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Potential of ICT industry for economic growth in developing countries
A case study of the Republic of Rwanda

Master's thesis

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Declaration

I Léandre MUNDERE, declare that this thesis is my own work and that it has not been presented in any other university. Where other source of information listed in biography have been used,

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Annotation

Information and Communication Technologies (ICTs) are becoming a global necessity to achieve milestones in a smarter and accurate way. To reach certain goals nowadays require a mix of all possible techniques and tools so that the users benefit from them in an automated and intelligent environment. The speed at which countries are developing is often associated to how they invest in science and technology. It is almost now impossible to expect a growth in the way citizens live if the governments don't think on new ways of fastening the flow of information, its' control and the way it is distributed to citizens. Thus by changing a small environment that they live in into a broad virtual reality, where they can still interact each other, or with the markets and get the best of the services in a shorter time. Not only that, an economic growth based on technology, is the new approach that almost every organizations and nations are adopting because this last one eases monitoring and prediction of what will be the future in a faster period of time. Although the above, developing countries still have issues on how to implement this, due to various problems that are discussed into deep in this work. The aim of this work is how those countries can benefit from ICTs as a strong pillar to take their economies to a next level. Although the case study is focused significantly on the Republic of Rwanda, the same approach can be used as well to other countries in the same range of economic classification, probably with slight changes according to the respective country of application.

ICTs were therefore concluded as a central key model to be adopted by governments and organizations which want to maximize their profits of economic growth and development.

Anotace

Téma: Potenciál ICT sektoru pro ekonomický růst rozvojových zemí, Případová studie Rwandské Republiky

Informační a komunikační technologie (ICT) se globálně stávají nutností ve snaze dosahovat cílů lepšími a přesnějšími cestami. K tomu je v současné době třeba zkombinovat dostupné techniky a nástroje tak, aby byly přínosné jejich uživatelům v automatizovaném a inteligentním prostředí. Rychlost rozvoje zemí je často spojená s mírou jejich investic do vědy a do technologií. Je téměř nemožné očekávat růst zemí v případě, že vlády neimplementují nové způsoby zrychlení toku informací, jeho kontroly a cest, kterými se informace dostávají k občanům. Proto by změnou uzavřeného prostředí, ve kterém žijí, na širokou virtuální realitu, ve které by stále mohli interagovat jeden s druhým a také se subjekty na trzích, získali lepší služby v rychlejším čase. Kromě toho je ekonomický růst založený na technologiích považován za nový přístup, který přijímá téměř každá organizace a země, protože umožňuje sledování a předpovídání toho, co se bude odehrávat v budoucnosti ve výrazně kratším čase. Nicméně rozvojové země mají stále problémy s implementací těchto principů, a to kvůli různým problémům, které jsou detailně diskutovány v této práci. Cílem této práce je představení přínosů, jaké mohou pro rozvojové země představovat ICT jakožto nosný pilíř pro jejich ekonomiku při transformaci na další úroveň. Přestože je případová studie výrazně zaměřena na Rwandskou republiku, stejný přístup může být aplikován i v jiných zemích, které spadají do stejné ekonomické kategorie. Při implementaci by byly pochopitelně nezbytné drobné změny upravené dle podmínek v dané zemi.

Závěrem lze konstatovat, že implementace ICT může být vnímána jako klíčový koncept pro vlády a organizace, které chtějí maximalizovat své zisky z ekonomického růstu a celkového rozvoje.

Acronyms

4G LTE: Fourth Generation Long-Term Evolution

BPO: Business Process Outsourcing

BRICS: Brazil-Russia-India-China-South Africa

EAC: East African Community

EASSy: East African Submarine System

EDPRS: Economic Development Poverty Reduction Strategy

FDI: Foreign Direct Investment

GATS: General Agreement on Trade Services

GDP: Gross Domestic Product

GNP: Gross National Product

HDI: Human Development Index

IaaS: Infrastructure as a Service

ICT: Information and Communication Technology

ICT4D: Information and Communication Technology for Development

iGDP: internet Gross Domestic Product

IMF: International Monetary Fund

IPAR: Institute of Policy Analysis and Research

ISP: Internet Service Provider

ITU: International Telecommunication Union

M&E: Monitoring and Evaluation

MDG: Millennium Development Goals

MIT: Massachusetts Institute of Technology

MoH: Ministry of Health

MTN: Mobile Technology Network

MYICT: Ministry of Youth and ICT

NATO: North Atlantic Treaty Organization

NEP: National Employment Policy

NEPAD: New Partnership for Africa's Development

NICI: National Information and Communication Infrastructure

NISR: National Institute of Statistics of Rwanda

OECD: Organization for Economic Co-Operation and Development

OLPC: One Laptop per Child

ORN: Olleh Rwanda Service

PaaS: Platform as a Service

POS: Point of Sale

PPI: Producer Price Index

RDB: Rwanda Development Board

RITA: Rwanda Information Technology Authority

ROI: Return on Investment

RURA: Rwanda Utilities Regulatory Authority

SaaS: Software as a Service

SME: Small and Medium Enterprises

SPIS: Solar Powered Internet School

SRMP: Smart Rwanda Master Plan

UN: United Nations

USD: United States Dollar

Wi-Fi: Wireless Fidelity

WiBro: Wireless Broadband

WiMAX: Interoperable implementations of the IEEE 802.16 family of wireless-networks standards

WTO: World Trade Union

Contents

Declaration	i
Acknowledgements.....	ii
Annotation.....	iii
Anotace	iv
Acronyms	v
List of tables	x
List of Figures	x
1. Introduction	1
1.1 Preamble.....	1
1.2 Why Rwanda?.....	2
1.3 Motive of the research	3
2. Theoretical Background	4
2.1 Historical view	4
2.2 Definitions.....	5
2.3 Exploring the concept of ICT and economic growth.....	7
2.4 Statement of the research problem	9
3. Objectives and Methodology	10
3.1 Type of research and objectives	10
3.2 Research question.....	11
3.3 Research methodology.....	11
3.4 Data processing	12
4. Current Situation in Developing Countries	13
4.1 Introduction.....	13
4.2 Why ICTs matter?	13
4.3 Economic indicators	14
4.4 Technological environment.....	17
4.5 Social and cultural environment.....	22
4.6 Political and legal environment.....	24
4.7 Trends in economic growth with focus on Sub-Saharan Africa.....	27
4.8 SWOT analysis of ICT in developing countries.....	28

4.9	Summary.....	32
5.	Potential of ICT Sector and Economy in Rwanda	33
5.1	Impact of ICT on economy and development.....	34
5.2	Economic indicators in Rwanda.....	35
5.3	Technological environment.....	44
5.4	Social and cultural environment.....	52
5.5	Political and legal environment.....	54
5.6	Competitive advantages of investing in Rwanda ICT sector compared to East African countries .	56
5.7	Plans and way forward.....	59
5.8	Rwanda’s ICT SWOT analysis.....	59
6.	Questionnaire Analysis and Discussion of Results	61
6.1	Introduction.....	61
6.2	Questionnaire discussion	61
6.3	Summary.....	71
7.	Recommendations and Conclusion	72
7.1	Recommendations	72
7.2	Comparison of this thesis to other similar works	73
7.3	Thesis conclusions.....	74
8.	Bibliography	76
	Appendices.....	80
	Appendix 1.....	80
	Appendix 2.....	82

List of tables

Table 1 - Internet penetration in some African countries	18
Table 2 - Sub-Saharan countries real GDP growth (percentage changes)	28
Table 3 - Rwanda Debt evolution	40
Table 4 - Monthly, quarterly and annual changes for PPI for all Rwanda.....	42
Table 5 - Estimated market penetration rates in Rwanda's Telecom's	55
Table 6 - SWOT matrix of Rwandan ICT industry.....	60
Table 7 - Respondents' perspectives on ICT.....	64
Table 8 - Respondents' ICT importance to economic growth	65
Table 9 - Respondents' reliability to ICTs	69

List of Figures

Figure 1 - Average growth rates of GDP, population and GDP per capita 1965-2010.....	15
Figure 2 - Distribution of colocation datacenters in the world	21
Figure 3 - Age structure and labor force in both developed and developing countries.....	23
Figure 4 - Deployment of an EASSy broadband in southern and eastern Africa.....	25
Figure 5 - Rwanda administrative map	33
Figure 6 - Economic and social impact of ICT.....	34
Figure 7 - Rwanda's progressive GDP growth.....	35
Figure 8 - Rwanda's progressive GDP/capita growth by quarters.....	36
Figure 9 - Evolution of employment rate for females and males groups	37
Figure 10 - Evolution of Inflation from the period of January 2003 to September 2014.....	39
Figure 11 - Imports/Exports balance in Rwanda in USD million.....	43
Figure 12 - Investment of GDP in research and development.....	45
Figure 13 - The dual focus of Rwanda's ICT plan	47
Figure 14 - A mobile money outlet in Kigali/Rwanda.....	49
Figure 15 - Rolling out a fiber optic cable in Rwanda.....	49
Figure 16 - A tele-center in a Rwandan rural area.....	51
Figure 17 - Comparison on ease of doing business in some Sub-Saharan countries	57
Figure 18 - Areas for foreign direct investment	58
Figure 19 - Respondents by gender	62
Figure 20 - Career background of respondents	63
Figure 21 - Respondents' countries of origin	63
Figure 22 - Key sectors which contribute to a healthy economy	67
Figure 23 - Factors which affect ICT policies implementation	68
Figure 24 - Sectors that shows economic growth of a country.....	70

1. Introduction

1.1 Preamble

Information and Communication Technologies are a new approach for living a modern life, they provide great promises to reduce poverty, increase productivity, boost up economic growth, and improve accountability and governance. That promise only grew when ICTs underwent a revolution in the 2000s. Nearly 5 billion people now use mobile phones, up from 200 million at the last decade's start, and the number of Internet users has risen 10-fold (*ICT for greater development impact, 2012*). People across the globe do much more than chat and play games. They learn where best to fish and what market to sell their products. They trace cattle from pastures to supermarkets. They report illegal logging and misuses of local budget. They pay bills, send money to their friends and families home and receive cash transfers. They do business on mobile phones. They use ICTs to prevent violence against women, and so on. They get state-of the-art schooling online. They remotely monitor and switch on irrigation pumps. And as we have seen recently in the Mediterranean region, they use social networks to make their voices heard and trigger change.

