companies irrespective to their sectors.

As the only blood and blood product supplier in Ethiopia, The National Blood Bank of Ethiopia provides service to a 100 million plus population, this obviously puts pressure on the institution in both blood donation and collection. Through investigations carried out in the company five major issues were discovered, these issues have the potential to slow down process and significantly decrease the quality of service the institution would rather have on a normal basis.

The recurring issues have a vast spectrum from maintenance to information storage. Nevertheless, the identified problems can be shortly listed as follows.

- Lack of genuine spare parts and Lack of manuals for existing equipment's
- Problems on procurement – the blood bank is not responsible for its purchases
- Problems on calibration – another organization is responsible for calibration as well
- Lack of proper timely preventive and curative maintenance and logging of the accidents in a manner that is retraceable again
- Lack of induction training for engineers working in the maintenance department
- Problem of data management and storage to an extent (especially in preventive and curative maintenance)

Interestingly enough some of the abovementioned problems are beyond the scope of this thesis and even perhaps beyond the scale of institution itself when it comes to especially referring the problems arising due to the involvement (or rather disengagement) of the other governmental organizations. Despite the scale and the spectrum of the issue, through intense research and studying other blood banks and similar institutions that provide service especially in the health care sector, it has been observed that even the biggest issue can be somewhat tackled through the incorporation and usage of various IT solutions.

In order to carry out a meaningful and valuable approach to inventory, storage, purchase orders and even eLearning within the company, usage of Information management through different ICT/IT platforms is typically an ideal solution, the use of technology can not be denied at least when it comes to that.

It can be seen that the last three recurring issues the company deals with are problems that can easily be tackled by implementing technological solutions be it web based applications or software's that ease processes and services, but before considering all the solutions that seem to be a one size fit for all issues it is important to study where the institution stands in terms of ICT and technology. This enables the solutions to be tailor made rather than a one size fit all that would fail, lag or even stop processes from taking place.

An important part of applying these technologies lies even before coming to a decision on the type of solution to be used. The appropriate solution can only be forwarded through careful consideration and study of the current state of the company, this careful consideration is best carried out through an e-readiness analysis.

In various resources E-readiness has a common definition that points to one direction, the definition usually points to the degree to which a company shows its readiness to take part in IT/ICT adoption and incorporation in whatever form it maybe. As can be understood from the definition a measure of preparedness is conducted through the e-readiness study, this is an important first step since it enables one to understand where the institution stands as well as what form of IT/ICT solution it needs. Participation in the electronic world is important, however the first step – conducting an e-readiness research must be carried out.

Conducting an e-readiness assessment might sound like a simple thing to do, however the various parameters and models developed through the years make the whole process a more complicated but pin down the needs to a very specific area, which is good. The models can be chosen based on what needs to be focused on as an institution or as a country.

This research however will oversee the models but only choose a few important indicators to assess where the company stands and to suggest what sort of platform and solutions must be implemented in order to deal with the five problems mentioned above, however the solution is not only limited to the problems identified in this research paper.

As a result, this research will produce a simple and concise from the already existing models in order to tackle reoccurring problems the institution faces, once the indicators are determined it will reveal where the company stands, this status can reveal in what direction the company can head to.

1.2 Research Questions

As this research works in creating a framework of questioning and developing an e-readiness testing parameters or important indicators for the National Blood Bank of Ethiopia the following are the investigative research questions.

- What are the important indicators that can show where the company is in terms of E-readiness?
- What significant indicators or parameters can be used to assess in the National Blood Bank of Ethiopia? The indicators should further enable to take a step forward in being a fully equipped and an e-ready institution, and according to those same parameters and indicators what are the barriers that has disabled the institution to move forward.
- What do these indicators inform about the company and how can these parameters be used for future studies?
- Based on the singular parameters what would be the best model to consider if one considers further enabling the institution to discover more about its e-readiness as an institution?

1.3 Structure of the thesis

Aiming to answer the abovementioned research questions the thesis will go through a few e-readiness models and studies in order to set the state of the art. It will then discuss some important and common platforms as well as technologies used in the modern world and how important they are if used in the case study used for this thesis – National Blood Bank of Ethiopia.

In order to use these platforms, there needs to be a necessity, the necessity will then be discussed and how one can identify these necessities will be discussed in further chapters. Once these parameters are identified and defined, it will be used to assess the e-readiness of the institution to an extent, once the assessment is carried out using the necessary methods the assessed data will be analyzed and will reveal what ground the institution stands on. Under the presentation of the results enablers and barriers will be identified.

Finally, the last chapters will discuss the different categories of results and conclude with critical discussion that can impact the institution and will further see outlook for future works, researches and studies.

2. State of the art

When considering e-readiness and e-readiness analysis, as the first stage is conducting the e-readiness analysis the next phase is usually applying what the sector, government or the SME is ready for. Once the analysis has been carried out it enables one to understand not only what the capacity of the company is but also what is needed currently and what is important for the users.

The developed world has already conquered the usage of high-tech solutions, devices and software's. This trend is not only in one sector, but it is seen that the usage and application is as vast, from SME's to e-governments developed countries are seen to have controlled communication and information storage in an impressive manner.

In this section will review how healthcare systems are aided with ICT and some of the tools used in different service sectors which also apply to healthcare institutions. Whether or not the technologies and tools be implemented to the case study of this research still stands as a question, however this question will be answered based on the data gathered and the analysis conducted on further chapters on this research.

2.1 Information Communication and Technology

Following the results and readings of various literatures and similar studies conducted on ICT, a research was found that was published on the expansion of ICT skills among students, the study was a case study on Mukuba University, the paper has defined ICT in a way that also relates to this paper, the definition is as follows,

"ICT could therefore be defined as the processing and sharing of information using all kinds of electronic devices, an umbrella that includes all technologies for the manipulation and communication of information" (Mwewa Peter, Samuel Boby Elizabeth, Musonda Allan 2014)

The abovementioned study also goes on to illustrate what exactly is meant by basic ICT skills. It mentions that basic ICT proficiencies comprise being able to use the internet in sending emails and use a mobile phone or a smart phone. It is an undeniable fact that ICT betters' systems and simplifies processes that would require

rather a longer amount of time. This fact applies in any part of the world be it developed, developing or under developing.

Health care is one of the areas that requires extraordinary precision and a lesser percentage of error as it is one of the most delicate areas, dealing with people lives is after all a dangerous area to play around with, areas that require the utmost care and precision in their respective fields are also the ones to benefit the most from the developments, incorporation and usage of information technology in their systems.

Having that into consideration above average computer skills are required for more than half of jobs today. The more technical and care a field needs the computer skills required will also be doubled.

2.2 ICT in health care systems

The main goal of healthcare lies in directing and controlling a group of people or entities. IN addition this group have to reach a predefine goal, the purpose of coordinating and harmonizing that group towards accomplishing a goal. it often includes the deployment and manipulation of human resources, financial resources, technological resources, and natural resources. Indian healthcare Industry is growing at 12% annually, according to a recent report by Springboard Research. The Indian healthcare division has began to serve clients or better to balance the lucrative business operation as well as meeting community aims. The main area of focus is to improve the service to the end customer i.e. patients. It is noted that if significant progress is to be accomplished over the coming decade, then computerization of clinical, financial, and administrative communications is vital to improve the value, in avoiding errors, improving customer support and enhancing productivity in the health care system. (Cyrille Delpierre, Lise Cuzin, Judith Fillaux, Muriel Alvarez, Patrice Massip and Thierry Lang, 2004).

If we take a glance at the role of information technology in IT there are countless tools, software's and medical materials used. These Health IT tools support in specific areas and promote better, more efficient healthcare through the use of today's technologies. Commonly used health IT tools are discussed below as discussed on as mentioned on the research entitled "Role of information technology in Health care" (Sampada S. Gulavani and R.V. Kulkarni, 2010)

- I. **Electronic Medical Records (EMR):** The EMR offers a clinician with actual-time access to patient data, such as patients medical state, visits to health workers, images and reports of diagnostic procedures, timetable of amenities, allergies and contact information to caregivers and a complete longitudinal record of care evidence based on decision support tools that can be used to aid clinicians during decisions. A fully unified EMR enables a physician to renew clinical and other information about a patient on a uninterrupted manner. The EMR can automate and streamline a clinician's workflow, ensuring that all clinical information is communicated. The EMR can support the collection of data for uses such as billing, quality management, outcome reporting, public health disease surveillance and reporting. Electronic document has tremendous advantages over the paper document such as it does not require a warehouse for storage and is readily accessible from anywhere.
- II. **Clinical Decision Support (CDS):** CDS includes computerized alerts and notices to care for workers and patients, clinical guidelines, condition-focused order sets, patient information statements and reviews, analytical assistance, and other tools that improve the outcome during the medical workflow. CDS provide clinicians, staff and patients with expertise and person-specific information, presented at appropriate times to enhance health and health care. CDS has the potential to increase adherence to clinical guidelines, protocols and best practices which helps to avoid medication errors, and to prevent complications. CDS necessitates quantifiable biomedical knowledge, person-specific information, and a logic or inferencing system that combines knowledge and data to produce "advice" to clinicians or professionals.
- III. **Computerized Physician Order Entry (CPOE):** CPOE is used by physicians for ordering medications, orders for x-rays and other diagnostic procedures, referrals, discharges, and transfers. One crucial higher-level product in CPOE is that suppliers put in writing instructions including treatments using computers. Automation of ordering is vital because most activities in health care refers to a specific order.
- IV. **Electronic Prescribing (E-prescribing):** E-prescribing is the communication, using electronic channels of treatment between a prescriber, dispensers, pharmacy manager, either directly or through an intermediary, including an e-prescribing network. E-prescribing consist of two-way communications amongst the point of care and the distributor. It is recommended that electronic prescription applications should be robust enough to include safety checks for

allergies, drug-drug interaction warning, dose appropriateness, drug-clinical condition warning, and drug-laboratory alerts.

- V. **Health Information Exchange:** It is the electronic link via internet and additional networks that enables health care providers to swap patient condition data. It is found essential that the systems that allow automated interaction amongst suppliers need to ensure that the information is safeguarded and that there is no unauthorized access, use and release. It requires to build statistics and messaging guidelines to establish the crucial goal of interoperability to communicate with one another. (Sampada S. Gulavani and R.V. Kulkarni, 2010).

Matching to a paper published under the European Union it can be observed that the incorporation of ICT into the health care is high at this day and age. The published paper shows how various elements of the ICT as well as internet of things is taking a huge part in delivering the needed services. The advancements and the services provided are the following (European Commission Publication)

- Information distributing with big data
- Instituting contact to healthcare workers through ICT telemedicine
- Digital health learning
- eHealth and cross border healthcare
- Use of robotics for ageing well
- Elderly care through ICT and innovation
- ICT in frailty, early detection and intervention

The abovementioned technologies and applications are tools in health care industry as far as 15 years as well as now. However, when it comes to service delivery and communication in healthcare one can consider other platforms and software's mainly concerned with communication and information exchange, a recurring theme today is EDI, of course there are many other technologies and platforms as well however the most used and popular platform seems to be EDI.

It is also observed that through understanding the structure, work processes and need of the National Blood Bank of Ethiopia, the institution can benefit from using this platform the most. Given the company's main job, which is to collect blood and blood products to then distribute it to all the hospitals in the nation, it is understood that the National Blood Bank of Ethiopia engages most in communication in updating other

healthcare institution that require services and keeping track of the company's own products.

As inferred from various sources mentioned under, EDI provides a perfect solution when it comes to the abovementioned activities.

Electronic Data Interchange (EDI) is defined by UNCTAD (United Nation conference on Trade and Development) as follows:

“Computer-to-computer transfer of commercial and administrative transaction using an agreed standard to structure the data pertaining to that transaction”.

The term *“Electronic Data Interchange”* is typically used to indicate interaction of business deals amongst computers in different companies in a typical format. Thus, the information transmitted by e-mail does not accurately come under the classification of EDI.

2.3 Elements of an EDI System

Hardware

The mechanical name for all sorts of computers and the associated basic apparatuses we use on a daily bases to date is referred to as Hardware. Computers are key elements in establishing EDI communications as they deliver the physical interface, which enables and facilitates the electronic transmission of message between two or more trading partners. An EDI structure can be created using any combination of mainframe and/or personal computers. (ESCAP/UNDP Manual, 1993).

Telecommunication Networks

Telephone lines comprise of telecommunication services that in turn provide the channel over which data can be automatically transmitted in an automated manner between dispatching and collecting computer devices. The connection might also be made via satellite. In the case where a telecommunication line cannot be linked to the receiving computer, the information can be written to a floppy disk or a magnetic tape. The floppy disk or magnetic tape can then be physically transported to be used the receiving computer. (ESCAP/UNDP Manual, 1993) This is of course used a few years down the technology line where there were less option than there is now in 2020

Communications Software and Conversion Software

Communications software enables messages to be conveyed and collected between computers. For one computer to “speak” to another computer it needs to have a software that enables means of interaction and interpretation. Translation software enables messages to be encoded and de-coded into a format which both computers can understand. Software at the transmitting computer, “translates” the message into the required format or sequence of data elements as required by the message standard. At the receiving computer, the software converts the basic message into a format, which can be understood by the receiving computer and printed or presented in simple language. (ESCAP/UNDP Manual, 1993,).

2.4 Methods of EDI Communication

Direct Method

By utilizing the telecommunications line, it is possible to send data amongst computers using the direct method. The telecommunication route can be a reserved line or a public switched telephone line (dial-up). With this method, the immediate connections between computers are restricted by the size of the telecommunications system. (Luis E. Nova, 1999).

Indirect Method

The Value Added Network (VAN) is an indirect method of message transmission that requires handling of electronic communications between computers using a third party. The use of a value-added network makes it possible for any number of computers to link up. “VAN” is the phrase used to define a system whereby telecommunication lines are associated to an electronic mailbox facility for the transmission and storing of messages between trading partners. (Luis E. Nova, 1999).

An electronic mailbox service may be compared with posting a letter. Instead of placing a hard copy letter in a post office mailbox, an electronic “letter” is posted to an electronic mailbox in the value-added network computer, which receives stores and passes the electronic message to the receiver on request.

An electronic mailbox can also be used in conjunction with a traditional database facility. A database facility is an information bank, (i.e. it stores information and

permits retrieval by authorized users only). A database can be situated within personal computers of trading partners or within a mainframe computer. The combination of an electronic mailbox and database facility enables messages received via the mailbox system to be processed and updated in the receiver's database. (Luis E. Nova, 1999).

Inter-connectivity

Business partners that need to carry out communications during trade or exchange of information and data on a specific value-added network will develop the need to communicate with each other by belonging to another value-added network, in a scenario as such they will have two options either to;

- Subscribe to the value-added network of the other trading partner and pass message via that network; or
- Convince the two value-added network providers to connect with each other so those messages can pass between one value-added network and the other.

As a definition, The process of connecting two networks is known as "inter-connectivity. This interconnection of two (or more) different value-added networks requires both a physical link amongst the networks and software which translate the messages into a format for communication and receivable that can be understood by both agents.". (Luis E. Nova, 1999).

2.5 EDI and Healthcare

EDI in healthcare provides secure electronic data interchange between healthcare organizations, care providers, and patients, and allows for more secure and efficient data processing, including healthcare claims processing.

Electronic data interchange healthcare transactions are not just emailing or something like this. EDI involves electronic data transmissions between computer systems and applications. And, of course, those systems and applications vary depending on the end-users and the mode of delivery.

Among others we can name:

- P2P EDI (point-to-point EDI)

- VAN EDI (value-added network EDI)
- Cloud EDI
- Mobile EDI,

2.5.1 Three Processes Involved in the Exchange of EDI

MAPPING: Usually an electronic data stays within a software application on a computer or mainframe. If it happens to be possible to import and export files from that application, (such as XML, a flat file, a restricted file, etc.), important information can be obtained and mapped to an EDI operation. (EDI 101 Guide).

TRANSLATION: When an incoming broadcast is received by the EDI software, the file must be broken down, or “parsed”, to detect everything it contains and what actions should be taken. EDI translation software will determine what trading partners and individual transactions are included in a transmission, and whether there are any duplicates. (EDI 101 Guide).

COMMUNICATIONS: - Broadcasting an EDI data requires transmissions and connections which come in both ways of a direct and an indirect variations. Indirect connections with trading partners are done through a value added network (VAN). Often referred to as the “electronic post office,” a VAN is a third-party service that transmits and stores data in an “electronic mailbox” until it is picked up by the appropriate party. (EDI 101 Guide).

2.5.2 Electronic Data interchange in developing countries

As we can see in some sectors around the globe EDI is used as an advanced business instrument around the world to enhance business communications. In many developing countries and especially in South Africa, small businesses are the backbone of the economy, but despite this, not many studies have been done on EDI adoption in SMEs. (Kuan and Chau (2001) argue that small businesses have certain unique characteristics when compared to larger firms. The broad applicability of previous EDI studies to small companies may be therefore be dubious.

EDI is used as a creative business device around the world to boost business communications. A lot of emerging and developing countries and especially in South Africa, as read on literature and further studies, small enterprises provide a huge support for the economy, However, in spite of this, not a lot of studies have been done on EDI approval in SMEs. Numerous countries in the developing world have distinct

experiences of the application of EDI. Consequently, it turns out to be vital to study the approval of EDI in various countries, systems and acknowledging that the results in one country could be advantageous to that of another if it is along the lines and similar profiles across countries. (Rubin Pillay, 2010).

Even though the National blood bank of Ethiopia cannot be considered as an SME, taking into consideration case studies as well as past studies especially from countries in the continent with similar economic background is of the relevance.

In order to enable organizational operations EDI has been widely acknowledged to carry out the work of internal operations through integrating internal and external systems.(Chen and Williams, 1998). As a equipment and technology that can provide several advantages to small firms EDI has taken the lead in discussions when it comes to implementation and usage, nevertheless corresponding to the statements of Bergeron and Raymond (1997) the adoption rate has not met prospects. Clemens and Row (1993) argue if more firms adopt the technology it could boost and enhance the financial wellbeing of a country, as a result many efforts have been made to recognize and understand more about the technology to identify issues affecting the implementation rate (Rubin Pillay, 2010).

Massive setup expenses were necessary long ago to set up EDI systems. However this trend did not help realize the benefits of this technology, and led it to be less effective than it is needed to be (Bergeron and Raymond, 1997). However due to advances in technology, EDI applications that required main-frame computers to run on can now be used on micro-computers at much lower costs. Small firms are now in a better position to afford this technology. (Rubin Pillay, 2010).

3. Literature Review

3.1 Defining E-readiness

E-readiness is defined in different ways across different kinds of literature reviews. E-readiness is a concept that is important for any firm or country that is embarking on the digital journey. Considering that, and since the aim of this paper is to conduct an e-readiness analysis, it is found important to glide through the different definitions of e-readiness in order to get a more in depth understanding of the term. Looking at the various definitions will also allow us to understand e-readiness in all its forms as well as enhance one's understanding in e-readiness and the different models that come with the definitions.

E-Readiness is defined as the degree to which an economy or community is prepared to participate in the digital economy (APEC 2000). E-readiness is defined as a gauge, the gauge will be able to showcase how well a society is positioned to use the prospects provided by information and communication technology, this definition is given out by The United Nations University.

On a study released by the ACSIJ Advances in Computer Science: An International Journal, Vol. 3, Issue 4, No.10, July 2014 e-readiness was defined as the availability of an organizations ability and other stakeholder capacity to accept and use information technologies solutions to study the strengths and weakness that abound the context of least developed countries that fall under the category of low bandwidth environment.

As e-readiness is deemed one of the focus of development for any country, it represents the transformation of society including the movement from traditional relations and methods to more modern ways of thinking or dealing with health, education and production. The key drivers of such transformation depend on scientific ways of thinking that enable decision makers from recognizing what they know and what do not, thus allow them to identify the crucial variables that influence the outcomes while trying to make implications based on accessible data (Babcock, 2005).

The importance of e-readiness or being an e-ready in a company, even moreover in a company is something that should be given an utmost attention. A company, a

government or any business can conduct an e-readiness analysis in order to understand the kind of technology they need to adopt into their respective government, company or any business.

Implementation of ICT services in healthcare organizations grows to be an important factor that should be incorporated if not yet. It is an undeniable fact that information technology has made things easier as well as possible in the networked world we are living today, given the fact it appears to be important that companies, especially healthcare organizations adopt it.

The idea of incorporating e-readiness was devised with the intention of providing an integrated structure to evaluate the breadth and depth of the digital divide between more and less developed and under developing countries during the latter part of 1990s (Mutulaa & van Brakel, 2006). Evaluating e-readiness enables governments to put, gauge and accomplish reasonable goals for an information society, information-based economy, or e-government. Computer Systems Policy Project (CSPP) created the first e-readiness evaluation tool known as Readiness Guide for Living in the Networked World in 1998. (Mutulaa & van Brakel, 2006).

3.2 Importance of E-readiness assessment

It is important to carry out e-readiness assessment in order to understand where an institution stands as mentioned on chapter one of this paper. However, throughout the years there had been several e-readiness assessments that were focused on smaller areas of SME's and focused on as big as governments in order to carry out systems such as e-government.

Although e-readiness improvement is crucial for almost all countries, developing countries' decision makers find themselves motivated to improve e-readiness and promote the implementation of ICT in their countries for three reasons: first, benefits of ICT are seen as part of the solution to their problem; second, these countries may be left further behind if they fail to address the digital divides between and within countries; and third, ICT is integrated into development and aid programs by international leaders and donors. (World Bank group, 2001)

E-readiness assessments are also helpful in that they can help authorities understand and identify key and relevant ICT-based development opportunities. For example, in order to put ICT to valuable use, a country must

be 'e-ready' in terms of infrastructure; be able to provide access to ICT to the population at large; must have a legal and regulatory framework on ICT use; and benchmark progress and collaborations. Additionally, an e-readiness assessment must lead to the advancement of a policy or the planning of an action plan that would focus on and tackle the opportunities and constraints associated in order to further the goals of a country in the area of ICT (Docktor, 2002).

E-readiness evaluations enable governments to measure and achieve realistic goals within an information society or information-based economy. Crucial for the development and conduction of an e-readiness evaluation, so that the results can be leveraged to catalyze action, improve global competitiveness, and use limited resources wisely. Furthermore, a well-conceived e-readiness assessment can help map a country's regional and global position, improve competitive strengths, and promote those areas where it has an advantage over others. Identifying other countries' e-readiness strengths and weaknesses can also help a country leapfrog technologies and policy decisions so as to position itself ahead of its neighbors. E-readiness assessments can help stakeholders make difficult decisions on how to use scarce resources and how to turn existing strengths into new revenues. They can also reveal which bottlenecks are worthy of the investment of time and money to remove. Using a globally recognized e-readiness assessment method can be helpful in securing the necessary funding to develop an e-strategy and implement E-programs (Docktor, 2002).

The value of e-readiness assessments is based on the notion that countries with pervasive information infrastructures that use ICT applications possess advantages for sustained economic growth and social development (The SADC E-readiness Task Force, 2002). E-readiness rankings provide companies wishing to invest in online operations with an overview of the world's most promising investment destinations. E-readiness rankings provide valuable insights into how governments can influence the rate and nature of the adoption of technology and applications (The Economist, 2004).

3.3 Drawbacks of E-readiness Assessment tools

Despite the critical significance of e-readiness evaluation tools there are some limitations to consider. By going through different literatures it can be understood that e-readiness parameters and structures are meant to measure issues at the higher level, the higher level being as a government or a country and to not consider the diverse conditions in lesser stages as a company such as SME's and even in companies that are as individual as the National blood bank as based in this research paper. Following that, these tools have a short-lived shelf life in a swiftly changing atmosphere which makes it crucial to conduct these evaluations frequently to catch up with the changes. (Mohammed Raji Musa, 2010).

There are various factors that influence the e-readiness implementation choices of SMEs. One such aspect is the degree and level of communication that is required across the enterprise. Usually it is anticipated that firms with dispersed, multi-location facilities would be more complex in their use of the Internet as a means of communication. Single location companies require less advanced or sophisticated methods to communicate with their employees; hence single location firms, in relation to multiple location firms, generally position lower in terms of their degree of e-readiness. If we consider the National Blood Bank of Ethiopia as the case study for this paper, the institution is not single location and its consequences are as shown below. The fact that the ownership is a state ownership needs to be considered as well.

The type of a company's possession may also be connected to the level of the firm's e-readiness. The degree of a firm's e-readiness might have a tendency to be highest if the firm is publicly owned, followed by firms that are private but non-family owned, and lastly by firms that are family owned. (Mohammed Raji Musa, 2010).

3.4 E-readiness assessment Models and tools

After referencing various literature on E-readiness it is understood that there are a lot of tools developed by different institutions in order to aid the process of assessing E-readiness within SME's, Different institutions as well as in a governmental level.

Academics tend to have classified E-readiness corresponding to its financial or social perspectives. However, look at e-readiness In a nutshell the E-readiness analysis

tools are mainly divided into micro and macro E-readiness assessment tools according to Stephen M. Mutula's Digital Economies.

3.4.1 Classification of E-readiness assessment tools

Classification based on output span

E-readiness measuring parameters and models have been devised to serve different purposes in different ways. These parameters can be identified with conditions of how they show out the evaluated information and explain the findings to be used by countries or communities within countries. They can also be defined and classified according to their perspective, whether economic or societal. "e-readiness assessments are, in fact, very diverse in their goals, strategies and results" (Bridges, 2005).

<i>E-readiness assessment tools</i>	
<i>Macro Assessment tools</i>	<i>Micro Assessment tools</i>
E-Readiness Ranking tool	Rizk's micro e-readiness Assessment tool
Readiness for the networked world	Agriculture and Food Canada Micro E-readiness Assessment Tool
Apec's E-commerce Readiness guide	SME survey tool (South Africa)
Rusj E-Business tool (Ready? Net.Go)	Holistic approach (Ireland) tool
Mosaic's global internet Diffusion framework	

Table 3.1: E-readiness Assessment tools Overall summary
(Stephen M. Mutula, 2010).

Macro Assessment tools

During the research about e-readiness assessment tools and throughout the years there have been a number of Macro assessment tools developed by various institutions. These different tools, that lie under one category i.e. Macro Assessment tools, have different definitions of e-readiness as well as the methodology of assessment, these tools however also measure different issues and topics.

Micro Assessment tools

While there are several tools available for measuring e-readiness at macro or national level, there is a paucity of tools for sectoral assessments. There is a fallacious assumption about ICT and small-sized enterprises that the significance of ICT at national level is the same as the significance at an individual firm level. However, e-readiness at sectoral level is influenced by a different set of economic, social and geographical circumstances; therefore, similar strategies cannot be applied wholly to such an environment without being tailor-made to suit its specific needs for the short, medium and long term. Industry sector differences and management characteristics and the supplier-customer environment of firms are some of the factors that influence the degree of e-readiness of SMEs. (Stephen M. Mutula, 2010).