By providing access to information, equalizing opportunities in rural areas, and contributing to pro-poor market developments such as microfinance and mobile money, ICTs offer new tools to directly address poverty. By contributing to growth, the ICT sector namely infrastructure, networks, ICT service industries and media also indirectly reduces poverty. Local ICT service industry create jobs, especially for youth and women in developing countries and promote trade competitiveness through exports. The ICT sector also offers opportunities innovation across the economy and greatly improves productivity.

Despite the recognized potentials for alleviating poverty, still they are not equally accessible, leaving the poorest people behind (*von Braun, 2010*). There is a set of interrelated and continually unfolding factors influencing the field of ICT and its role in development (*Chambers, 2010*):

1. Change in the dimensions that define ICT and development has accelerated, not only in communication technologies and the expansion of web 2.0¹ but also in the awareness and aspirations of those living in poverty.
2. Following on from the relatively open and participatory approaches in the aid sector during the 1990s, an emphasis on control, accountability and impact assessment has developed in recent years.
3. Paradoxically, at the same time there has been a multiplication and diversification of participatory methodologies in the development field.

1.2 Why Rwanda?

The end of the Tutsi genocide² in 1994 saw a decimation of the nation's people, economy, resources, and political system. However, miraculously the country rebounded with a sense of forgiveness and optimism and looked turned the tragedy into an opportunity for a new beginning. The government has been ardent about developing the country economically and is willing to drastically change the way of life to do achieve this goal. The use of Information and Communication Technologies is becoming a crucial component of the global economy and Rwanda wants to be among the leaders in Africa in this area. It has already outlined several concrete plans for accomplishing this by 2020. The government developed plans keeping in mind the history and economical state of the country and was realistic about challenges they would face. Because of this insightful and cautious approach they have been relatively successful early on their endeavor. The government, private, non-profit, and education sectors have been collaborating and are helping each other achieve the common Vision2020³ goals. The outlook for Rwanda is now more positive than it has ever been in its modern history. Barring any drastic negative change in the political climate, Rwanda should enter the next quarter of the century as a prosperous country and a key player in the knowledge-based economy.

¹ Web 2.0 describes World Wide Web sites that use technology beyond static pages of earlier web sites. The term was coined in 1999 by Darcy DiNucci and was popularized by Tim O'Reilly Media web2.0 conference in late 2004.

² The Tutsi genocide is the most recent genocide on the history of humanity which happened in Rwanda in 1994 taking around 1 million lives and thus resulting in multiple widows and orphans.

³ Vision2020 is a government development program in Rwanda, launched in 2000. Its' main objective is transforming the country into a knowledge-based middle-income country, thereby reducing poverty, health problems and making the country united and democratic.

1.3 Motive of the research

As an individual who comes from a developing country, you can't stop thinking about why your nation is not as much similar as most of developed countries, as to say, Czech Republic for instance when it doesn't have more resources and other business opportunities than Rwanda. For most of the times, economic growth don't have a lot of to do with what the underground hides, it is most nowadays about how people think and react to daily problems. Thus, using modern technologies whereas they are, automate most of the actions possible so to generate more manpower for other necessary services. ICT as an industry should not only mean communication devices such as smartphones and computers, but also the way we plan education, agriculture and governance.

2. Theoretical Background

2.1 Historical view

Developing countries, low income countries or third world countries, are terms that have been used interchangeably since the Cold War. This term was referred to any country that was not aligned either to the NATO, or the communist bloc. The author will use in the next sections of this thesis the term “developing countries” to avoid misinterpretation. Actually, there are many factors that are common in developing countries and these will be discussed deeply along the next chapters, such as ICT availability, GDP, HDI and CPI. These last are also known as economic growth measures.

Because of the complex history of evolving meanings and contexts, there is no clear or agreed upon definition of the Third World. Some countries in the communist bloc, such as Cuba, were often regarded as "Third World". But since many third world countries were extremely poor, and non-industrialized, it became a stereotype to refer to poor countries as "third world countries", yet the "Third World" term is also often taken to include newly industrialized countries like Brazil or China. Historically, some European countries were part of the non-aligned movement and a few were and are very prosperous, including Switzerland, the Republic of Ireland and Austria (*OECD, 2009*).

Over the last few decades since the fall of the Soviet Union and the Cold War, the term Third World has been interchangeably used with the “least developed countries”, “global south” and “developing countries” to describe poorer countries that have struggled to attain a steady economic development, a term that often includes the Second World countries like Laos. This usage, however, has become less preferred in recent years. Recently the term Majority World has come into use, because most people of the world live in poorer and less developed countries (*UNCTAD, 2009*).

On another hand, ICT has become a catchword with different interpretations and viewpoints even among experts. As the name suggests, ICT encompasses all the technology that facilitates the processing, transfer and exchange of information and communication services. In principle ICTs have always been available since the advent of the printing press. The only difference is that from the 20th century, rapid advances in technology changed the traditional ways in which information was processed, communications conducted, and services available (*Adu, 2002*). These technological

advances have changed business operations and the way people communicate, they have introduced new efficiencies in old services as well as numerous new ones. One could even imagine to go as far as replacing the term “post-industrial society” with “information society”, that is a society where the ability to access, search, use, create and exchange information is the key for individual and collective well-being (*Kaplan, 2001*).

2.2 Definitions

Developing countries: in this work the term a developing country shall refer to any country with a low living standard, underdeveloped industrial base, and low human developing index relatively to other countries. In other words, it will mean any country with these 3 characteristics:

- Citizens have lower life expectancy
- Citizens have less education
- Citizens have less income

Developing countries are defined according to their GNI per capita. Countries with a GNI of 11,905 USD and less are defined as developing countries. Countries that are slightly over that amount will also be considered as developing for the year 2015 and their situation will be reviewed for 2016. This puts in total 147 countries in conditions of being developing country status (*World Bank, 2013*).

ICT: Information and Communication Technology is a broad concept which is impacting so much the way we live in these days. It has become a global must for any efficient standard life. When ICT is used for impacting the economic growth of a country it is usually referred as ICT for development (ICT4D). It does not include only electronic devices, but also the overall understanding of citizens about communication technologies, community development, poverty, healthcare, education and agriculture. Information and Communication Technologies are an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning (*Measuring information society, 2014*)

ICTs are also defined as tools or techniques that allow recording, storing, using, diffusing and accessing electronic information (*World Bank, 2002*). This thesis also accepts more broadly that ICTs are ‘tools that facilitate communication and the processing and transmission of information and the sharing of knowledge by electronic means (*UNDESA-GAIG, 2009*).

In 1998, OECD member countries agreed to define the ICT industry as a combination of manufacturing and services industries that capture, transmit and display data and information electronically (*OECD, 2002*). The OECD’s 1998 activity-based definition of ICT was reviewed in April 2002. It was decided that, although this definition gives only a first approximation of the ICT sector, it should not be changed at this stage; rather its implementation should be improved with the help of more detailed national classification (*Measuring the information society, 2002*). ICT is often used along with Information Technologies (IT), but it defers a little bit in such a way that it focuses a lot on the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information.

Economic growth: it is an increase in the capacity of an economy to produce goods and services, compared from one period of time to another. Economic growth can be measured in nominal terms, which include inflation, or in real terms, which are adjusted for inflation. For comparing one country's economic growth to another, GDP or GNP per capita should be used as these take into account population differences between countries (*Good Practice on ICT and poverty reduction, OECD 2005*).

Pro-poor growth: this concept is used along with economic growth and it highlights a lot on the development of poor people. Poor people are those who are earning less than one dollar (1USD) per day. Anyone with an income less to that shall be referred as a poor in this work (*Good Practice on ICT and poverty reduction, OCED 2005*).

Pro-poor growth, therefore, requires extension of infrastructure services to rural areas where the majority of the poor reside, often far from major centers of growth. Connecting such communities to the economy of a nation requires substantial investment in infrastructure which would be delayed, if not absent altogether, if poverty reduction was not a priority; that is, pro-poor growth

typically requires more targeted investment in infrastructure. This holds true for ICTs, where extension of the telecommunication system to the rural poor must be actively encouraged by pro-poor policies.

Some experts claim that this is far from common practice: “If one looks at Africa, the costs of access to ICTs will simply mean that there will never be ICT diffusion as it currently is. There is certainly a clearness that privatization on its own has not been a successful strategy. The lack of effective regulation, to give an extended private monopoly, has actually done many of our countries a great disservice.” There is a need for pro-poor policies that ensure the ICT sector covers rural areas.

2.3 Exploring the concept of ICT and economic growth

It seems that for the actual speed of living, you cannot dissociate ICT to economic growth, as a matter of fact; countries with less ICT infrastructures and strategies are the ones which are also low economically. We therefore witness the role of living a decent life with the use of communication technologies, even though these should be used rationally.

In order to discuss the contribution of ICTs to pro-poor growth, there is a need to establish a basic understanding of what the term means. Economists and agencies have various views on pro-poor growth and how it should be defined; alternative views are summarized in a paper by E. Pernia⁴: Pro-poor growth has been defined variously. Some analysts refer to it as a growth which results into significant poverty reduction, thereby benefiting the poor and improving their access to opportunities (*UN 2000, World Bank 2000 and OECD 2001*). Others equate pro-poor growth with high elasticity of poverty with respect to growth (*e.g. Ravallion and Datt, 2002*). Ravallion and Chen (2003) also introduce the concept of “mean growth rate of the poor”, which seems analytically ambiguous. Pro-poor growth is the type of growth that enables the poor to actively participate in economic activity and benefit proportionally more than the non-poor from overall income increase.

⁴ E. Pernia (2003): this paper attempts to discuss the pro-poor growth, and argues that it represents a major departure from the “trickle-down” phenomenon.

This signals a clear departure from the trickle-down development notion⁵ of the 1950s and 1960s that meant a gradual top-down flow from the rich to the poor. Klasen (2001) similarly defines “pro-poor growth to mean that the poor benefit disproportionately from economic growth.

2.3.1 ICT versus economic growth

There is a direct relationship on how one can maximize the profitability of a country’s economic situation by designing strong ICT policies. In this work, ICT sector shall be understood as a combination of economic activities producing goods (technologies) and providing services, meant for information processing, communication, and distribution in an electronic way, including their recording, transmitting and depicting (*OECD, 2011*).

Investing in ICT is a key driver of economic growth for emerging and developed markets alike (*World Economic Forum, 2010*). There is a correlation between ICT readiness, availability of broadband, computers, and software in a country-and competitiveness. Countries with the most advanced ICT sectors present the highest levels of competitiveness, suggesting that having a country enabled by ICT improves its overall economic performance in the long run.

2.3.2 Importance of ICTs for economic growth

Innovation is an inevitable tool when dealing with new ways of doing business. In the 1980s, Robert Solow triggered the idea of productivity paradox⁶, saying “you can see the computer age everywhere but not in the productivity statistics.” And for many years there was a similar developing country growth paradox: that you could increasingly see ICTs in developing countries except in the economic growth data.

⁵ A trickle-down theory is an economic idea which states that decreasing marginal and capital gains tax rates especially for corporations and entrepreneurs can stimulate production in the overall economy.

⁶ The productivity paradox (also the Solow computer paradox) is the peculiar observation made in business process analysis that, as more investment is made in information technologies, worker productivity may go down instead of up.

That is still largely true for computers and to some extent the internet, but much less true overall as mobiles have become the dominant for of ICTs in development. In particular key studies such as those by *Waverman et al (2005)*, *Lee et al (2009)* and *Qiang (2009)* have demonstrated a clear connection between mobiles and economic growth and/or between telecoms more generally and economic growth.

2.4 Statement of the research problem

Over decades, developing countries have tried to bypass their economic situation through various ways, such as expanding or introducing new industries, human resource investments, and some others such Rwanda promoted ICT and entrepreneurship. Rwanda is among the best implementers of the UN's MDGs that has as mission to use ICT sector as a way to accelerate socio-economic growth, improve productivity of private sector and the development of ICT itself (*MYCIT Strategy, 2013*).

As stated in Chapter 1, economic growth will only be efficient if new forms of data processing and analysis are made in such a manner that they are accessed faster and with accuracy; no matter which sector of ICT they are in, ranging from agriculture to e-Government. The flow of information internally in any country will characterize the way business is done there. The major problem that most developing countries face is that it takes a long time to deliver information from one point to another, a challenge which hinders the speed of development.

Coming back to the main idea of this work, Information and Communication Technology sector is a key factor for empowering the economy of any country. Therefore, the questions is: how much does this impact a developing country which is in the middle of other heavy and urgent duties such as education, nutrition and political instabilities? Is ICT sector a primary area to focus on? Obviously, the answer is much clear to be yes, because ICT is not only about electronic gadgets, it concerns even the mindset of the total population.

3. Objectives and Methodology

Getting into depth of the research idea, will help us not only to understand very well the purpose of the study but also to screen out relevant concepts necessary to the accomplishment of the test of solutions. As the development of ICTs continues at a rapid pace, the development community will face ongoing challenges regarding the integration of ICTs into development cooperation. Understanding well objectives and the methodology used in any type of research helps to narrow it, guide the information to be collected and facilitate the development of the methodology.

3.1 Type of research and objectives

3.1.1 Type of research

According to Ellis, A., & Fouts, J. (1993) on the theory of “*Research on educational education*”, which categorizes researches into three major categories namely: descriptive, well controlled experimental and quasi-experimental, and large scale or meta-analysis; the author preferred to use a descriptive research:

A descriptive research uses quantitative and qualitative methodologies; this type is very useful for theory building, for helping shape interventions, and for helping understand the target or focus of an intervention. A descriptive research helps to understand the common implementation problems and other pressing problems in current practice.

3.1.2 Objectives

The aim and purpose of this study is to show the current situation of ICT industry in developing countries and different ways by which governments can benefit from their usage. Basically, the most profound study is carried on Rwanda, but the same approach and suggested recommendations in Chapter 7 can be applied as well on other developing countries probably with slight modifications depending on the country of application. This work will serve as well as a baseline for potential investors who would like to start a business in these targeted countries or as a reference to other researchers who might want to deepen the research question.

3.2 Research question

Referring to the new UN recommendations called the Millennium Development Goals⁷ (MDGs), it is currently important that none of the developing countries will be able to reach the global speed stepping to economic transformation without this policy as fast as they can. The main question of the research is how to use ICT industry as a tool for economic growth; however, the author also will take advantage of following sub-questions:

- a. During the past decade, most of successful countries such BRICS have used ICT to take their economic situation to a next level, what is the existent ICT industry in the selected case study country (Rwanda) and other developing countries?
- b. How are governments implementing the policies to transform their economy?
- c. What can be done to fasten the economic transformation plan?
- d. What are statistical facts that show that goals are being met?

Information of Communication Technologies are a must for any country regardless how much it invests in it. ICT as an industry in Rwanda focuses on the different areas of activities: finance, education, healthcare, agriculture and governance.

3.3 Research methodology

The chosen method is to use qualitative and quantitative approaches of the descriptive methodology, whereby the author based on data got from answered questions by the Monitoring and Evaluation teams of both MYICT and National Institute of Statistics of Rwanda (NISR) to assess the effectiveness of Information and Communication Technologies as a perfect tool for economic growth in Rwanda.

In order to develop a critical study, a questionnaire was distributed to other independent respondents who are keen on in the field of ICT, economy and third party as well. These come from different nationalities, but since the study focuses a lot on developing countries, the most focus was on those who come in the same targeted field of research and country. The questionnaire was designed using SurveyMonkey, a web application that manages and analyzes online surveys. Since

⁷ Millennium development goals are eight international development goals that were established following the millennium summit of the United Nations in 2000.

the application is a commercial tool, it only allow a maximum of 10 questions. Despite this limitation, the author managed to touch all sensitive areas that served as a backbone of this work.

3.4 Data processing

Collected data via the SurveyMonkey platform were analyzed via the inbuilt tools, Microsoft Excel was used to enter data and convert it into tables and graphs. Therefore, quantitative data is presented in the form of charts, graphs and tables while the qualitative are presented in the form of word-reporting mode.

Additional data were gathered via emails, results and findings are discussed in Chapter 6.

4. Current Situation in Developing Countries

4.1 Introduction

The use of ICTs in developing countries is still far behind compared to developed economies. Even though there is a trending use of modern technologies such as fiber optic for broadband services in a number of sub-Saharan countries, its maximization is not yet seen, due to a number of things such as appropriate infrastructures, and economic reasons among others. Not only these issues, but also this is slowed by other factors like the recent Ebola outbreak, hunger in the horn of Africa and other serious diseases which turn eyes of implementers and let ICT as a priority.

Nevertheless, there are some countries which are performing very well and at the same time giving a hope about the future; these include Angola, Nigeria, Ivory Coast, and Kenya among others. Africa is at the verge of going digital. Only 16% of the continent's one billion people are online, but that share is rising rapidly as mobile networks are built out and the cost of internet-capable devices continues to fall. More than 720 million Africans have mobile phones, 167 million already use the internet, and 52 million are on Facebook (*Measuring the Information Society 2013, ITU*).

Today, the internet's contribution to Africa's GDP remains low, at 1.1%, just over half the levels seen in other emerging economies. This figure varies widely across individual countries, from 0.6% in Ethiopia to 3.3% in Senegal.

4.2 Why ICTs matter?

As countries go online, they realize efficiencies in the delivery of public services and the operations of large businesses as well as Small and Medium Enterprises (SMEs) alike. The benefits of internet-driven productivity gains are not limited to web-based companies: among SMEs, 75% of the economic impact of the internet has risen to companies that are not pure internet players.

The internet will generate economic growth and social transformation in some key sectors: financial services, education, health, retail, agriculture and government. In financial services for instance, M-Pesa's mobile money solutions have brought millions of Kenyans onto the financial grid for the first time, remote diagnostics are expanding medical services to rural areas that have few healthcare professionals.

ICTs present a powerful contribution in all sectors, they also demonstrate various characteristics and usability in a range of development sectors, namely:

1. Access to market data can assist market expansion and reduce transaction costs
2. Traders can reduce risk of overstocking by using ICTs to confirm supply and demand
3. Emergency warnings by various media can substantially reduce risks
4. The combination of rural roads and ICTs can lean to more effective responses to health.

As stated earlier in this chapter, a group of experts claimed that this is far from common practice: “If one looks at Africa, the costs of access to ICTs will simply mean that there will never be ICT diffusion as currently is. There is certainly a clearness that privatization on its own has not been a successful strategy. The lack of effective regulation, to give an extended private monopoly, has actually done many of our countries a great disservice”⁸.

According to previous studies, there is no evidence that ICT infrastructure can be a substitute for traditional infrastructure (roads, energy, water, sanitation...). On another hand, ICT services might enhance economic development value of traditional infrastructure: roads can open up access to markets for farmers, for example, and the use of phones can then enable them to select markets more efficiently and conduct remote transactions.

4.3 Economic indicators

4.3.1 Gross Domestic Product

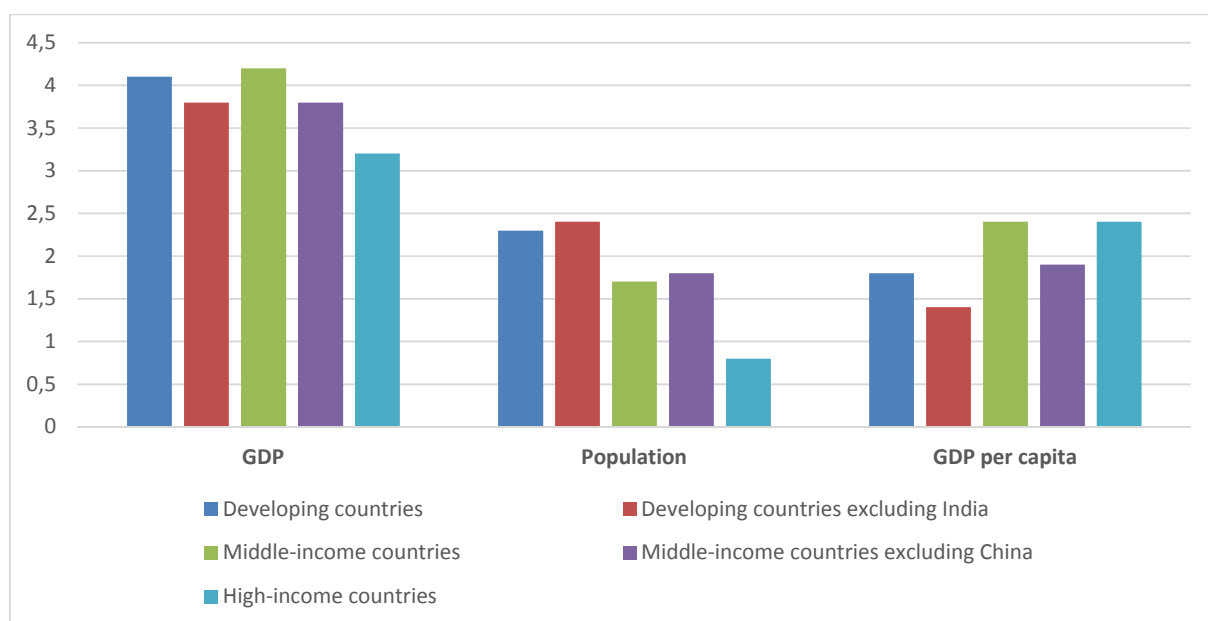
GDP growth in sub-Saharan Africa for instance, is expected to remain strong at about 5.75% in 2015. This will be backed up by sustained infrastructure investment, buoyant services sectors and strong agricultural production, even though oil-related activities provide less support. This overall positive outlook is, however, overshadowed by the dire situation in Guinea, Liberia and Sierra Leone where the Ebola outbreak is exacting a heavy human economic toll. In a few countries, activity is facing headwinds from domestic policies, including South Africa, where growth is held back by electricity bottlenecks, difficult labor relations, and low confidence; and in Ghana and,

⁸ Harvard Forum (2004).

until recently Zambia where large macroeconomic imbalances have led to pressures on the exchange rate and inflation (*Regional Economic Outlook, 2014*)

GDP growth rates in developing countries are on average higher than those in developed countries. Over the 1965-2010 period, the average annual growth rate was 4.1% in low-income countries, 4.2% in middle income countries and 3.2% in high-income countries (Figure 1).