Classification based on usage

E-economy vs. E-society

The tools use commonly varying definitions for e-readiness and different techniques of magnitude and the assessments vary significantly in their goals and results. (World Bank Group, 2001, p. 1) so it is binding on the user to select the best tool differing on the goals to be achieved and the aspects to be considered. Some of these tools focus on societal aspects and other tools focus on economic aspects. (Azab N., Kamel S., Dafoulas G., 2009).

Indices vs. Analyses

The tools may also be classified as either analytical or indexing. Critical tools designed to help decision makers to focus on some critical issues in strategic planning and system implementation. (Koh, C., and Prybutok, V.R., 2002) An example of this is the APEC e-readiness assessment for ecommerce. This tool's results can be used to develop the most suitable strategies to overcome the impediments to deployment

of e-commerce. This assessment tool is not comparison between economies, but to be of use to analysis within them. (APEC, 2000,) It is preferable and recommended by some studies that the results of the assessment surveys should be presented in an analytical report that contains an overview of strengths, weaknesses, opportunities and threats, as well as recommendations on policy actions and possible next steps. (UNDESA, 2003,).

Other assessments provide grades of E-government E-readiness facts according to the standards of each one of these assessments or surveys. The UN global e-government readiness index presents an assessment of the countries according to their state of e- government readiness and the extent of e-participation worldwide and hence ranks the 191 member states of the UN according to a quantitative composite index of e- readiness based on website assessment, telecommunication infrastructure and human resource endowment. (UNDESA, 2005, p. 4) The survey offers insights into different strategies and common themes in e-government development among regions and across them. (UNDESA, 2005).

Levels of e-readiness have implications for the capacity of SMEs to partake in the global digital economy. Generally, most governments across the world have been investing in ICTs to enable SMEs to enhance their productivity and competitiveness. Information Society Index measures have shown that half of the countries from Western Europe, North America and Australasia, dominate other countries in E-readiness leadership. There was a clear correlation between information wealth and economic prosperity. The Information Society Index is a new measure developed to understand the free and rapid flow of information across the world (Minton, 2003).

Countries in North America with well-developed ICT structure invariably have most of their SMEs increasingly going online. For example, a survey of e-readiness of SMEs in the agricultural sector of the United States showed that a significant number of firms were poised to reach their highest level of e-readiness in the near future. Similarly, Canada was, in 2003, the world's most connected country and a global leader in the digital economy, with approximately 85% of its SMEs and larger enterprises using the Internet. Findings on the degree of e-readiness of the United States' SMEs within the agricultural sector revealed that 69% of the SMEs had websites, and 31% accepted credit cards as payment for business to business (B2B) transactions (Consulting and Audit Canada, 2004:12).

3.4.2 What is measured by the models?

Discussed below are some of the E-readiness analysis models along with what each of these models measure.

- E-Readiness Ranking tool
 - Connectivity and technological infrastructure
 - Business environment
 - Consumer and business adoption
 - Legal and policy environment
 - Social and cultural environment
 - Supporting E-services.
- Readiness guide for living in the networked World
 - Infrastructure
 - Access
 - Applications and services
 - Economy
 - Enablers - policy, privacy, security and ubiquity.
- Risk E-Business tool (Ready? net.go)
 - Connectivity (infrastructure and access and pricing)
 - E-leadership (government policies and regulations)
 - Information security (intellectual property, privacy, and electronic signatures)
 - Human capital (ICT education and available skilled workforce)
 - E-business climate (competition, political and financial stability, foreign investment and financial infrastructure).
- Mosaic's global internet Diffusion framework
 - Pervasiveness - level of use by individuals
 - Sectoral absorption - level of use by academic, commercial, health and government sectors
 - Connectivity infrastructure -quality and robustness of the underlying network

3.5 E-readiness rankings

According to Digital Economy rankings 2010 the following tabulated information has been found regarding the E-readiness rankings in the world based on the following categories.

The Scoring criteria categories and weights Category are as follows:

<i>Category</i>	<i>Weight out of a 100%</i>
Importance of connection and technology transportation	20%
Business situation	15%
Social and cultural ecosystem	15%
Lawful environment	10%
Administration strategy and vision	15%
User and company implementation	25%

Table 3.2: Capacity And Weight

Source: Economist Publication – Digital Economy rankings for 2010

2010 rank (of 70)	2009 rank	Country	2010 score (of 10)	2009 score
1	2	Sweden	8.49	8.67
2	1	Denmark	8.41	8.87
3	5	United States	8.41	8.60
4	10	Finland	8.36	8.30
5	3	Netherlands	8.36	8.64
6	4	Norway	8.24	8.62
7	8	Hong Kong	8.22	8.33
8	7	Singapore	8.22	8.35
9	6	Australia	8.21	8.45
10	11	New Zealand	8.07	8.21
11	9	Canada	8.05	8.33
12	16	Taiwan	7.99	7.86
13	19	South Korea	7.94	7.81
14	13	United Kingdom	7.89	8.14
15	14	Austria	7.88	8.02
16	22	Japan	7.85	7.69
17	18	Ireland	7.82	7.84
18	17	Germany	7.80	7.85
19	12	Switzerland	7.72	8.15
20	15	France	7.67	7.89

Table 3.3: European Rankings

Source: Economist Publication – Digital Economy rankings for 2010

The above figures were updated to include an assessment of how countries are well prepared are for technological change across three key categories.

1. Access to the internet
2. Digital economy infrastructure
3. Openness to innovation

Using these categories, the previous table was updated on 2013, the update was also a forecast till 2017, as a result the following table is a 2013 till 2017 update in seeing how technologically ready countries are.

	2013-17			2018-22	
	Score	Ranking		Score	Ranking
Finland	9.71875	1	Australia	9.71875	=1
Sweden	9.4375	2	Singapore	9.71875	=1
Australia	9.15625	=3	Sweden	9.71875	=1
Austria	9.15625	=3	US	9.4375	=4
Germany	9.15625	=3	Finland	9.4375	=4
Netherlands	9.15625	=3	France	9.4375	=4
Singapore	9.15625	=3	Germany	9.4375	=4
Japan	8.875	=8	Japan	9.4375	=4
South Korea	8.875	=8	Netherlands	9.4375	=4
Taiwan	8.875	=8	Austria	9.15625	=10
US	8.59375	=11	Belgium	9.15625	=10
Canada	8.59375	=11	Hong Kong	9.15625	=10
Denmark	8.59375	=11	South Korea	9.15625	=10
France	8.59375	=11	Taiwan	9.15625	=10
Hong Kong	8.59375	=11	Canada	8.875	=15
Israel	8.59375	=11	Denmark	8.875	=15
New Zealand	8.59375	=11	Estonia	8.875	=15
UK	8.59375	=11	New Zealand	8.875	=15
Belgium	8.3125	=19	Switzerland	8.875	=15
Estonia	8.3125	=19	Israel	8.59375	=20
Norway	8.3125	=19	UK	8.59375	=20
Switzerland	8.3125	=19	Norway	8.3125	22
UAE	8.03125	23	Ireland	8.03125	=23
Qatar	7.46875	=24	Spain	8.03125	=23
Spain	7.46875	=24	UAE	8.03125	=23
Czech Republic	7.1875	=26	Lithuania	7.75	26
Ireland	7.1875	=26	Czech Republic	7.46875	=27
Italy	7.1875	=26	Italy	7.46875	=27
Lithuania	6.90625	=29	Malaysia	7.46875	=27
Malaysia	6.90625	=29	Poland	7.46875	=27
Poland	6.90625	=29	Qatar	7.46875	=27
Russia	6.90625	=29	Argentina	7.1875	=32
Chile	6.625	=33	China	7.1875	=32
Portugal	6.625	=33	Russia	7.1875	=32
Slovenia	6.625	=33	Slovenia	7.1875	=32
Argentina	6.34375	=36	Chile	6.90625	=36
China	6.34375	=36	Portugal	6.90625	=36
Brazil	6.0625	=38	Slovakia	6.90625	=36
Bulgaria	6.0625	=38	Bulgaria	6.625	=39
Hungary	6.0625	=38	Hungary	6.625	=39
Latvia	6.0625	=38	Ukraine	6.625	=39

Table 3.4: World Rankings 2013 – 2017

Source: Economist Publication – Estimated Digital Economy rankings from 2013 -1017

North America and countries in Europe are leaders in e-readiness stature, and are significantly ahead of their counterparts in developing or transitional economies. countries with high levels of e-readiness are performing well in the digital economy E-readiness assessments are useful as information gathering mechanisms that assist governments when planning strategies for ICT integration and in making improvements on specific components of e-readiness.

Such assessments help governments understand and identify relevant ICT-based development opportunities. The assessments also help businesses determine preferred investment destinations and more. The policy implications of the issues discussed in this chapter underscore the role of government in putting in place an institutional framework covering infrastructure and legislative mechanisms and regulations in order to create an environment conducive to improving e-readiness.

3.6 Blood and Blood Products

According to Britannica, blood is a fluid that carries oxygen and nutrients to the cells and carries away carbon dioxide and other waste products. Technically, blood is a means of transport liquid pumped by the heart to all parts of the body, after which it is returned to the heart to repeat the process.

The human body inform us that the human body is composed of 70 -80% water, although the numbers are different based on different factors such as gender, age and body mass index but in an average the blood in our bodies accounts for 7 to 8 percent of our total weight. (American Red cross publication)

Blood supplies all nutrients and oxygen in the body. It has been medically demonstrated that human beings will not survive without blood. (Juma Nazana, 2012) Many medical innovations that have enhanced the treatment of serious illness and injuries have increased the need for blood transfusion for patients" survival, to support them through recovery or to maintain their health (Red cross and red Crescent Societies journal, 2010) Demand for blood is driven by an array of factors that include obstetric hemorrhage, road traffic accidents, armed conflict, sickle cell disease and childhood anemia, malnutrition, HIV, malaria, and parasitic infections (Evan M. 2012).

Amongst its many roles the blood is used to transport Oxygen, Carbon dioxide, hormone nutrients and metabolic waste as well. The blood is composed of Platelets, red and white blood cells and its fluid medium is plasma which accounts to 55 percent, while the three elements make up for 45% of its total content. (American Red cross publication)

- **Red blood cells:** These cells carry oxygen to the tissues in the body and are commonly used in the treatment of anemia.

- **Platelets:** They help the blood to clot and are used in the treatment of leukemia and other forms of cancer.
- **White blood cells:** These cells help to fight infection, and aid in the immune process.
- **Plasma:** The watery, liquid part of the blood in which the red blood cells, white blood cells, and platelets are suspended. Plasma is needed to carry the many parts of the blood through the bloodstream. Plasma serves many functions, including the following:
 - Helps to maintain blood pressure
 - Provides proteins for blood clotting
 - Balances the levels of sodium and potassium
- **Cryoprecipitate AHF:** The portion of the plasma that contains clotting factors that help to control bleeding.

According to the information form American Red Cross, categorization of blood refers to the presence or absence of antigens, including protein substances found on the surface of red cells. Blood groups (A, B, AB, and O) and Rh types are descriptions of certain antigens. For example, donors who lack the A and B antigens and the Rh antigen are O negative donors. Donors who have a type B antigen and an Rh antigen are B positive donors. Accordingly, when it comes to blood donation, a person can only receive blood from similar blood group or one other depending on the blood type. The following tabular representation from the American Red Cross shows what kind of blood type can be received by patients including the percentage of blood type by population percentage.

YOUR BLOOD TYPE	% OF POPULATION WITH BLOOD TYPE	PATIENTS WHO CAN RECEIVE YOUR RED CELLS	PATIENTS WHO CAN RECEIVE YOUR PLATELETS	PATIENTS WHO CAN RECEIVE YOUR PLASMA
O+	38%	O+, A+, B+, AB+ (84%)	ALL TYPES (100%)*	O+, O- (45%)
O-	7%	ALL TYPES (100%)*	ALL TYPES (100%)*	O+, O- (45%)
A+	34%	A+, AB+ (37%)	ALL TYPES (100%)*	A+, A-, O+, O- (85%)
A-	6%	A+, AB+, A-, AB- (44%)	ALL TYPES (100%)*	A+, A-, O+, O- (85%)
B+	9%	B+, AB+ (12%)	ALL TYPES (100%)*	B+, B-, O+, O- (56%)
B-	2%	B+, AB+, B-, AB- (15%)	ALL TYPES (100%)*	B+, B-, O+, O- (56%)
AB+	3%	AB+ (3%)	ALL TYPES (100%)*	ALL TYPES (100%)*
AB-	1%	AB+, AB- (4%)	ALL TYPES (100%)*	ALL TYPES (100%)*

Table 3.5: Blood Types and Groupings

Source: American Red cross Publication

Type O- is called the *Universal Donor* because it can be given to anybody; it has no protein to cause clumps. Type AB+ is the *Universal Receiver* because the recipient has all of the proteins and so will not form clumps.

The need for blood transfusion arises when people lose a reasonable amount of blood due to several reasons such as emergency. It takes a few weeks for the body to make new blood to replace those lost. In this case, blood transfusion gives a massive advantage for the patient. Blood transfusion is the best way of replacing the blood rapidly.

Blood transfusion is given to a patient replaces blood lost during an operation or after an accident, to treat anemia which is a common disease caused by short production and supply of red blood cells (McClelland and Pirie, 2010).