Figure 1 - Average growth rates of GDP, population and GDP per capita 1965-2010



Source: World Bank 2012

The GDP being higher in developing countries, doesn't mean necessarily that they will overtake developed countries; that is a world where there is a gradual elimination of the gap between rich and poor countries. Much faster population growth in developing countries is offsetting comparatively faster GDP growth, causing GDP per capita growth rates in these countries to be relatively low or even negative (*World Bank, 2012*).

As a result, the gulf between the average GDP per capita in developing countries continues to widen. In the last 50 years, the gap between the average income of the richest 20 countries and that of the poorest countries doubled in size, with the wealthiest group reaching a level more than 30 times of the poorest (*OECD, 2011*).

4.3.2. Consumption and Investment

Developing countries have come increasingly to see FDI as a source of economic development and modernization, income growth and employment.

The entire African continent (except South Africa) received FDI inflows worth an estimated 8.2 billion USD in 2010. For comparison, this equals the amount of inward FDI attracted by Finland the same year, and it represented a mere 0.6% of total world FDI flows. Several recent studies have discussed the possible reasons for this seemingly spectacular failure of African countries at attracting foreign investors. The main factors motivating FDI into Africa in recent decades appear to have been the availability of natural resources in the host countries (e.g. investment in the oil industries of Nigeria and Angola) and, to lesser extent, the size of the domestic economy. The reasons for the lackluster FDI in most developing countries are most likely the same factor that have contributed to a generally low rate of private investment to GDP across them (*Investment for development, OECD, 2011*).

4.3.3 Employment and labor activity

It is a difficult task to capture the diversity of the economic activities of those who work in the world, the vast majority of whom are found in developing countries. Certain stylized features will have to suffice. Of these, and as distinct from developed countries, two prominent features are: (1) that developing countries are characterized by a status in employment in which own-account work, rather than paid employment, (wage-earning) is considered greater; and, (2) somewhat contrary to a standard textbook in labor economics, much economy activity in developing countries cannot be understood as the ‘derived demand for labor’ (*Duncan and Ishraq, 2012*). Much activity is in fact outside of market altogether, e.g. subsistence farming, or endeavoring to ‘create demand’, e.g. street vending, which can be understood as an employment-led, survivalist strategy, rather than a ‘growth-led’ demand for labor. The distinction here is that between growth or demand absorbing labor into jobs. As is common in developed countries, versus an abundant, underemployed supply of labor seeking to create its own demand for its service. As anywhere, the two sides of the market meet in the end, but it is a question of whether it is demand or supply that is driving this reunion.

4.4 Technological environment

4.4.1 Internet penetration

While most regions of the world have undergone a boom in the internet adoption and experienced considerable internet-related growth over the past decade, Africa is at the bottom of this journey. McKinsey's iGDP analysis⁹ shows that Africa's iGDP (internet GDP) stands at 1.1%, just over half its share in the major emerging countries and less than a third of the average in major developed countries. In dollar terms, this report estimates that Africa's iGDP amounted USD18 billion in 2012.

African countries show a great interest in using mobile devices than PCs because the mobile industry is closing the voice and the data gap. The first wave of internet of internet access through PCs and fixed/modern dial-up through work, school or public access (internet cafés). The second wave is through mobile phones because: they are easier to use, cheaper equipment compared to computers, prepaid (modern dial-up was postpaid), no electricity at home needed. Internet enabled mobile phones use low bandwidth and social networking are key drivers. Moreover to this, mobile internet reduces the cost of communication: Facebook Zero whereby users access a version of Facebook at no price, WhatsApp and Viber among others.

⁹ The sample of emerging countries used for this comparison includes Argentina, Brazil, China, India, Malaysia and Turkey. The sample of developed economies includes Canada, France, Germany, Hungary, Japan, Sweden, the UK, Taiwan and the US.

Table 1 - Internet penetration in some African countries

	Mob ile pene trati on % of popu latio n	Interne t penetr ation % of popula tion	Urban internet penetrat ion % of populat ion	Faceb ook users millio n	Online retail penetrat ion %	High speed intern et penet ration	Internet use within compan ies index, 0-7	Govern ment depart ments online	Gove rnme nt IS onlin e %
Algeria	103	14	52	4.1	0.39	2.5	3.1	10	1
Angola	49	15	47	0.6	0.49	0.1	3.4	34	7
Cameroon	64	5	-	0.6	0.01	0	4.6	15	16
Ivory Coast	96	4	-	-	-	0	3.9	32	17
Egypt	115	36	46	12.2	0.37	1.8	4.6	53	29
Ethiopia	24	1	43	0.9	0.40	0.8	3.6	20	4
Ghana	100	14	49	1.6	0.43	0.2	4.5	15	9
Kenya	72	28	72	2.0	0.73	0	5.0	24	23
Morocco	120	51	52	5.1	0.50	1.6	4.5	24	13
Mozambique	33	4	-	0.4	-	0.1	4.5	17	11
Nigeria	68	28	48	6.6	0.04	0.1	4.5	10	1
Senegal	88	18	68	0.7	0.44	0.6	5.3	18	3
South Africa	135	17	54	6.3	0.49	1.5	5.3	31	19
Tanzania	57	12	-	0.7	-	0	3.8	17	4

Source: Internet World Stats, International Telecommunications Union Database 2013

4.4.2 E-Government and some chosen technologies in companies and households

Within Africa, there exists a substantial and growing digital divide between urban and rural areas. For example, only 12% to 22% of the population of African countries live in its major cities, however they account for approximately 75% of all the telephone lines (*Dzinou, 2003*). In Egypt, urban household are four times as likely to be connected to the internet and eight times as likely to have a computer as rural households (*Shindy, 20s06*).

In sub-Saharan Africa (excluding South Africa), less than 20% of all rural communities are directly connected to mains electricity (*Karekezi et al 2001*) and those lucky enough to be offered access to ICT often lack suitable power resources to run the equipment.

Business process outsourcing, software development and local hardware manufacturing could all contribute to increasing Africa's trade balance (which is currently positive and could grow to USD13 billion). In South Africa, BPO already generates more than USD1.5 billion in revenue and accounts for 54,000 direct jobs; while Morocco's BPO sector is at similar scale (*MGI Lions go Digital, 2013*). Ghana, Kenya, Nigeria and Senegal are among the countries which plans and potential to build their own BPO sectors. SSome low-cost devices are already being manufactured on the continent, particularly in Nigeria and South Africa, and there are a number of software development hubs.

As the Internet expands across Africa, it has become a launching pad for a new generation of digital entrepreneurs. So many examples can be given in this field as well: in Nigeria alone, Konga and Jumia have become major online retailers, Paga is emerging as a key player in mobile payments, and Jobberman has created a digital marketplace for employers and job seekers. In Mozambique, a startup called moWoza has created a more efficient supply chain by using text messaging and a smartphone application to deploy available taxi drivers to deliver parcels from wholesalers to informal traders. In Rwanda, the use of SafeBoda, an android app that let taxi-motors connect with customers is chaning the whole experience of urban transport via smart and fast service.

4.4.3 Internet as transformational tool to economic growth

Internet exerts a strong influence on economic growth. In the developed world, it already contributes more than 20% of GDP growth. In China and Brazil the internet has contributed more than 10% of total GDP over the past years, and its impact is accelerating (*The great transformer, October 2011*). An increase in a country's Internet maturity correlates with a sizeable increase in real per capita GDP, a fact that underlines the potential for Africa to harness the internet as a tool to make a leap forward in economic and social development. As countries go online, they realize efficiencies and invite innovation in the delivery of public services and the operations of large and small businesses alike.

The benefits of Internet-driven productivity gains are not limited to web based companies: among SMEs, 75% of the economic impact of the Internet has raised to companies that are not pure internet players. In a global survey of 4,800 SMEs, the McKinsey Report found that across all sectors, companies utilizing web technologies grew more than twice as fast as those with minimal online presence. These web knowledgeable enterprises also brought in more than twice as much the revenue through exports, and created more than twice as many jobs, as their offline peers. According to survey respondents, the Internet has created 2.6 new jobs in the SME sector for every job eliminated by increased efficiency (*Internet matters: McKinsey Global Institute, 2011*).

4.4.4 Cloud computing

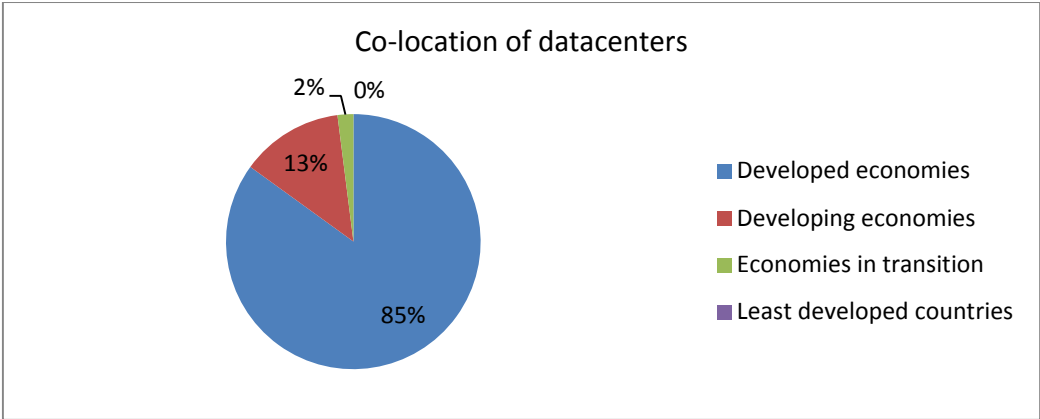
Should the provision of cloud-related services be a distinct regulated activity? Governing the right to establish and/or supply a cloud service in the domestic jurisdiction, through some form of prior licensing or authorization requirement, is about enabling regulatory control over market entry (*UN: Information Economic Report, 2013*).

For developing countries, while the dominance of foreign companies offering cross-border services may be a concern, it is both practically and legally difficult to address this market reality through regulatory intervention. From a practical perspective, preventing access to foreign cloud services would likely require a radical intervention in the global connectivity of the state, especially in respect of the internet. From a legal perspective, a majority of developing countries are members of

the World Trade Organization (WTO) and signatories to the General Agreement on Trade Services (GATS), committing themselves, at least in some sectors, to liberated trade in services, including through cross-border supply.

Developing countries face the major problem of using cloud services not only because they don't have the qualified personnel to use but also its' cost. Developing countries within the limits of their resources, infrastructure such as costly data centers must be constructed. At present developed economies account for as much as 85% of all data centers offering colocation services (Figure 2). The combination of few national data centers and high costs for international broadband communications further weighs on the net value of relying on cloud services.

Figure 2 - Distribution of colocation datacenters in the world



Source: UNCTAD 2013, *Datacenters map*

The cloud is critical to the economic welfare of emerging economies because it is central to the tapping the economic gains from the move to globalization of the design, production, distribution and support of goods and services over the last 30 years and its growing ICT intensity (*Peter Cowhey and Michael Kleeman, UC San Diego, 2005*). If developing countries are to profit from the transition to the cloud technologies, they have to frame their policies in light of five implications of the cloud of the world economy as summarized hereafter:

1. The cloud is central to being competitive in higher value-added products because products in the world economy are becoming more ICT intensive.

2. Cloud ICT is vital to being competitive in South-South commerce¹⁰, which is already the fastest growing share of world trade and investment and the future home to most of the world's middle class.
3. Cloud computing can strengthen SMEs and employment in all economies.
4. The cloud creates significant benefits for both individual users and governments.
5. The emergence of the cloud and the build out of broadband infrastructures has strong synergies in developing economies.

The use of cloud computing technologies mixed with broadband services will contribute a lot on developing countries. While many cloud services are designed to cope with narrowband networks such as mobile networks, they will achieve their full potential if broadband is available. Moreover, the deployment of cloud technologies can actually accelerate the broadband systems by increasing the value of such networks to the users and thus their adoption, improving economic returns for network operators.

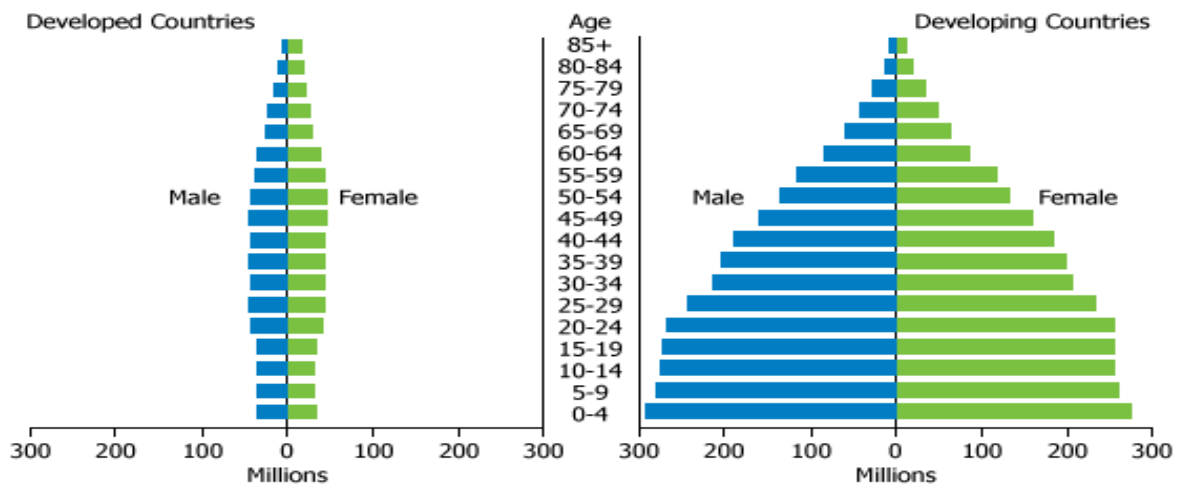
4.5 Social and cultural environment

4.5.1 Age structure and labor force

Unfortunate the speed of development, most of developing countries have a growing population, compared to developed countries. Since 1980, most population growth has been concentrated in the world's poorest counties, making it difficult to lift large numbers of people out of poverty (Figure 3). Sub-Saharan Africa's population has more than doubled over the last 30 years, rising from 390 million in 1980 to 883 million today. Europe's population grew more slowly, from 693 million in 1980 to 740 million in 2011 (*Carl Haub, 2013*).

¹⁰ South-South cooperation is a broad framework for collaboration among countries of the South in the political, economic, social, cultural, environmental and technical domains. Involving two or more developing countries, it can take place on a bilateral, regional, sub regional or interregional basis.

Figure 3 - Age structure and labor force in both developed and developing countries



Source: United Nations Population Division, The 2010 Revision medium variant

As shown in Figure 3 above, young people are in big numbers than older people. For instance, Sub-Saharan Africa has the world's highest share of youth in the working age population. Still, the region's youth employment problem should be seen in qualitative rather than quantitative. This is especially true in developing countries and for the most vulnerable groups: young women, youth in rural areas, and youth from poor families, and those with no or little education. Private sector employment creation has been weak, due to low growth-elasticity of employment, especially in resource-rich countries. According to business owners, electricity and finance are the biggest obstacles to growth. There is an urgent need for pro-employment economic and social policies stimulating and building on structural change (*ILO, 2013*)

4.5.2 Cultural environment

As just noted, there is a recognition that, in practice, developing countries have often adopted a significantly techno-centric approach, yet that development "cannot succeed by focusing exclusively on technology" (*Davison et al., 2005:66*). Most of citizens of developing countries still have the habit of larger families. To understand the way the members of a project work together, it is necessary to look further than the coordination rules and procedures that are stated in Chapter 3. The way a project team will define a problem, develop possible solutions and implement a new method of working is conditioned by the cultural environment of the project.

Many developing countries still have oral-based cultures. This has a big effect on the communication patterns of a society and thereby on the use and reach of information technology. In such countries, communication patterns follow an oral flow in which radio is often more popular than newspapers and or online news services.

Finally, although IT has been a mixed blessing in different African countries, overall there have been many negative consequences. Scarce foreign currency has been spent on equipment which is not used. Dependency on multinational corporations and expatriate personnel has increased, and sociocultural conflicts have been introduced. Moreover, what Africa has experienced for the most part so far is not IT transfer but transplantation, the dumping of boxes without the necessary know-how. Donor agencies, in particular, have a reputation for doing this (*Mayuri Odedra-Straub, 2009*).

4.6 Political and legal environment

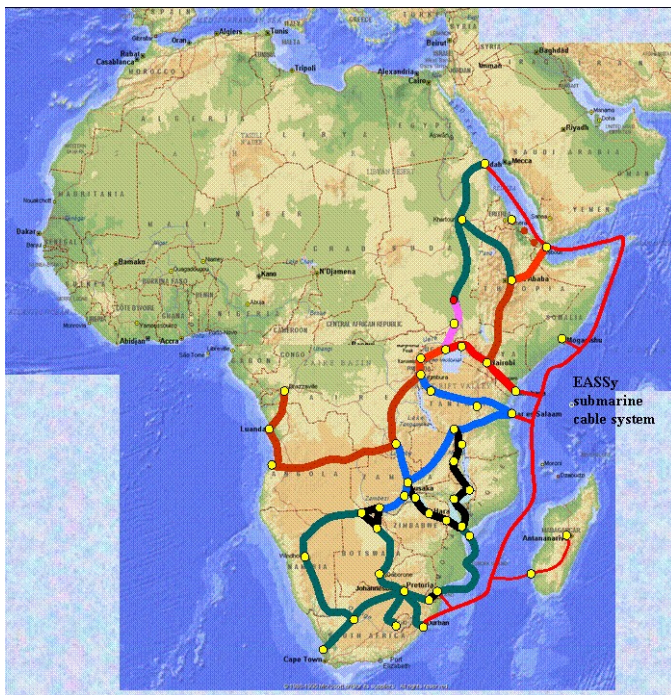
The political environment in developing countries is often disturbed by political instabilities and non-ending inter-cultural conflicts, which sometimes play a major role in the fast implementation of some projects of mass benefit.

4.6.1 Strategies of sustainable development

Demand is also driven by government ICT strategies. Many countries are moving processes such as benefit payments, tax filing and passport applications online; efforts are gearing up to digitize education, health and public services. Big and promising ICT infrastructures are being planned across the African continent; for instance, projects such as Maroc Telecom's USD 1.2 billion investments to upgrade its network and install fiber optics across Morocco. Undersea cable systems are already expanded and high speed 4G networks are being planned. Morocco, Nigeria and Kenya are implementing plans to provide most of their populations with high speed Internet access.

Large businesses and institutions are beginning to exploit the Internet to reduce costs and increase sales. Airline industry is embracing online check-in and e-ticketing, for instance, while banks are prompting online services and developing mobile microfinance products.

Figure 4 - Deployment of an EASSy broadband in southern and eastern Africa



Source: ITU, 2013

4.6.2 Legislative measures linked to technology and data protection

This domain is still a little bit behind, with the defenders of civil and intellectual property rights becoming ever more demanding in terms of legal proceedings and of penalties to be imposed on those engaged in the illegal use of data worldwide, African countries that do not yet have the regulations governing data protection will be unable to access the opportunities offered by technology (ITU, 2014).