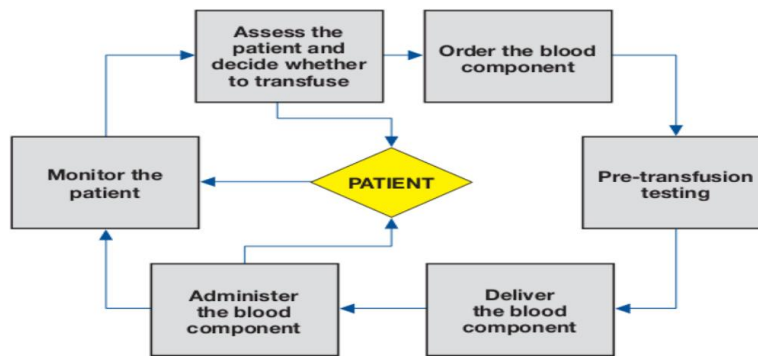


Figure 3.1: Patient Blood transfer process

Source: McClelland D, and Pirie F, (2010), Manual of Optimal Blood Use, Support for safe, clinically effective and efficient use of blood in Europe.

3.7 Blood Banking

Johns Hopkins Medicine characterizes blood banking as the procedure that takes place in the lab to make sure that donated blood or blood products are safe before they are used in blood transfusions and other medical procedures. Blood banking includes typing the blood for transfusion and testing for infectious diseases. Blood banking obviously happens if there are volunteer blood donors, blood donors can vary from strangers, family members or the person himself prior to undergoing a surgery or a procedure they might require to undergo. Donating blood for yourself is called an autologous donation, Volunteer blood donors need to have a certain criterion prior to donating. These criteria include minimum age and weigh requirement, good health condition, and need to pass physical and health history exam given before anyone makes a donation.

In order to be able for the blood bank to be able to receive volunteer donations and transfer it to others a variety of tests undergo once the blood is donated, according to the information found from Johns Hopkins website on blood banking, the tests include

- Typing: ABO group (blood type)
- Rh typing (positive or negative antigen)
- Screening for any unexpected red blood cell antibodies that may cause problems in the recipient
- Screening for current or past infections, including:
 - Hepatitis virus B and C

- Human immunodeficiency virus (HIV)
 - Human T-lymphotropic viruses (HTLV) I and II
 - Syphilis
 - West Nile virus
 - Chagas disease
- Irradiation to blood cells is performed to disable any T-lymphocytes present in the donated blood. (T-lymphocytes can cause a reaction when transfused, but can also cause *graft-versus-host* problems with repeated exposure to foreign cells.)
 - *Leukocyte-reduced blood* has been filtered to remove the white blood cells that contain antibodies that can cause fevers in the recipient of the transfusion. (These antibodies, with repeated transfusions, may also increase a recipient's risk of reactions to subsequent transfusions.) (Hopkins Medicine)

Challenges across blood banks (especially in developing countries)

- Safer Blood Supply and storage comes at higher costs.
- Growing number of Infections that transmit through blood.
- Customer expectations of quality and safety.
- Active volunteers
- Blood transport and storage facilities.
- Increasing longevity of blood and blood components.
- Wastage of blood and blood components.
- Appealing doctors to prescribe components and encouraging blood banks to prepare blood components. This should optimally utilize the scarce whole blood. (Hospital software's)

Ethiopia is the second most populous country in Africa with an estimated population of 114.96 Million with an area of over 1.1 million square km according to world population review, according to some unofficial sources Ethiopia elaborated its health policy in 1993.

These sources reveal that blood amenities were provided by the Ethiopian Red Cross Society from 1969 to 2010 through its 12 regional blood banks located in the capital cities of 8 of the 11 regions and covering the requirements of 52% of the hospitals in the country thus restricting access to comprehensive emergency obstetric care. The rest of the hospitals have been organizing their own blood sourcing mechanisms a

system that compromised the quality of the blood supply. Since 2004 and with funding from PEPFAR through CDC, focus has been on expansion and consolidation of the service to ensure universal access.

A total of 21 blood banks have been constructed, equipment for the blood banks secured, 46 vehicles bought to support blood donor mobilization, recruitment and blood collection have been bought. An organogram for the BTS as well as facility level organizational structures have been developed. Positions for blood transfusion services have been created in the government of Ethiopia civil service structure with specific job descriptions and recruitment of staff into vacant positions in these blood banks.

According to the report of the WHO, Ethiopian section placing the Blood Transfusion Service (BTS) under the mainstream health care delivery system has improved efficiency of managing the blood banks to ensure the whole population has access to safe blood supply.

The national blood bank service of Ethiopia indicates that Management of blood and blood transfusion services in Ethiopia is carried out by the National Blood Bank, the institution is a non-governmental association established with core functions of community mobilization & education on voluntary blood donation, blood collection, laboratory processing, testing & production of blood, distribution to health facilities, promotion of appropriate clinical use of blood, and research & capacity building in blood transfusion services (BTS). (WHO)

The national blood bank has a total of 282 employees with various qualifications including health professionals, IT experts, and administrative staffs. Its main center is located in Addis Ababa and it has also the responsibility to oversee, support and monitor the activities of nine regional and two city administrative blood banks in the country which are administratively under their respective regional health bureaus.

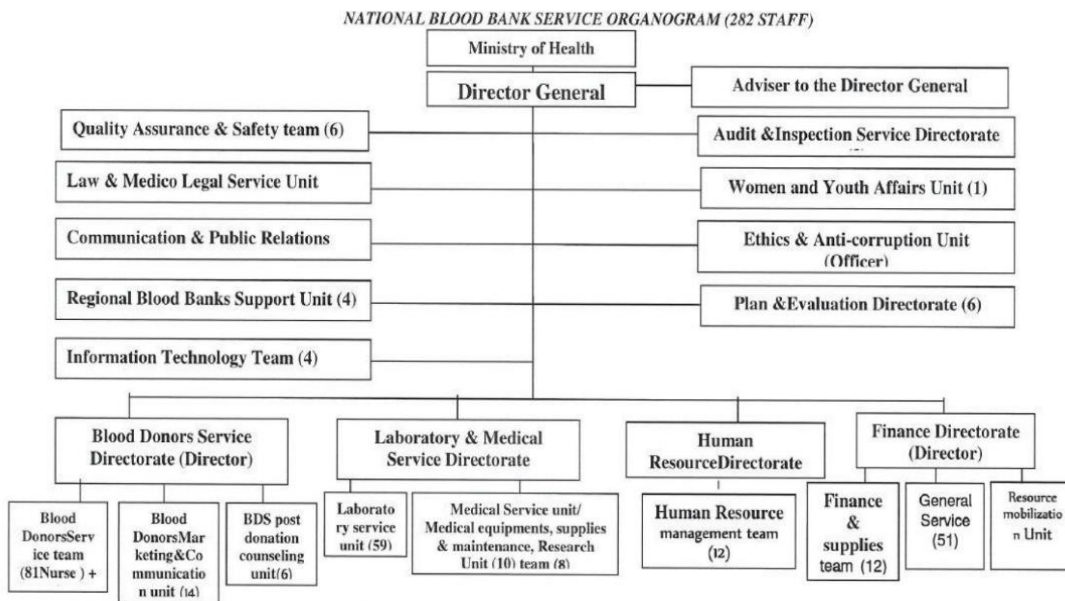


Figure 3.2: National Blood Bank of Ethiopia Org. chart

(Source: National Blood bank Service Ethiopia)

3.7.1 ICT in blood banking and Blood donation

An Information system consists of input messages, message processing and output messages. It has also processing rules which control the execution of the Information system. If the processing rules are formalized, we can have computer-based Information systems. But if the processing rules need a lot of personal knowledge, judgment and Intuition, the information systems are manual. A purposeful Information system shall help users to make good decisions and support their actions (Anders G. Nilsson 1998)

Blood Bank Information systems

Blood Bank Information Management System is an information system which helps to manage the records of donors and patient at a blood bank. It is mainly designed to store, process, retrieve and analyze information concerned with the administrative and inventory management within a blood bank. (Clemen Teena, K. Sankar and S 2014)

A scheme as such will permit the approved an officer to login using a confidential password and simply manage the histories of the donors and the patients in need of blood services. In addition, the blood bank information management system is not obsolete to the professionals; rather it plays a great role in attracting the donors and other stakeholders due to its simplicity in the reservation, and notification of donation time to the needy. On top of this any stakeholder and/or regional blood banks in need of blood can easily access to the type and quantity of blood available in any blood bank center (Gaddisa Bekele, 2016).

KBase Life: Is a knowledge base's blood bank information system. It is a web-based system to manage, control and monitor each and every aspect of a blood bank. It helps in managing and tracking information right from donor recruitment to the component's final transfusion, including all production steps, latest lab activities. In addition to the core blood bank activities, it manages inventory to laboratories/clinical tests, back office application like HR, Finance and billing and health education as well. This system is deployed at the Malaysia National Blood Bank (Knowledge Base SDN, 2006).

Blood Donation Management System

Blood Donation Management System is a web application with supporting mobile application aimed to serve as a communication tool between patients (who need blood) and blood donor. The system was designed at Jahangirnagar University, Dhaka, Bangladesh (K M Akkas 2015).

Blood Donation System Based on Mobile Cloud Computing: The Blood Donation System (BDS) is designed as a framework and planned to be developed and implemented for the Kingdom of Saudi Arabia. The system is comprised of two main components, which are the Cloud Computing (CC) component and the Mobile Computing (MC) component (Almetwally M. Mostafa 2014)

Punjab Online Blood Bank Management System: This system is a web-based blood bank management system that is designed to store, process, retrieve and analyze information concerned with the administrative and inventory management within a blood bank. The Punjab online blood bank management system provides different functionality like blood donation camp and camp organizer management, donor management, inventory management, blood requisition and issuance of blood,

online transfer of blood from one blood bank to another, discarding of expired and unsuitable blood, etc. (Punjab Online Blood Bank Management System 2016)

A Knowledge Based System for Blood Transfusion

This system was designed for the national blood bank center of Ethiopia. The aims of the system was to acquire knowledge necessary in blood transfusion and designing a knowledge based system that can provide advice to experts involved in blood transfusion. The system cross matches the compatibility of the patient's blood and the blood going to transfuse. The researcher used a rule-based knowledge representation method to represent the relationship between facts and rules. The result shows that the system registers 83.3% complete knowledge of blood transfusion task. This system can be integrated as one module in the whole blood bank information management system. (Guesh Dagneu 2018)

Effective donor recruitment through internet

One of the most significant findings to emerge from the literature is that there are misconceptions regarding safe blood donation and there is an increasing need to find the most efficient channels of communication to motivate, educate and recruit voluntary non-remunerated blood donors. The result of a study on the knowledge of HIV/AIDS transmission and screening in United States blood donors indicated that the usage of innovative ways to increase the knowledge of high-risk individuals about the implication of risk behaviors may have a potential value in the self-deferral program of high-risk blood donation volunteers. Another study on the knowledge, attitudes and practices regarding blood donation among the Saudi population supported the necessity of education and motivation through dissemination of information regarding blood donation particularly on electronic media. However, no complementary research was conducted on the efficacy of Internet to support that conclusion. (H.M. Jalalian, L.A. Latiff, S.T 2008).

The indications from several studies have already portrayed and supported the effectiveness of internet based educational intervention in other disciplines of health promotion and educating the patients to overcome their sickness. However, a major limit with this kind of educational intervention is that very few researches exist concerning internet application for online recruitment of safe blood donors. Although; From the findings of earlier studies, it seems that the overall internet users` population and blood donors are similar in many aspects of their socio-demographic

determinants as both groups are usually young men and women who are studying or possess a higher level of education than average (H.M. Jalalian, L.A. Latiff, S.T 2008).

Healthcare solution providers argue that the implementation of information communication technology can radically transform how blood banks function. Countless solutions are offered by healthcare solution providers in order to better systems both in blood banking and generally in healthcare systems, the few of the many solutions promised are:

- scanning equipment and barcoding that can reduce miss-reporting.
 - Correct and timely notices of expiring bags, with identification of bags
 - Interactive rank of available stock in storage areas and/or blood bank
 - Virtual data of donors would be useful in identifying habitual donors, in order to keep an emergency donor list to contact.
 - Prediction of blood requirement or possible stock-outs in near future will help blood banks to plan and restock well in advance by coordinating blood donation
 - Bar code and stickers printing further reduces any chances of human error.
-
- Blood banks incorporation information management systems let the users enter the data of donors and bags at the point of collection.
 - Well formatted reports can be adequate requirement of any regulating agency. To avoid unnecessary repetition
 - Client assistance can be carried out in forms such as SMS, booking the blood bags on the web, etc. which in turn will lead to client satisfaction. (Hospital Software)

4. The case study: National Blood Bank of Ethiopia

During the process of undergoing into consideration of several health care providers to study and research into a critical problem that seems to be persisting as a theme throughout the country the investigator made several considerations in choosing the national blood bank.

The National Blood Bank was chosen after careful consideration of several factors that account to the institutions character, as a healthcare products provider the blood bank has its own set of unique characters that are not at all similar to other healthcare provider institutions. The main unique character being that the blood bank is rather a health care Products provider instead of health care systems differentiates it on a major point. With that in mind, the fact that the communication line of the blood bank is goes as vast as contacting and working with volunteers, nurses and health professionals that assist them, health care institutions (e.g. Hospitals), other organizations involving in purchasing and calibration, the department within the blood bank itself i.e. maintenance, IT services, Laboratories, quality department, and managements as well. All these interrelations outside the company and within the departments make the blood bank an interesting case to look at and work with. Since the National Blood Bank Service is the only blood and blood products supplier for the nation it would not be an understatement to say that it is one of a kind, at least for the country.

The aim in doing this e-readiness analysis in which the process and methodology will be explained further in this chapter is, to present major measurers in order to be used as indicators of e-readiness in the National Blood Bank Service in Ethiopia. The e-readiness is put to a test by for major indicators which are also referred to as parameters, once the necessary data is gathered and the results are reviled the parameters will be a set of variables that can be used as indicators to measure e-readiness. Once these indicators are identified from the data gathered, the data analysis chapter will further reveal where the case study stands on the scale of e-readiness.