Governments of developing countries often find it difficult to justify devoting resources to strengthening the intellectual property system, which they may see as benefiting primarily foreign interests. Copyright piracy and trademark counterfeiting are allowed to proliferate on the theory that they are minor offenses against wealthy multinational concerns that can easily afford the loss. These acts may even be defended as necessary in view of the limited resources of consumers in developing countries. Such an approach overlooks important consequences for consumers and the economy (Nathan et al.: *The TCB Project*, 2013).

4.6.3 Weak institutions versus effective use of ICTs

Researches have shown that ICTs cannot be developed without strong institutions that overtly facilitate private investment (*Maximo Torero and Joachim von Braun, 2006*). Many of the national telecommunications monopolies in developing countries were privatized in the 1980s and 1990s, introducing them to competition. This stimulus, combined with ongoing technological change, provoked the constant development of new services in some developing countries, especially the exponential increase of cellular telephone penetration in poor countries. This increase has not occurred in all countries, in some, the stimulus is taking effect slowly, erratically, and with uncertainty. For example in countries like Argentina, Chile, Mozambique, Peru, Senegal and Uganda, the government is facilitating rapid ICT progress with the help of non-governmental organizations and the private sector. On another hand, in countries such as Cameroon, Ethiopia, North Korea and Zimbabwe governments stand in the way of reform.

The lesson for reducing unequal access seems clear because governments need to differentiate market efficiency gaps from the true access gaps (effectively, missing markets) and then respond with the appropriate set of interventions for each case. With market efficiency gap, a difference exists between what markets are achieving under current conditions and what they could achieve if the functioned well.

To correct this, governments should focus on establishing market oriented policies and regulations that create a level playing field for the private sector and new entrants. The only issue relate to how far the market can reach commercially and how best to implement more competitive conditions and in what order. Strong, autonomous, and capable regulatory agencies are needed to assure market competition and freedom of business choice, provide attractive licenses designed to encourage growth.

4.7 Trends in economic growth with focus on Sub-Saharan Africa

According to Sachs (1992), the gap between the North and the South is growing in spite of the promise of the development discourse. As such stipulating high mass consumption as the end point for all development presents a concern for countries which wish to avoid the social environmental problems caused by over consumption. Fangjun (2009) asserts that the division of tradition and modernity by modernization theorists such as Rostow was over simplified. It was criticized as being too generalized as modernization of the west was made the criterion for modernization worldwide, thus leaving the transformation of many more countries unexplained. This argument corresponds with Rostow's concept of the universality of the process of modernization which has been criticized for its concept and notion of a single, fixed end-stage of development and ethnocentrism (*Peet, 1991*).

Peet also argues that the development history of Euro-America is generalized into a sequence of stage economic growth which all societies must follow. It is highly unlikely for all Third World countries to repeat the same stages because a global structure has been created by capitalism including a center of power which is in some ways unfavorable to the undeveloped world. Peet (1991) further criticizes modernization theory by arguing that values, institutions or technologies developed in one society often do not fit other cultures and may actually be dysfunctional for development.

It would be better for developing countries to modify or recreate their own institutions rather than imitate the west. It is no wonder that African countries report high levels of growth and GDP per capita and yet possess the inability to tackle problems such as women empowerment and quality education. Growth in GDP which is supposed to be the centerpiece of development has limited impact on the economic and social development of African countries as depicted in Table 2.

Table 2 - Sub-Saharan countries real GDP growth (percentage changes)

	2004-08	2009	2010	2011	2012	2013
Sub-Saharan (Total)	6.5	2.8	5.3	5.1	5.4	5.3
Of which:						
Oil-exporting countries	8.6	5.2	6.6	6.0	7.1	6.1
Middle-income countries	5.0	-0.8	3.7	4.3	3.4	4.0
Of which: South Africa	4.9	-1.5	2.9	3.1	2.7	3.4
Low income countries	7.3	5.5	6.3	5.8	5.9	5.9
Memo item						
World economic growth	4.6	-0.6	5.3	3.9	3.5	4.1

Source: IMF, (2012) World Economic Indicators database

Despite a slow world recovery and given the difference in performance among country groups, Sub-Saharan Africa has experienced strong growth (*IMF, 2012*). In the last decade and particularly in 2011, most of the countries of this region (most especially oil exporters and low income countries) performed better than the rest of the world in terms of growth. However, sub regional problems that may undermine progress exist such as drought in the Sahel, lingering inflation in Eastern Africa, Ebola in western Africa.

4.8 SWOT analysis of ICT in developing countries

The SWOT analysis involves examining the Strengths, Weaknesses, Opportunities and Threats of the entire environment with regard to use and produce ICTs as tool to transform economy. Strengths and weaknesses are internal to setting, while opportunities and threats are external to it.

a. Strengths

A combination of national commitment and license obligations imposed by governments is driving an accelerated rollout of telecommunications infrastructure. This is complemented by a competent (though far too small) existing skills base, and the enthusiasm and desire amongst the youth of the developing countries to acquire ICT knowledge. Tight bonds and economical movements between neighboring nations is a good channel to connect slowly but powerful the while block in a short time and less investment.

b. Weaknesses

Large areas of some countries still have minimal ICT infrastructure, and even with the falling cost of infrastructure many people cannot afford to participate in the information society. Some monopoly telecom companies prevents competitors from speeding up service delivery. Many of developing countries don't have static national strategy which provokes a proliferation of uncoordinated projects. Illiteracy in these countries as well and educational base is a major fact, and this has a direct effect in the production of scientists, engineers and ICT workers. The result is an extreme skills shortage in ICT sector, followed by the brain drain to foreign countries.

Governments suffer from many problems which manifest themselves into poor service delivery, and this also extends to public service ICT roll-out. Historical baggage in many forms (management, bureaucracy, policy) hampers the rapid establishment of information – based businesses. The local ICT market is small and has to operate without economies of scale. Inadequate incentives for international investors, lack of local skills and crime limit the finances available for ICT ventures, which results in less local development and poorer local economies of scale.

c. Opportunities

Despite some weaknesses discussed above, there are also correspondent opportunities on another hand in the developing economies. Basically, the market is still young and you can almost start anything without big competitors.

According to the African Bank Report, there are numerous opportunities for entrepreneurs and investors to launch their business in. Africa has experienced rapid growth in the ICT sector and with over half a billion mobile subscribers, the continent is set to become a choice destination for telecom investors (*NEPAD, 2010*). The following section highlights the main ones:

Infrastructure: the infrastructure has improved over the past 5 years with new roads, power plants and communication networks projects being planned and rolled out across the continent. On Omo River in Ethiopia, there is an ongoing hydropower plant which will generate 1870 Megawatt and thus be the biggest in Africa.

Mobile: global mobile companies that have taken the bold step of investing in the African mobile industry are reaping a high return on investment (ROI). A typical example is Bharti Airtel, a company that is currently investing over 1 billion USD in its mobile operators in Africa. Bharti declared a profit of 13 billion USD in Africa for 2010/11 financial year.

Mobile Money: Africa's mobile transactions are spearheading the future of banking on the continent. Safaricom Kenya's M-Pesa is currently dominating the East African mobile landscape. According to Comviva's VP Mayank Sharma, mobile money is Africa's fastest growing Value Added Service (VAS). In the next 5 years the service will spread to the rest of Africa and therefore changing the entire banking culture.

Mobile Internet: Africa has experienced a massive boom in mobile phone access with more than 500 million active mobile phones across the continent. Africa's mobile internet uptake continues to grow at an alarming rate, with Uganda, for example, having grown by about 15% in less than 2 years. Africa's vast mobile population is creating a new investment opportunity for mobile operators, content providers, smart card companies and mobile phone manufacturers.

e-Government: it has arrived in Africa and great progress has been made to fully implement projects such as "sms gov" services and setting up information kiosks at various community centers. In South Africa, some local municipalities are investing and rolling out their own broadband services in order to build countrywide digital cities. In Kenya, the government has launched an *open data portal*¹¹ to provide citizens with access to Government data online.

Broadband: there has been a significant improvement in Africa's broadband investments with high capacity projects being rolled out across the continent. These include the EASSy submarine cable with a capacity of 3.84 Terabit per second, that links South Africa to Eastern countries, MAINONE cable that links Portugal to South Africa, SAT-3 with a capacity of 120Gbits/s that links Spain to West African countries and South Africa, SAFE cable that links South Africa to Asia, and SEACOM an African cable system that connects South and East Africa countries.

e-Agriculture: the use of mobile technology in African commercial farming is gaining momentum. Mobile phones are currently being used by farmers in various African countries to determine daily

¹¹ Launched in 2011, the Kenyan Open Data initiative is a platform which makes key government data freely available to the public.

prices in local markets. e-Agriculture has fast revolutionized communication between subsistence and commercial farmers.

e-Healthcare: African scientists and health professionals are using the latest technology to diagnose some of the continent's most deadly diseases. For example Cellscope¹² has been introduced into use in Malawi to diagnose malaria, and there is a demand for collaborative technologies that provide rural doctors with access to international experts during medical procedures in real time.

d. Threats

To broaden this study, investors must as well know what is waiting for them so that they can plan their activities according to major issues that they might encounter, among others, these are:

- The use of computers, access to Internet and other tools of ICT are limited greatly to the urban areas, and the challenges faced by the ICT sector in the country include particularly the fact that the people in the rural areas are yet to know how to use computers, noting that the people in rural areas are keyboard-shy (*ITU Report, 2013*).
- According to the ITU's report "*2013 African ICT week*", other challenges that developing countries face, are that the cost of broadband prices are still high compared to the general income of citizens. The aim is to reduce its cost gradually and put broadband ICT means & services within every citizen's reach and this will transform the economic situation in the long run.
- There are almost no African ICT statistics centers in Africa, thus the reliability of numbers is not high because it takes a lot of effort to collect data from Africa and analyze it in remote locations.
- Lastly, illiteracy is as well a major concern that developing communities face, most people simply are not able to use electronic devices since they cannot read neither write.

¹² Cellscope is a microscope attachment for cellular phones which is designed to allow field workers to take images of specimens and send them to an expert for diagnosis.

4.9 Summary

Even though most of developing countries are undergoing significant changes in these last decades trying to tackle down main problems, everyone can witness a remarkable involvement in the ICT sector. As shown in previous paragraphs, there are many reasons why households in developing countries are not yet connected to the internet, primarily related to the affordability and availability of internet services. With more than 70% of the population in developing countries living in rural areas, the infrastructure challenge to connect all of these people to high-speed internet is enormous. Though, with the continuous increase in wireless-broadband deployment and services, coupled with falling prices, however, internet access in households in developing regions is expected to improve over the next few years (*Measuring the Information society, 2013*).

5. Potential of ICT Sector and Economy in Rwanda

Rwanda, is a landlocked country in the Central-East Africa, with 26,338km² of surface, on which live 11,776,620 inhabitants (NISR, 2014). Rwanda is the world's 149th-largest country. It is almost one third of the size of the Czech Republic. Rwanda has a temperate tropical highland climate, with lower temperatures that are typical for equatorial countries because of its high elevation. Kigali the capital city is in the center of the country, it has a typical daily temperature range between 12 °C (54 °F) and 27 °C (81 °F), with little variation through the year. Rwanda borders by the Democratic Republic of Congo, Uganda, Tanzania and Burundi. These last 3 countries together with Kenya make an economic community called the East African Community which influences economy and security in the region. Steep mountains and deep valleys cover most of the country. It has in the north a volcanic region whereby Kalisimbi is the highest (4,324metres).

Figure 5 - Rwanda administrative map



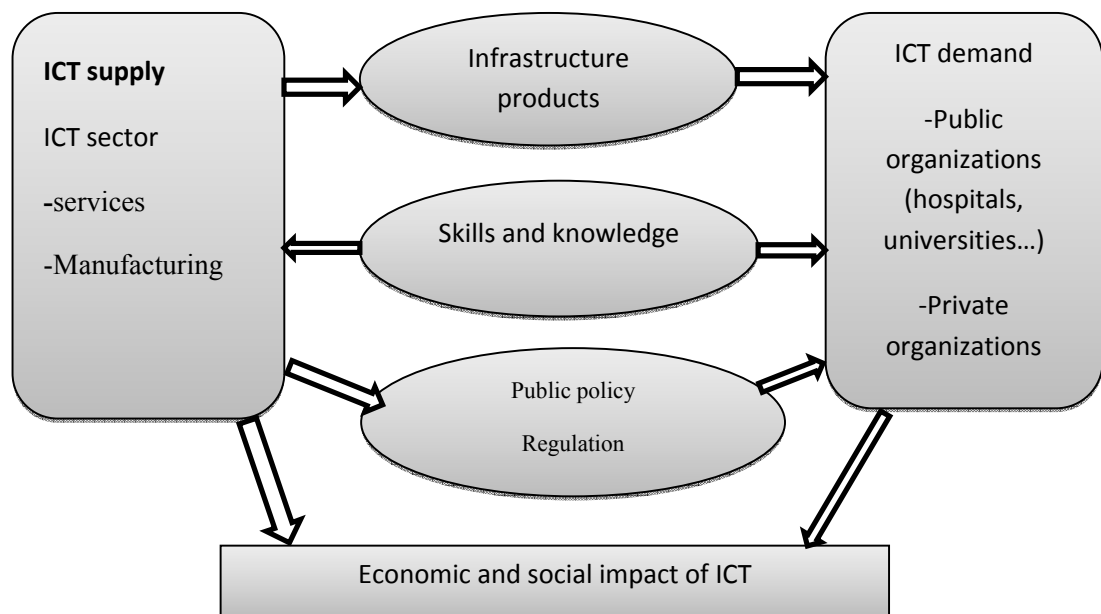
Source: Nations Online project

5.1 Impact of ICT on economy and development

In the late 1980s, the OECD started a work on defining performance indicators for the ICT industry, with the aim of enabling international comparison and informing policy. The report *Performance Indicators for Public Telecommunications operators (OECD, 1990)* summarized the initial set of indicators used by the OECD to compare the development of telecommunication services in member countries. The report also included a summary of the initial OECD methodology for comparing telecommunication tariffs. This methodology formed the basis of analyzing the telecommunication sector in the biennial *Communications Outlook (OECD, 1991)*.

Often, ICT in developing countries is not used as a standalone component; it is rather associated to its applications on how it can contribute to development, which makes it become ICT for development (ICT4D). For instance in Rwanda, the year 2013 was characterized by several achievements in five key priority sectors: Governance, Health, Education, Agriculture and Finance/Business sectors.

Figure 6 - Economic and social impact of ICT



Source: *Manual measure the use of ICT, 2014*

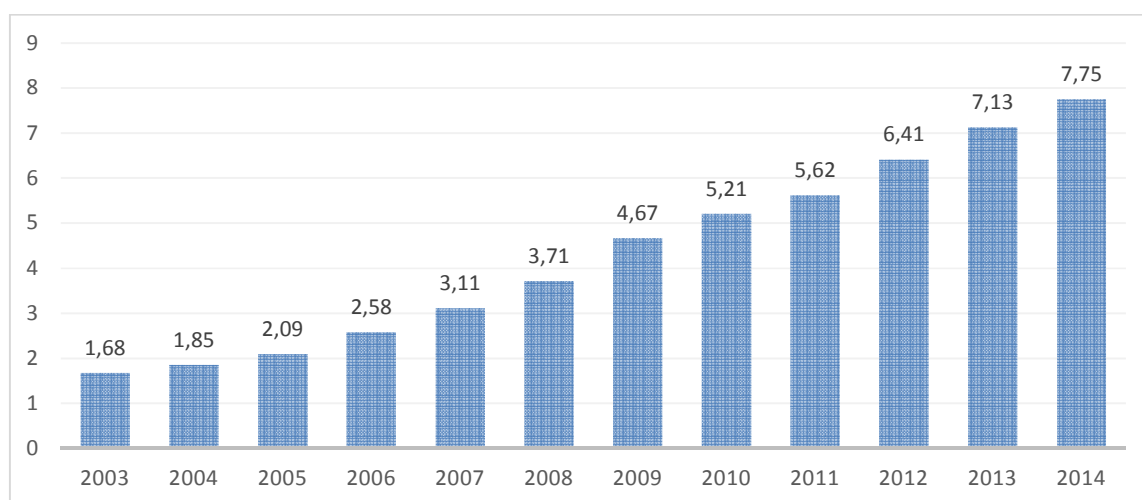
5.2 Economic indicators in Rwanda

Rwanda is a low income country, GNI per capita (USD): 560, GDP (PPP): USD16.937 billion (Total), USD1592 (Per Capita), GNP (Nominal): USD7.769 billion (Total), USD730 (Per Capita), HDI: 0.434, Currency: Rwandan Franc (RWF), Exchange Rates: 1USD = 683.9 RWF, 1 EUR= 857.3RWF (Prices are for “Buying” November 2014, Rwanda Central Bank). The national budget for the fiscal year 2015/2016 was evaluated to USD 2.9 billion, rising from USD 2.7 billion the previous year (*MINECOFIN, 2014*).

a. GDP

The gross domestic product (GDP) is a measure of national income and output for a given country’s economy. The GDP is equal to the total expenditures for all final goods and services produced within a country in a stipulated period of time. GDP in Rwanda was worth 7.13 billion US dollars in 2013. The GDP value of Rwanda represents 0.01% of the world economy. It averaged 1.79 USD billion from 1960 until 2013, reaching an all-time high of 7.45 USD billion in 2014 and a record low of 0.12 USD billion in 1961 (*NISR, 2014*).

Figure 7 - Rwanda’s progressive GDP growth



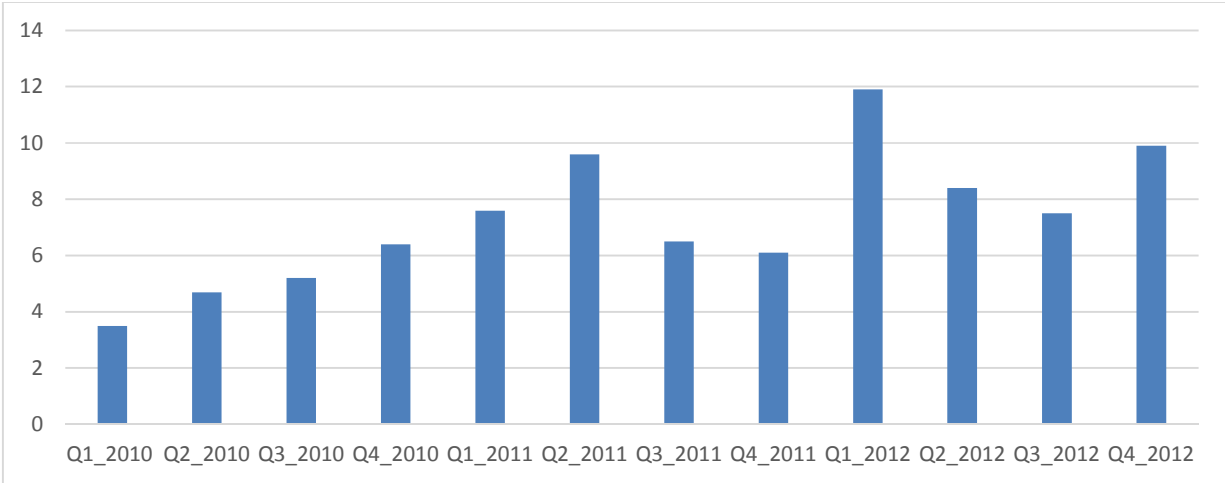
Source: www.tradingeconomics.com | World Bank

In the fiscal year 2013-2014, the service sector contributed 47% of the GDP compared to 33% by the agriculture sector. The industry sector contributed 15% and 5% attributed to adjustment as tax less subsidies on products. In the fiscal year 2013-14, the private final consumption expenditure was 76% of the GDP while the government final consumption expenditure was 15%. The level of investment (gross capital formation) is estimated at 25% of reflecting high levels of construction output (NISR, 2014).

GDP sometimes called Real GDP is the market value of all goods and services produced in a country during a specific time period. Real GDP measures a society’s wealth by indicating how fast profits may grow and the expected return on capital. It is labeled “real” because each year’s data is adjusted to account for changes in year-to-year prices.

In Rwanda, the National Institute of Statistics (NISR) has shown that 90% of total population lives on agriculture, which makes it more profitable though the land is not big enough but extremely productive when cared for. Radical reforms which have made it easier for businesses to get credit, pay taxes, starting a business have boosted the country’s rating in the World Bank’s Doing Business Report. This makes Rwanda among countries with most improved economy since 2005(World Bank Doing Report, 2014), it came 32nd out of 189 countries.