The assessment tools or parameters will aid in collecting information from the management and a randomly selected sample size involving all employees.

4.1 E-readiness tool selection

In selecting an appropriate tool for e-readiness, certain parameters need to be satisfied. The right tool should also depend on the users' goals, and requires users to choose a tool that measures what they are looking for and do it against a standard that fits their own view of an 'E-ready' society (Bridges.org, 2003). Accordingly, the tool should, among other things:

- Measure performance in all areas that are identified as important
- Be flexible enough to cover areas that it does not normally cover
- Provide assessments at both macro and micro level, i.e. from country down to the sectoral level
- Allow for the benchmarking of a community against other communities in each of the identified areas
- Be simple enough for a layman to understand.

Overall, although e-readiness methods and tools differ in definition, approach and objectives, they are all designed to gauge how ready a society or an economy is to benefit from IT and e-commerce. Importance of doing e-readiness analysis and assessment.

4.2 The Parameters for this case study

The parameters chosen for this particular case study are what is seen in each of the models seen in the previous pages and the tables that identify the models as Macro and Micro. Through literature review and studying the models, it was observed that the different models- although represent and assess different aspects of e-readiness, there were fundamental parameters which were present throughout all models.

As a result, instead of using a single handed model to test the e-readiness of an organization, the most basic and important factors were chosen to study a similar pattern in the case study for this paper – The National Blood Bank of Ethiopia

4.2.1 The selection of parameters

For the purpose of this study it was important to study the most important factors that matter for the e-readiness analysis. The most important factors in the e-readiness analysis were chosen through careful studying and literature review of all the Micro,

Macro and all other e-readiness analysis models and studies made through time. The most important factors that are listed here under can also be identified as the parameters that showed up the most in most of the models, whilst doing the literature review for the e-readiness and the various models we have there under the recurrence of these parameters only proved to show how important these factors are no matter what model was to be chosen.

In addition to the recurrence of these parameters in each model, the parameters are believed to be the most important factors to get a technology going that is at set. Each of these parameters are defined down below.

The importance of these parameters can also be verified through seeing each models and how these four parameters chosen here are a reflection of each, since in every model these factors are fundamentally considered more or less.

4.2.2 The Important Four Parameters

Technological Infrastructure

Technology that is less complex, cost effective and executes the needs of companies' specific goals is seen to be vital for SMEs e-business adoption. Every business has to develop strategies to understand the impact of technology on e-business as ICT is becoming more widely used and the role of existing ICT infrastructure needs to be determined. In this category, it is important to ascertain the hardware, software and telecommunication infrastructure that exists. (Chugh, R & Gupta P 2010)

Human Resources and skills Human inventiveness

Has a significant contribution towards overall business efficiency, Amalgamation of company specific business practices, knowledge and technical expertise allows businesses to leverage the potential of human support in fulfilling individual customer needs in a steady and personal way. Existing human skills and expertise needs to be assessed to reap the benefits of e-business. (Chugh, R & Gupta P 2010)

Government support

Government intervention to promote, educate and provide incentives to adopt e-business. Assessment in this category will determine the contribution of governments in providing favorable environment, implementing policies that address issues related

to system infrastructure and broadband use and governing laws guarding security and privacy. (Chugh, R & Gupta P 2010)

Internet Penetration (access)

Assessing adoption of the Internet by customers and suppliers is of prime importance. This will in turn ensure the facilitation of SMEs in coming to a decision whether they should accept and adopt e-business or not. High Internet usage by customers and providers would mean a good sign for SMEs, although a lesser rate of internet approval by consumers and suppliers becomes a building block to e-business implementation by SMEs (Chugh, R & Gupta P 2010).

During the data collection and interview process these four important parameters have been bundled into three in order to make the participants in the questioner follow a set of similar theme. As a result, the two parameters

- Technological Infrastructure and internet penetration are under one consideration
- Government support analysis was conducted through a one on one interview form with the deputy director of the institution
- Human Resources and skills Human inventiveness has been measured in a similar manner as the first parameter in this bullet point.

As the initial stage, this research would like to test how valid the above parameters are when used in evaluation by discovering how important they are in establishing the institutional readiness (e-readiness) to adopt in its areas and at an institution level. Of these values some are likely to be of higher value whereas other indicators aren't anticipated to be as crucial. Nevertheless, this must be tested and verified throughout the process of the research.

The figure right under can be considered as the relational model for e-readiness parameters considered in data collection.

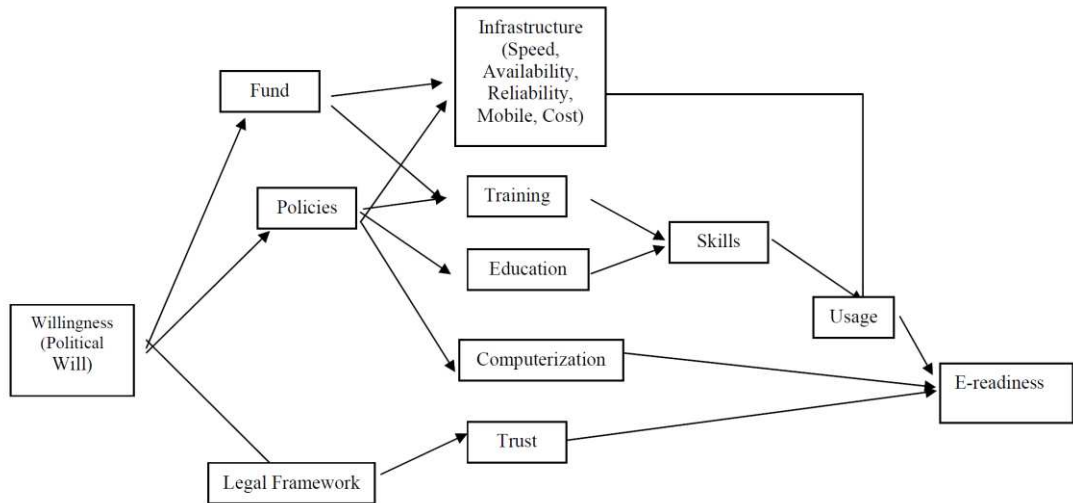


Figure 4.1: E-readiness relation model (Mohammed Raji Musa, 2010)

The parameters in this study are nominated from a various lists of actions previously used by other studies in e-readiness assessment tools, as well as designed and used by global organizations for this purpose. An approach was used in this paper to explore how accessible the information of these measures is by gathering information from the cast study institution: National Blood Bank Service for Ethiopia.

4.3 Sample size

- The sample is going to mainly focus only and only on the blood bank it's employees from top management to lower level management.
- The sample was selected in a more or less random method when it comes to the two major Parameters, technological infrastructures and human resources skill.
- The governmental support and policy parameter was tested through an informal online interview form, where the deputy director had to reply one by one to the questions in a short and long answer formats.

Calculator

What margin of error do you need? % ⓘ
5% is a common choice

What confidence level do you need? % ⓘ
Typical choices are 90%, 95%, or 99%

How big is the population? ⓘ
If you don't know, use 100,000

What do you believe the likely sample proportion to be? % ⓘ
If you're not sure, leave this as 50%

Your recommended sample size is **163** ⓘ

Figure 4.2: Sample Size Calculator(selectstatistics.co.uk)

- A margin of error tells you how many percentage points your results will differ from the real population value.
- A confidence level refers to the percentage of all possible samples that can be expected to include the true population parameter, a 95% confidence interval is a range of values that you can be 95% certain contains the true mean of the population.
- A sample proportion can often be determined by using the results from a previous survey, or by running a small pilot study.
- Minimum sample size that needs to be estimated the true population proportion with the required margin of error and confidence level.
- According from the information collected from the blood bank the total number of employees is 282.

4.4 Data collection Plan

The Questionnaires explored information relevant to the measures related to the use of IT.

- General personal information (e.g. age, gender, education level)
- Skills of computer software usage.
- Speed and reliability of internet connection.

- Connectivity and access.
- Types of services used on the internet.

On the topic of Government support and policy, the deputy manager of the institute was interviewed on topics of

- Legislations
- Different policy forms
- Confidentiality and
- Cyber Crime laws

5. Data Analysis and Implications

The spectrum of this research as mentioned in the previous topics such as technological infrastructure, Human Resource skills, and Governmental support. It still remains to be a complicated and a detailed process to identify e-readiness in all its traits since it is a very big concept to grasp in just a few questionnaires.

During this study numerous skills and lessons were learnt which need to be considered while examining the e-readiness of an organization:- the national blood bank service of Ethiopia. During collection and analysis, a certain trend was followed throughout, the process is illustrated as follows. The data analysis process was developed by the researcher. The figure down below is the analysis process depiction.

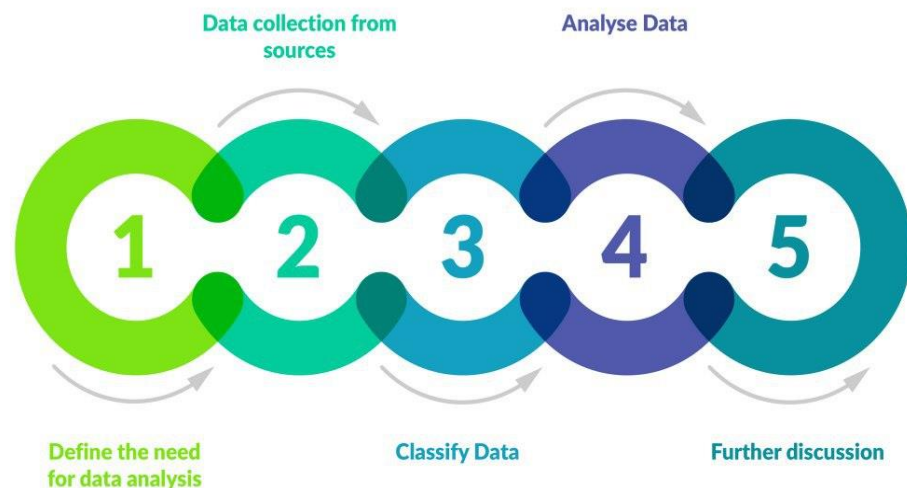


Figure 5.1: Data Analysis process (As developed by the researcher)

The data analysis needed: once the questioner was designed based on the few parameters chosen from different models it is important to analyze the incoming data from the case study in order to understand the implication of the responses gathered from the questioner.

Data collection from sources: Since this case study was carried out in a specific environment, i.e. the case study for the National Blood Bank Service data collection form sources was carried out through virtual interviews – online questioners and follow up.

Data classification was conducted after the data was collected in order to understand the implication of one type of data on the other, after proper categorization, the data is better understood easily for the researcher during the process of analysis.

Data analysis was easily conducted once the above three stages were completed, the analysis took place in the same manner data collection took place, in terms of category, once each category was analyzed into its respective parameter – it was studied as a whole data with the other parameters to understand and measure the whole e-readiness status

Further discussions are carried out based on the analyzed data and the findings from the questioners, the discussions and recommendations simply refer to further actions that can be taken in the institution the case study was conducted on and include a set of advised actions that can be done in order to enhance functions and processes. This section can be found on the next chapter of this research paper.

NOTE: The data collection was conducted in a form of questioner and a virtual interview. The questions on the questioners were designed, to get a general overview rather than in detailed information. Due to time, location and availability of resources and problems that have arisen during the time this research was carried out there was a challenging curve during the time the data analysis specifically took place.

5.1 Measurement indicators

As the investigator was able to observe that a lot the e-readiness measurement tools focus on a macro level which is mostly suitable and ready for bigger case studies, especially when conducted at a country level. As a result, when assessing it was important to conduct the case study at a micro level, this is due to the fact that on the macro level the categories appear to be cumbersome to conduct small scale analysis as such. In addition to that none of the models assessed during the literature review do not provide any support on how to develop or extend the e-readiness analysis. As a result, the four major parameters considered on the methodology section of this

research paper keep a balanced consideration between the models and eliminate redundancy.

Based on the need, these categories can be narrowed and expanded. Using some of the operational definitions from research papers like A unified approach for assessing E-readiness of SMEs, while developing a similar e-readiness assessment framework, there are major components of the framework that are included and defined. These three major components include (Chugh, R & Gupta P 2010)

- *Barriers* that make the provision of the e-readiness requirements difficult and are often the *motivation* to assess the availability and suitability of those assessment categories.
- *Enablers* that would make it possible to overcome barriers and *support and facilitate* the provision of the assessment categories.

Assessment methods to assess how a business entity scores in different areas of E-readiness categories at different levels of operation (micro and macro). The existing methods provide for both qualitative and quantitative *measurements*. Some methods that could be used are questionnaires, case studies, interviews, third party reports and analysis of primary and secondary data. (Chugh, R & Gupta P 2010)

Based on a similar model and operational definition from a fairly similar study when it comes to the choice of framework or parameter listed below are the enablers and barriers of each parameter chosen specifically for this research. As discussed previously, the four factors i.e. Technological Infrastructure, Human resource skills, Internet penetration, and Government support, these parameters will be weighed on the barrier enabler scale on the table below.

<i>Categories</i>	<i>Barriers</i>	<i>Enablers</i>
Technological Infrastructure	Security concerns – High entry costs	Government support, technological infrastructure existence, available information
Human resource/skills	Inadequate skills, Educational status	Training and adequate information
Internet penetration	High costs	Technological infrastructure availability, government support, trainings and educational status of the human resource
Government support	Lack of government incentives, poor perception of benefits	Adequate information, government approval and support

Table 5.1: E-readiness Parameters Barriers and Enablers

Source: Mohammed Raji Musa, 2010

5.2 Parameter Assessment

Using the criteria and the definitions mentioned above the proposed parameters should by principle be able to confirm the validity when assessing the e-readiness. The overall approach of this study was to develop a simple and applicable set of parameters that would enable the researcher to gather a reliable data information with a higher level of accuracy.

The people who participated in the study were chosen randomly except when it came to the interview on the Governmental support since it had to be conducted with the concerned body only.

Though, during the time this research was conducted it was not feasible to a deeper analysis and a deeper review due to the lack of resources and the time the interaction/interviews and questioners was conducted was during an unfortunate time to say the least.

5.3 Findings

The four parameters were categorized into three categories, Infrastructure, Human resources and governmental issues, these parameters were finally found to be as indicators deduced from analysis and the interview.

<i>Infrastructure and penetration</i>	<i>Human Resources skills</i>	<i>Government & Management</i>
Internet speed	Skills	Political will
Availability	Trust	Fund
Reliability	Usage	Polices
	Training	Legal framework

Table 5.2: Parameters and their Indicator Source: Mohammed Raji Musa, 2010

5.4 Technological infrastructure and Internet penetration category

Average working speed of internet in the workplace (not including sites for blood donation)

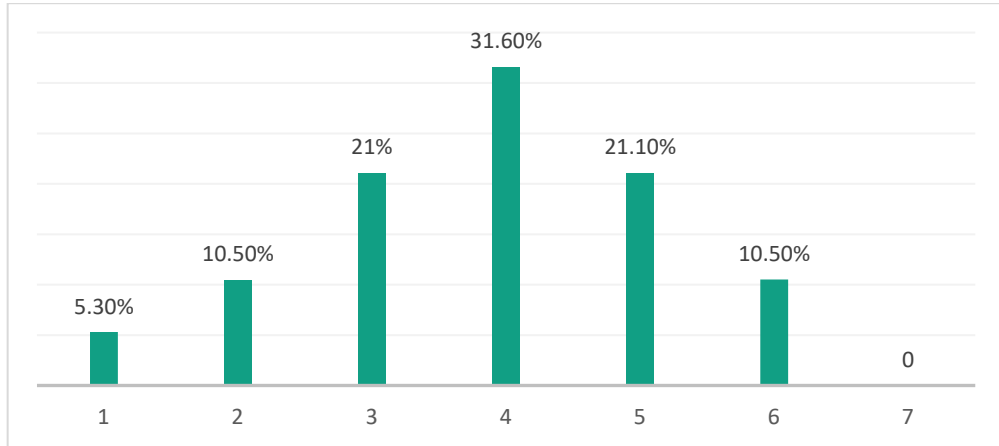


Figure 5.2: Rating the speed of Internet (Results found from questioner)

Reliability of Internet connection from employees on a scale of one to five

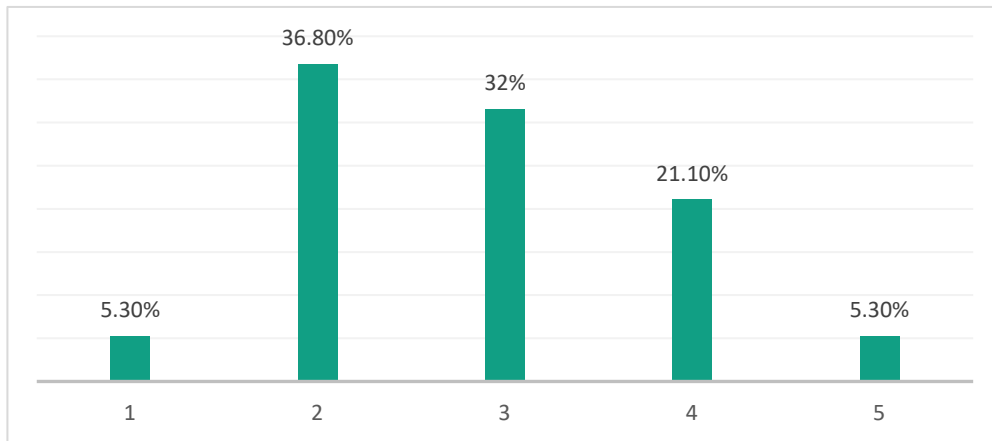


Figure 5.3: Reliability of Internet connection (Results found from questioner)

Estimated number of desktop computers that have internet connection, from employees

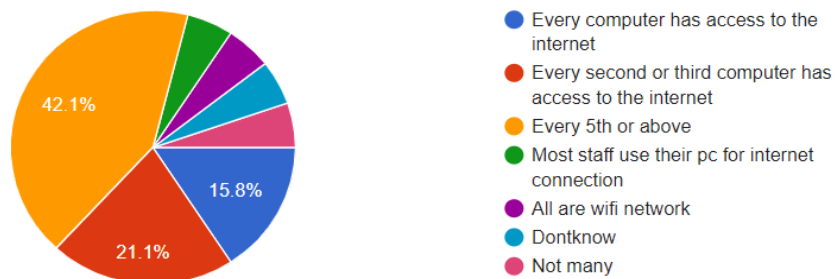


Figure 5.4: Internet Connection to Desktops(Results found from questioner)

Percentage of computers to employees

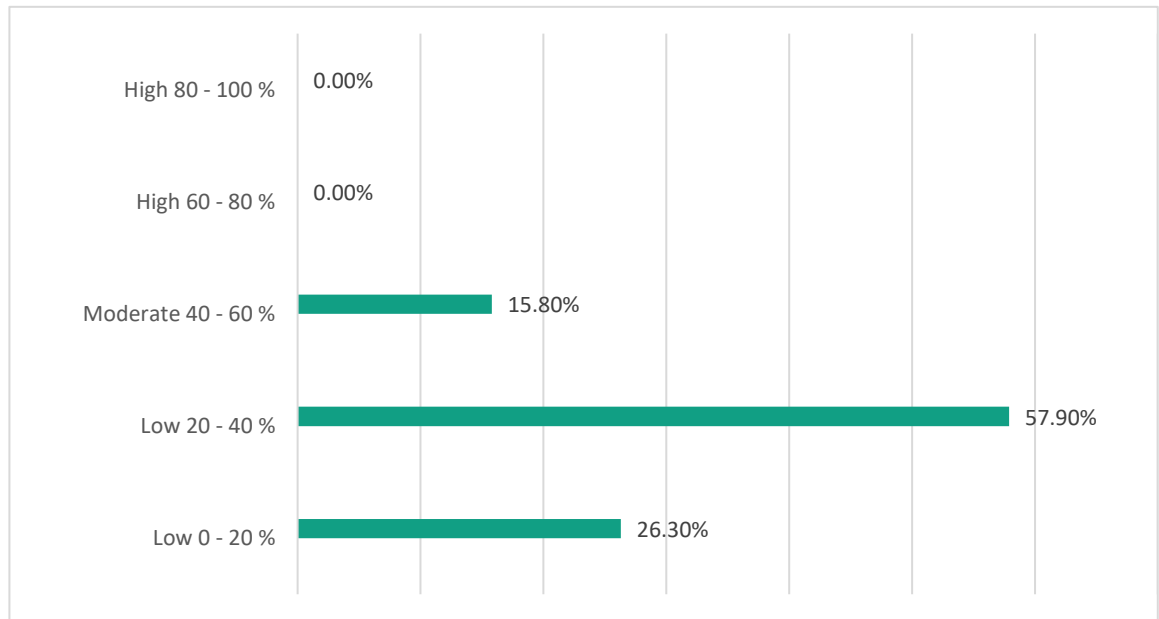


Figure 5.5: Ratio of Computers to Employees (Results found from questioner)

Disconnections happening during work – estimated on percentage (during the 8 working hours' employees need to stay connected)

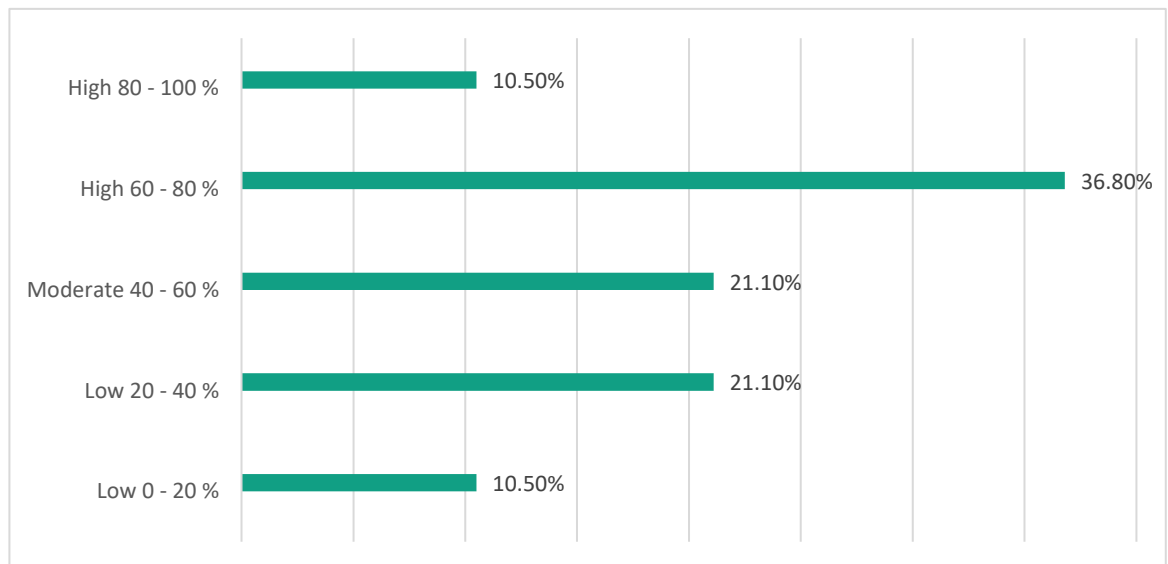


Figure 5.6: Internet Disconnection rate (Results found from questioner)

Average speed of connection the employees experience on average

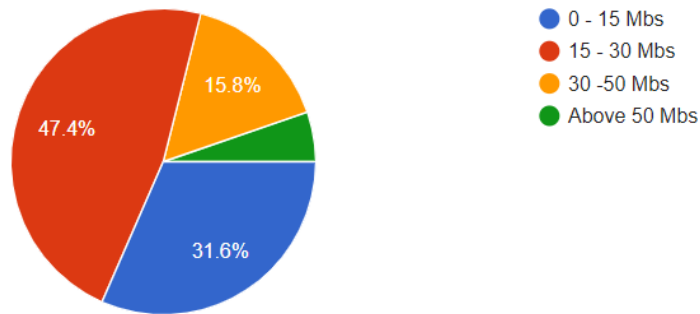


Figure 5.7: Average Speed of Internet (Results found from questioner)

Types of IT support the institution uses employees are aware of

- Technical support
- Training
- Blood systems information systems
- None, I am aware of

According from data gathered from the same questionnaire the answers to the question inquiring what type of data storage system the company uses the figures show that the major systems used are the

- Blood safety information system
- Hard Disk and paper

5.4.1 Human resources and Skills

Educational Background

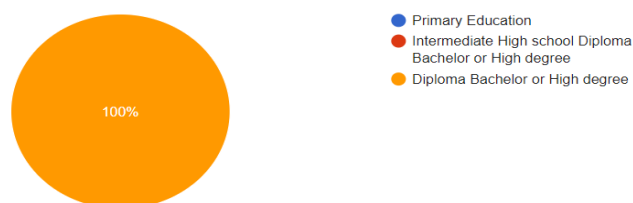


Figure 5.8: Educational status (Results found from questioner)

When employees were asked to rate themselves on the usage of ICT and technology (1 being low skills and 5 being high skills)

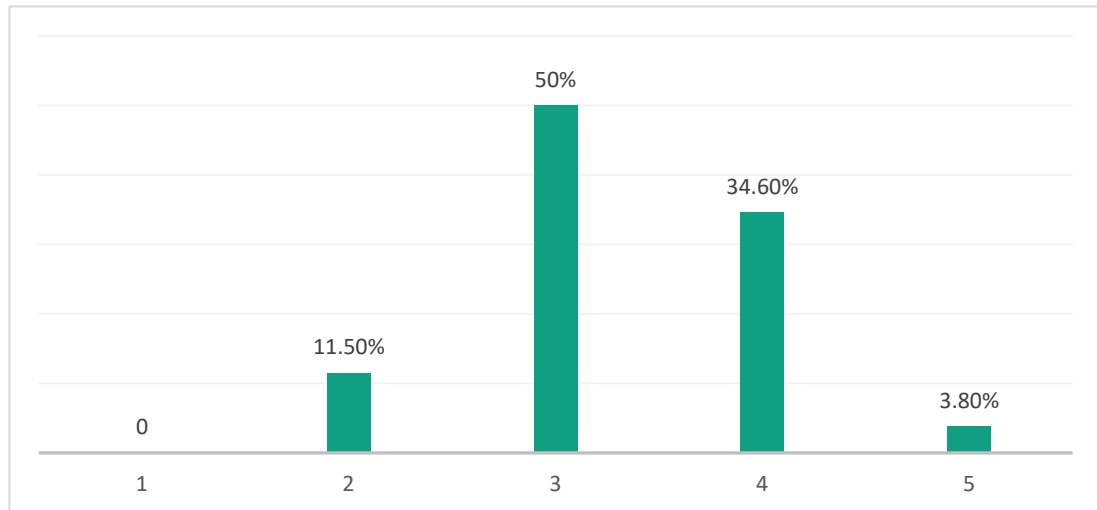


Figure 5.9: ICT Involvement Rate (Results found from questioner)

Employees were asked about the availability of IT/ICT trainings in the organizations were described as

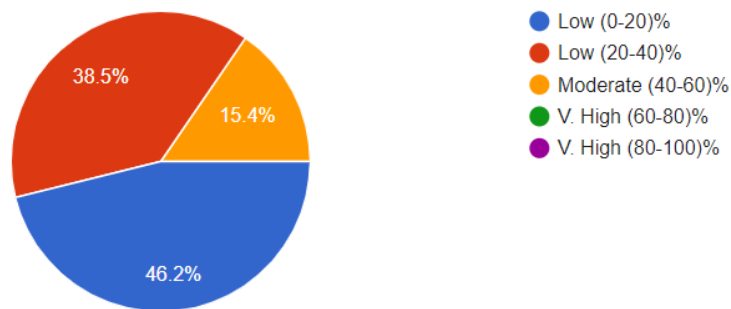


Figure 5.10: Availability of IC/IT Training (Results found from questioner)

Employees were also asked if they carried out any work processes using IT in the work place

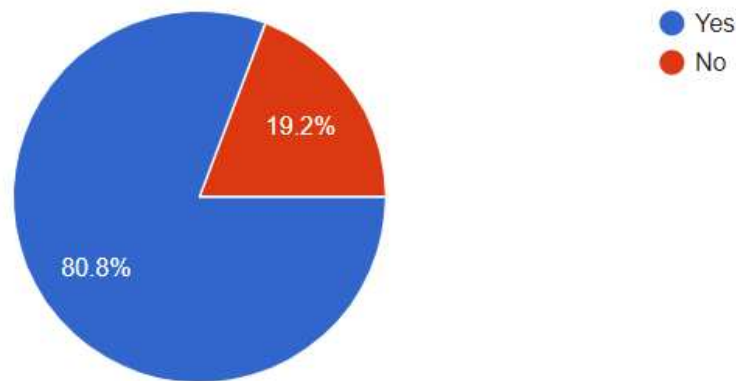


Figure 5.11: Work Processes Carried out Using IT (Results found from questioner)

Employees who answered yes mentioned what the platform and software was and common answers such as the BSIS, Microsoft office, Results entry, stock status and data encoding were mentioned

Employees were asked about their confidence level if they had to carry out any of the following tasks

- Using excel spreadsheets,
- using search engine,
- using email services,
- downloading and installing software's and
- identifying the cause for a computer failure

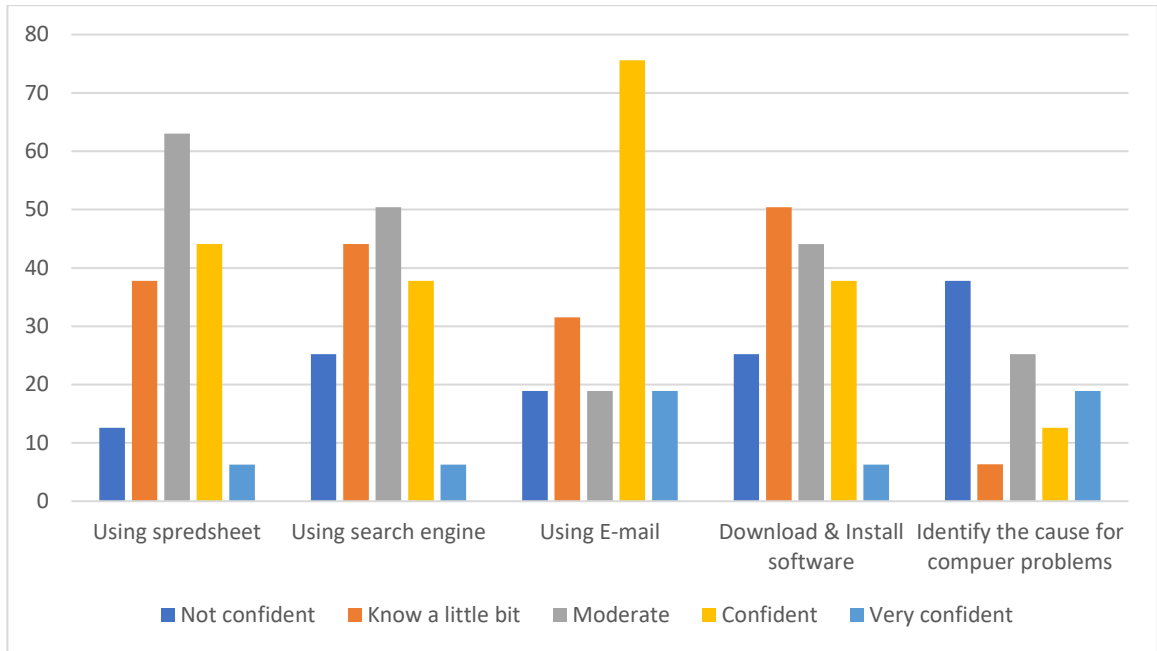


Figure 5.12: Familiarity to Work Processes (Results found from questioner)

5.4.2 Government Support and policies

On the topic of Government support and policy, the deputy manager of the institute was interviewed on topics of

- Legislations
- Different policy forms
- Confidentiality and
- Cyber Crime laws

During describing the persistence of the government to deploy ICT for the development of the work environment it was understood that he government has shown high level of interest for deploying of the project, however further works and developments the government has taken or may wish to take in the near future were not mentioned.

Concerning funding, it is understood that the institution seems to have funding from an NGO and the government allocates a certain amount of budget, however the details of the budget and the NGO funding weren't discussed in depth

Legislations on working with ICT were discussed and it was discovered that The blood bank is mandated to carry out all blood transfusion related activities so the any need for an ICT system to support these functions are under its mandate

The interview checked for the following 5 policies within the company and the results are shown on the graph under (respectively as seen on the graph)

- Policy of increasing computer and internet penetration
- Policy for developing and training ICT capacity in government offices
- Policy for employing ICT staff in government.
- Policy of computerizing and automating offices records and files
- Policy for (Funding)Grant in ICT for administration offices and ICT projects

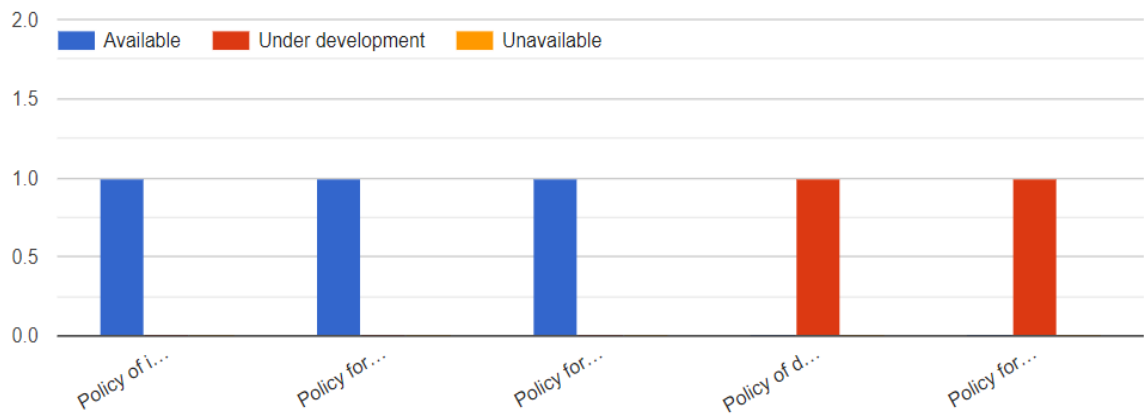


Figure 5.13: Governmental Policy Availability (Results found from questioner)

5.5 Implications and meanings

From the above findings on the different parameters and categories the following interpretations are developed.

5.5.1 Technological Infrastructure and Internet penetration

The questionnaire revealed that the employees found the working speed of their connection to be average and below average only 30% of the sample size found to be the connection above average and there was no score collected at the highest point. Similarly, the working speed was found to be less reliable with 65% confirming that it was either average or below average. Data on the internet penetration of each of the computers seems to be diverse however it was recorded that the highest

amount of answer is where 43% said that every 5th or above Desktops have internet connection as opposed to each. The percentage of computers to employees stood low at 20-40% of the sample size confirming. Since disconnections are common issues the employees were asked how frequently they occur and the highest value stands at 60-80% of disconnections happening whenever there is connection. From the same questionnaire it was understood that the company's data was not digitized because the majority of answers fell under the Moderate range which is 40-60% of the company data being stored in a digital format. The average speed of connections available for users was majorly recorded to be between 15 to 30 Mbs.

Clearly from this data one can understand that there are gaps that need to be filled especially when it comes to internet penetration

5.5.2 Human Resource Skills

Employees feel that they have a moderate amount of experience with the usage of ICT 50% rated themselves as average users 11% rated themselves to be under average. The availability IT/ICT related training was rated to be on the low side by over 80% of the employees. However, there was a data showing that only 19% of the employees carry out work processes using IT and technologies.

Findings about governmental policies and frameworks have been discussed in the previous sub chapter.

6. Summary and Outlook

6.1 Conclusion

As discussed during the first few chapters of this paper the importance of doing an e-readiness analysis gives out the information the institution/country is being conducted on. It is important to understand and see the exact needs of the case is before rushing into apply any sort of technology and or software's to be used. Often times what seems like is need for a specific industry might not be what is exactly needed. It is important to carry out e-readiness assessment in order to understand where an institution stands.

The factors considered in this investigation have been carefully chosen from a long list of methods used by e-readiness evaluation tools devised and used by global organizations (mentioned in the literature review) for this purpose. The approach used for this research investigates how available the information of these measures is by collecting data from the case study organization: National Blood Bank Service for Ethiopia.

The Collected data shows how the sample size understands the definition of IT/ICT services and how they use it in their working environments, apart from a few individuals it was seen that the employees used the desktops for mundane activities that weren't too much complicated as opposed to using the available resources for technologies and/or platforms that could enhance processes rather than add up bureaucracy.

6.2 Future considerations

Upon doing the analysis, it was understood that further investigation is needed to conclude important factors that could enable the institution to make important decisions. Since this research was conducted with minimum resources and under a stressful time for the institution (the COVID-19 outbreak) Further works should be done by drilling down to specifics. The specific measures include a more extensive questioner as well as a face to face questionnaires where the researcher could understand and enquire some facts from face value. In addition to that it would be important to carry out team sessions in the fashion of brainstorming to understand more how the employees work with technology and with each other since a huge part

of their jobs includes communication and team work, the communication and team work that is carried out across the institution is not only fixated to between employees but also other health care providers that the institution works with.

With that in mind it would also be an ideal situation to understand and figure out the communication methods and working process that is carried out between the blood bank and other hospitals that require its services in a daily basis if not more. Clearly it is understood that the communication gap is big and needs work, since this part of the problem is not covered in this thesis it would be ideal to understand and solve the status of the institution first before jumping into the institution's relation with other healthcare providers.

The mentioned methods in the introduction and literature review of this thesis, such as usage of ICT/IT software's and platforms that include EDI could be of great use for the national blood bank of Ethiopia considering that it could benefit and improve work processes the most using those especially when it comes to outside communication. It should be noted that the same platform is a powerful tool to work within the institution itself.

As far as the analysis and the parameters are concerned, the researcher believes that the parameters are a perfect place to start small, but details and specifics need to be brought out through extensive questioner and on-site interviews. One of the disadvantages of conducting the research in a long distance format is that the communication gap as much as it can be filled using ICT, since some part of the employees are at a disadvantage with not getting connection both within the institution and outside the institution, small parts of the employees couldn't be contacted.

In addition to that during the data collection it was observed that most of the work processes were carried out manually or on paper, the institution could start populating the offices with desktop computers if complete digitalization is desired to be achieved, in addition to that, there exist huge gap areas where employees ranked themselves as unconfident and below average when it comes to the usage of ICT and Knowledge, similarly the availability of ICT trainings seems to be on the low according to the data gathered, as a result to elevate the two, it is advised that the institution increases the number of devices as well as trainings on basic uses to move onto helpful devices and ICT platforms that can be used institution wide. Once the number of employees

match the number of desktops or PC's it would not only be appropriate but also important to organize more and more ICT trainings to boost the level of confidence in the employees.

With regards to government policies, the data seems like it is lacking detailed information, however it can be seen that the national blood bank of Ethiopia has full support and polices in effect where it needs to be. Hence, future works should focus on drilling down into the details of the framework like interviews and questionnaires prepared and studying in depth what the polices and rules are and if they are truly in effect.

In conclusion, the parameters used in analysis section of this research are very basic and necessary, these parameters enable the progress of future works and analysis greatly, as a result it is important that further works to be carried out on similar topics in the institution continue on the basis of similar parameters and the data available from this research that has already covered the basic questions and discovered necessary data that is important and useful for further research.

Reference

- Almetwally M. Mostafa, Ahmed E. Youssef, Gamal Alshorbagy, Alazhar, A Framework for A Smart Social Blood Donation System Based On Mobile Cloud Computing, Cairo, Egypt, 2014.
 - Citation in text: Almetwally M. Mostafa 2014
- Anders G. Nilsson, (1998) Information Systems Development, A Frame of Reference and Classifications, the Institute for Development of Activities in Organizations, STOCKHOLM, Sweden
 - Citation in text: Anders G. Nilsson 1998
- APEC E-Commerce Readiness Assessment Guide (2000)
 - Citation in text: (APEC 2000)
- Azab, N. A., Kamel, S. and Dafoulas, G., (2009) " A suggested framework for assessing electronic government readiness in Egypt" Electronic Journal of e-Government Volume 7 Issue 1 2009, pp. 11-28, Retrieved April 14, 2009, from www.ejeg.com
 - Citation in text: Azab N., Kamel S., Dafoulas G., 2009).
- Chugh, R & Gupta P 2010, 'MAMS - A Unified Approach for Assessing E-readiness of SMEs', In Mills, A, Gutierrez, J, Osei-Bryson, K and Janczewski, L (eds.), Proceedings of the 2010
 - Citation in text: Chugh, R & Gupta P 2010
- Clemen Teena, K. Sankar and S. Kannan, (2014) A Study on Blood Bank Management, Bharath University, India,
 - Citation in text: (Clemen Teena, K. Sankar and S 2014
- Cyrille Delpierre, Lise Cuzin, Judith Fillaux, Muriel Alvarez, Patrice Massip and Thierry Lang, (2004) A systematic review of computer- based patient record systems and quality of care: more randomized clinical trials or a broader approach
 - Citation in the text - Cyrille Delpierre, Lise Cuzin, Judith Fillaux, Muriel Alvarez, Patrice Massip and Thierry Lang, 2004).
- Docktor, R. (2002). E-Readiness in 2002: Defining and achieving your e-fitness goals. Retrieved on August 12, 2004, from <http://www.ip3.org/pub/docktor.htm>
 - Citation in the text: (Docktor, 2002)

- European Commission, Directorate-General for Communications Networks, Content and Technology Research and Innovation in the field of ICT for Health, Wellbeing & Ageing Well: an overview
 - Cited in the text: European Commission Publication
- Evan M. Bloch, Marion Vermeulen, and Edward Murphy (2012), Blood Transfusion Safety in Africa: A Literature Review of Infectious Disease and Organizational Challenges.
 - Citation in text: Evan M. 2012
- Gadisa Kebede (2016) Designing a Web-Based Blood Bank Information Management System for the National Blood Bank of Ethiopia
 - Citation in text: Gaddisa Bekele, 2016
- Guesh Dagneu, (2018) Designing a Knowledge Based System for Blood Transfusion, Addis Ababa University
 - Citation in text: Guesh Dagneu 2018
- H.M. Jalalian, L.A. Latiff, S.T. Syed Hassan, P. Hanachi and M. Othman, (2008) Application of Internet and Information Technology in Recruitment of Safe Blood Donors.
 - Citation in text: H.M. Jalalian, L.A. Latiff, S.T 2008
- Juma, Nazana(2012) Blood Bank Management Information System, University of Zambia,
 - Citation in text: Juma Nazana, 2012
- K M Akkas Ali, Israt Jahan, Md. Ariful Islam, Md. Shafa, (2015) Blood Donation Management System Parvez Institute of Information Technology, Jahangirnagar University, Dhaka, Bangladesh, Department of Computer Science and Engineering, Jahangirnagar University, Dhaka, Bangladesh,
 - Citation in text: K M Akkas 2015
- Knowledge Base Sdn Bhd, KBase life blood bank information system, 2006.
 - Citation in text: Knowledge base 2006
- Koh, C., and Prybutok, V.R., (2002). E-Government Readiness: A Research Framework and an Action Research Case of a Municipal Government,
 - Citation in text: (Koh, C., and Prybutok, V.R., 2002)
- L. Stapleton & A. Fouopi Lemouchele (2011). "The Adoption of Electronic Data Interchange in Africa: A Country Case Study of the Cameroon through an Institutional Lens", Proceedings of the International Federation of Automation and Control World Congress, Catholic University of Milan,
 - Citation in text: L.Stapleton 2011

- Luis E. Nova 1999 Electronic data interchange: its benefits in trade activities for developing countries [More!] World Maritime University
 - Citation in text: Luis E. Nova, 1999
- McClelland DBL Pirie E and Franklin IM (2010), Manual of optimal blood use, support for safe, clinically effective and efficient use of blood in Europe. EU optimal Blood Use project
 - Citation in text: (McClelland and Pirie, 2010)
- Minton, S. (2003). *Nordic nations still top information index*.
 - Citation in text: (Minton, 2003)
- Mohammed Raji Musa (2010) An e-readiness Assessment Tool for Local Authorities: A Pilot Application to Iraq
 - Citation in text: Mohammed Raji Musa, 2010
- Mohammed Raji Musa, An e-readiness Assessment Tool for Local Authorities: A Pilot Application to Iraq, Mohammed
 - Citation in text: Mohammed Raji Musa, 2010).
- Mutula, S.M. and van Brakel, P. (2006) An Evaluation of E-Readiness Assessment Tools with Respect to Information Access: Towards an Integrated Information Rich Tool.
 - Citation in text: Mutulaa & van Brakel, 2006
- Mutulaa & van Brakel, (2006)An evaluation of e-readiness assessment tools with respect to information access: Towards an integrated information rich tool
 - Citation in text: Mutulaa & van Brakel, 2006
- Mwewa Peter Samuel Bobby Elizabeth Musonda Allan, (2012) An Investigation into the Development of ICT Skills among Mathematics Students in Higher Learning Institutions, A Case of Mukuba University
 - Citation in text: Mwewa Peter, Samuel Bobby Elizabeth, Musonda Allan 2014)
- Mwewa Peter, Samuel Bobby Elizabeth, Musonda Allan (2014) An Investigation into the Development of ICT Skills among Mathematics Students in Higher Learning Institutions , A Case of Mukuba University.
 - Cited as; (Mwewa Peter, Samuel Bobby Elizabeth, Musonda Allan 2014) Citation in text: Mwewa Peter, Samuel Bobby Elizabeth, Musonda Allan 2014)
- Punjab Online Blood Bank Management System, department of health and family welfare government of Punjab. Available at <http://bbmspanjab.gov.in/> 2016.

- Citation in text: Punjab Online Blood Bank Management System 2016
- Research and Innovation in the field of ICT for Health, Wellbeing & Ageing Well: an overview 2019
- Sampada S. Gulavani and R.V. Kulkarni (2010) Role of Information Technology in Health Care
 - Citation in the text: (Sampada S. Gulavani and R.V. Kulkarni, 2010)
- Stephen Mutula, Justus Wamukoya 2002 Web Information Management: A Cross-Disciplinary Textbook
 - Citation in text: Stephen M. Mutula, 2010
- Towards 100% voluntary blood donation: 2010 A global framework for action. World Health Organization and International Federation of Red Cross and Red Crescent Societies.
 - Citation in text: Red cross and red Crescent Societies journal, 2010
- Visvanathan Naicker Eletronic Data Interchange in Developing Countries: Lessons from South Africa., University of the Western Cape Rubin Pillay, University of the Western Cape
 - Citation in text: Rubin Pillay, 2010
- Williams, J.R. and R.C. Babcock 2005 Assessment of size at maturity and gonad index methods for the scallop
 - Citation in text: Babcock, 2005

Publications

- Consulting and Audit Canada, 2004 (Citation similar)
- EDI 101 Guide (Citation similar)
- ESCAP/UNDP manual on electronic data interchange (EDI) in transport (1993)
 - Citation in the text: ESCAP/UNDP Manual 1993
- <https://select-statistics.co.uk/calculators/sample-size-calculator-population-proportion/>
 - Cited in text: -statistics.co.uk
- The Bridges Organization Report, 2003
 - Citation in text; (Bridges, 2005).
- The Economist Intelligence Unit and IBM Corporation, 2004
 - Citation in text: (The Economist, 2004)
- UNDESA, (2003/2005). e-Government Readiness Assessment Survey,
 - Citation in text: UNDESA(20032005)

- World Bank Group Report, 2001(Citation similar)

Internet sources:

- <https://select-statistics.co.uk/calculators/sample-size-calculator-population-proportion/> - March 2020
 - Cited in text: [-statistics.co.uk](https://select-statistics.co.uk)
- <https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/blood-banking> (February 2020)
 - Citation in text- Hopkins Medicine
- <https://scialert.net/> (March 2020)
 - Citation in text – Science alet
- <https://hospitalsoftwares.wordpress.com/2013/04>
 - Citation in text – Hospital software
- <https://www.uwsp.edu/centers/CASE/documents/volunteerism/blood-drive/blood-types.pdf> - (January 2020)
 - Citation in text – American Red Cross Publication

List of Figures

Figure 3.1: Patient Blood transfer process	31
Figure 3.2: National Blood Bank of Ethiopia Org chart.....	34
Figure 4.1: E-readiness relation model	42
Figure 4.2: Sample Size Calculator.....	43
Figure 5.1: Data Analysis process	45
Figure 5.2: Rating the f speed of Internet.....	50
Figure 5.3: Reliability of Internet connection	50
Figure 5.4: Internet Connection to Desktops.....	50
Figure 5.5: Ratio of Computers to Employees	51
Figure 5.6: Internet Disconnection rate	51
Figure 5.7: Average Speed of Internet	52
Figure 5.8: Educational status	52
Figure 5.9: ICT Involvement Rate	53
Figure 5.10: Availability of IC/IT Training	53
Figure 5.11: Work Processes Carried out Using IT	54
Figure 5.12: Familiarity to Work Processes.....	55
Figure 5.13: Governmental Policy Availability	56

List of Tables

Table 3.1: E-readiness Assessment tools	21
Table 3.2: Capacity And Weight	25
Table 3.3: European Rankings	26
Table 3.4: World Rankings 2013 – 2017	27
Table 3.5: Blood Types and Groupings.....	30
Table 5.1: E-readiness Parameters Barriers and Enablers	48
Table 5.2: Parameters and their Indicator	49

Appendix A

This part contains the research questionnaire given to the employees of the company; the following set of questions are focused on the technological infrastructure of the company.

Dear Sir or Madam,

Thank you for agreeing to participate in the research being carried out.

The following questions focus on the technological infrastructure of the internet as well as the advancement and distribution of ICT of the National Blood Bank of Ethiopia.

Please attempt ALL questions.

1. What Department are you working in and what is your Job title?

2. The average working speed of the internet at your office (in the workplace) can be described as?
 - i. 1 being the lowest
 - ii. 7 Being the highest
3. How would you describe the reliability of an internet connection at the workplace on a scale of five?
 - i. 1 Least reliable
 - ii. 5 very reliable
4. What is the average internet penetration in your company? (estimated by the number of PC's or Desktops that have an internet connection)?
 - i. Every computer has access to the internet
 - ii. Every second or third computer has access to the internet
 - iii. Every 5th or above
5. What is the percentage of computers to employees in your organization?
 - i. Low - 0 -20%
 - ii. Low - 20 - 40%
 - iii. Moderate 40 -60 %
 - iv. High 60-80 %
 - v. High 80 - 100%

6. How often do disconnections happen in your organization?
 - i. Low - 0 - 20%
 - ii. Low - 20 - 40%
 - iii. High 60-80 %
 - iv. High 80 - 100%
7. What percent of the company data is digitized?
 - i. Low - 0 -20%
 - ii. Low - 20 - 40%
 - iii. Moderate 40 -60 %
 - iv. High 60-80 %
 - v. High 80 - 100%
 - vi. I am not aware
8. What is the average speed of connections available for users?
 - i. 0 - 15 Mbs
 - ii. 15 - 30 Mbs
 - iii. 30 -50 Mbs
 - iv. Above 50 Mbs
9. What type of IT support does the institution use that you are aware of?

10. What does the company/institution use to store different types of data across the company? (Paper or a dedicated database) Please describe?

Appendix B

Human Resources and skills

Dear Sir or Madam,

Thank you for agreeing to participate in the research being carried out.

The following questions focus on personal skills within employees of the National Blood Bank of Ethiopia

Please attempt ALL questions

1. What Department are you working in and what is your Job title?

2. What is your educational background? What is your educational background?
 - i. Primary Education
 - ii. Intermediate High school Diploma Bachelor or High degree
 - iii. Diploma Bachelor or High degree
3. How do you rate yourself when it comes to the usage of ICT and technology?
 - i. 1 Low Skills
 - ii. 5 Very High skills
4. How would you describe the availability of IT /ICT related training at your organization?
 - i. Low (0-20) %
 - ii. Low (20-40) %
 - iii. Moderate (40-60) %
 - iv. High (60-80) %
 - v. High (80-100) %
5. Do you carry out any work process using IT in the workplace?
 - i. Yes
 - ii. No
6. If Yes, what are they? _____
7. How confident would you feel if you had to carry out the following tasks?

	I am not confident at all	I know a little bit	I have moderate knowledge	I am very confident	I am a specialist
Using excel spreadsheets					
Using the search engines					
Using e-mail					
Downloading and installing software's					
Identifying the cause for computer problems					

8. What is the most complex software you use in the workplace?

Appendix C

Questions on Government Support and Policies

Dear Sir or Madam,

Thank you for agreeing to participate in the research being carried out.

The following questions focus on the governmental support the National Blood Bank of Ethiopia receives as well as corresponding policies the institution follows for ICT/IT purposes.

Please attempt ALL questions

1. How would you describe the persistence of the government to deploy ICT for the development of your work environment or the project you intend to launch on a scale of five?

2. What Department are you working in and what is your Job title?

3. How do you describe funding specifically for ICT?

4. What are the legislations (Governmental or not) you need for your ICT work or providing services?

5. For the following legislations, mark each one as available, under development, unavailable.

	Available	Under Development	Unavailable
Confidentiality and Privacy law			
Cyber-crimes law			

6. How confident would you feel if you had to carry out the following tasks?

	Available	Under development	Unavailable
Policy of increasing computer and internet penetration in government			
Policy for developing and training ICT capacity in government offices			
Policy for employing ICT staff in government. (IT unit, number of staff,			
Policy of digitizing offices records and files			
Policy for Funding ICT in government offices and ICT projects			