Figure 8 - Rwanda’s progressive GDP/capita growth by quarters



Source: Rwanda National Institute of statistics, 2013

$$\text{GDP} = \text{AE (AD)} = \text{C} + \text{I} + \text{G} + \text{NX}$$

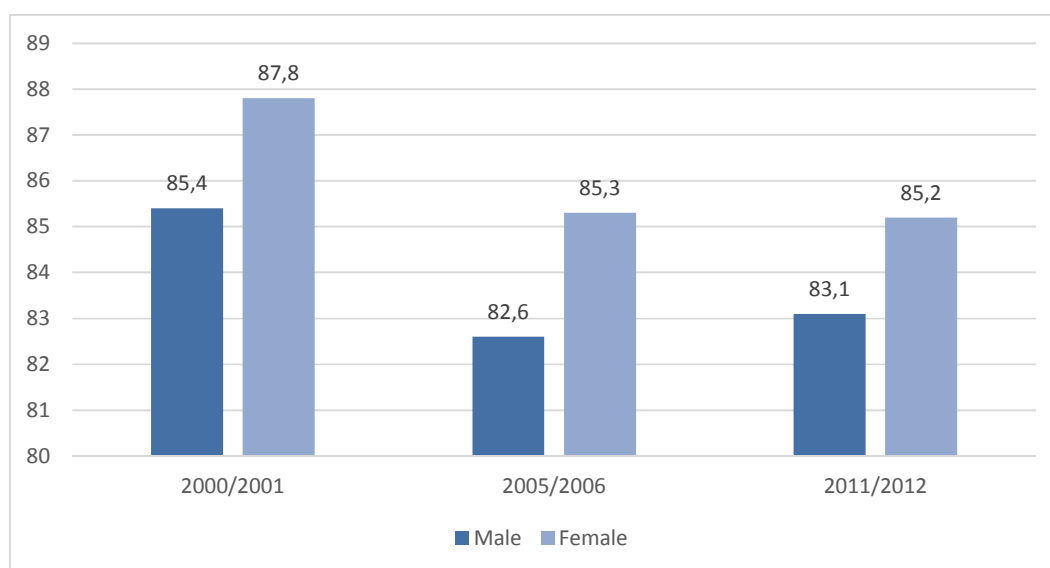
Formula 1: Calculation of GDP, source Macroeconomics II, Professor Hajek, UHK

Where AE represents aggregate demand, C is personal consumption expenditure, I represents investments, G is government expenditure; and lastly NX is the net exports (exports minus imports).

b. Employment

Rwanda has always recorded a high female employment rate over the past ten years than in men category. Even though the difference is not so big, women are still have a bigger employment rate since 2000. This was 85.2% for females against 83.2% for males in 2012. The situation was the same in 200, where employment rate was 87.8% for female and 85.4% for male.

Figure 9 - Evolution of employment rate for females and males groups



Source: *National Institute of Statistics of Rwanda, 2013*

The National Employment Policy (NEP) was adopted in 2007 and, subsequently, a five-year action plan (2007-2011) was developed for youth employment promotion in Rwanda, where “youth” refers to the 16-35 age cohort, with age 16 being the minimum working age, unlike other international definitions that define the youth cohort as the 15-24 year age group. The NEP reports

that at least 70% of job seekers are not qualified for the kinds of jobs they seek or standards demanded by employers. Data from the national Higher Education Council reveal that the majority of 2010 university graduates (12,717) are in natural sciences (29%) and humanities and arts (26%). The national skills audit conducted in 2009 reports an average 40% skills deficit and severe skills gaps in some categories such as technicians, with current demand exceeding supply by 60% across the public, private and not-for-profit sectors. Thus a reform of the education system to develop human resources that are consistent the country's labor-market requirements remains a key priority (*African Economic Outlook, 2012*).

c. Consumption and Investments

Rwanda is a unique case among its Sub-Saharan African peers in that it has already undergone a large scaling-up of public investment. The Rwandan government has made clear its desire to lower its reliance on foreign aid while still maintaining high public investment levels (*Will Clark & Birgir Arnason, 2014*).

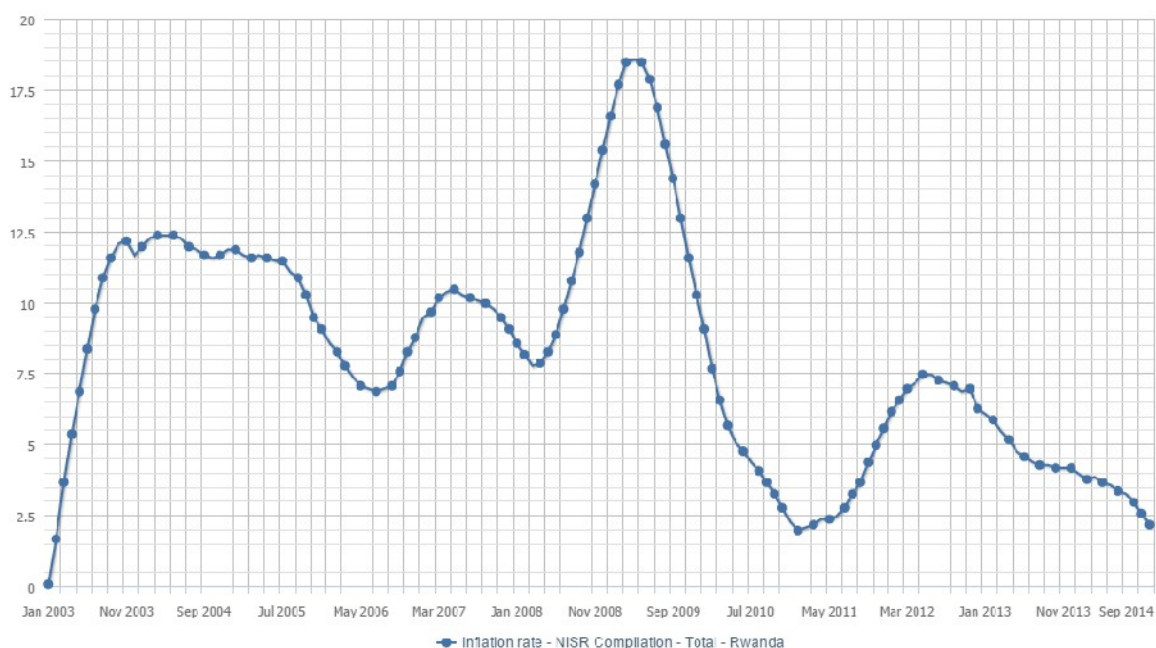
The *2012 Doing Business Report* indicates that there is still a room for improvement in terms of protection and enforcement of contract rights. For instance, Rwanda's ranking on registering property deteriorated markedly from 41 out of 183 countries surveyed in 2010 to 61 out of 183 in 2011.

Rwanda's 2010 Investor Perception Survey, which rates investor perceptions on core issues that impede or facilitate improvements in investment climate, showed an increase in composite Investor Perception Index from 60.17 in 2009 to 71.04 in 2010. The legal framework sub-index improved from 64.47 to 69.37 during this period while governance sub-index improved from 76.85 to 85.47 thanks to improved investor confidence in the political and legal systems (*Doing Business, 2015*).

d. Currency indicators and foreign trade

The value of a currency influences the way of lives in a given country and thus play a major role on international trade. For a period of over 10 years, there have been variations on the value of the currency reaching a highest value of 17.5 in November 2008. As shown in the Figure 10 hereafter, the current inflation is evaluated at 2.5.

Figure 10 - Evolution of Inflation from the period of January 2003 to September 2014



Source: www.statistics.gov.rw

For others indicators, the interests rates are 7.331 and 17.110 for deposit and lending respectively, whereas interbank money market is 5.709, weighted average on T-bills¹³ is evaluated at 5.319 (*Rwanda National Bank, 2014*).

e. Internal and external trade

Foreign trade plays as well major role in the overall country's economic growth. Total exports grew by 29% to USD 672 million in fiscal year 2012/13. Rwanda's traditional exports of minerals, coffee and tea accounted for 48% of the total, down from 56% in fiscal year 2011/12 and indicating a more diverse set of exports driven by the agro-processing sector (*Ministry of commerce, 2014*).

Informal exports made up 18% of all revenues. Almost half of exports went to the region, with exports to DR Congo reaching USD 150 million (Including informal). The number of exporters

¹³ T-Bill or Treasury bill is a short term debt obligation backed by the US government with a maturity of less than one year. T-bills are sold in denominations of USD 1.000 up to a maximum purchase of USD 5 million and commonly have maturities of one month, three months or six months.

increased from 851 in 2011 to 1.294 in 2012/13, although the 13 largest exporters (exporting more than USD 10 million) account for 49% of all exports (*Rwanda Revenue Authority Database, 2013*).

On another hand, internal trade, firms responding to the Rwanda Industrial Survey 2012 (RIS 2012) indicated that the supply of domestic inputs has improved in all sectors. Imports account for 27% of all inputs on average, with manufacturing sectors relying more heavily on no-Rwandan suppliers than other sectors (*Minicom, 2014*).

f. National debt

The amount of debt that a country has in different banks shows its future in terms of self-sustenance. Referring to Table 3, the debt has risen since 2003 in global terms, when it was 1.859 million dollars although it has fallen at a percentage of GDP, when it amounted to 100.62%.

The position of Rwanda, as compared with the rest of the world, has worsened in 2013 in terms of GDP percentage. Currently it is country number 47 on the list of debt to GDP and 14 in debt per capita out of 179 (*Rwanda National Bank, 2014*).

Table 3 - Rwanda Debt evolution

	Millions USD	% GDP	USD/Capita			Millions USD	%GDP	USD/Capita
2013	2.184	28.74	182		2006	826	26.58	88
2012	1711	23.48	149		2005	1828	70.67	199
2011	1521	23.72	139		2004	1907	90.81	212
2010	1296	23.06	122		2003	1859	100.62	210
2009	1203	23.05	116		2002	1809	107.90	208
2008	1002	21.44	100		2001	1653	98.65	195
2007	1008	27.19	104		2000	1761	102.51	218

Source : <http://countryeconomy.com/national-debt/rwanda>

As shown in the table above, the debt has significantly been reduced from 70.67% to 26.58% in year 2005 to 2006, because of the international debt wave, whereby most of developing countries benefited from debt forgiveness.

Economic growth in Rwanda has experienced a significant transformation which translated into alleviating poverty and improving the lives of all Rwandans. The real GDP growth increased from 2.2% in 2003 to 7.2% in 2010 with the peak growth of 11.5% in 2008. Overall, the average growth rate has been 7%. This was achieved through the long-term economic development plan, Vision 2020, and its medium-term strategy, the Economic Development Poverty Reduction Strategy (EDPRS) which gives a clear direction on how to move from poverty to a middle income country. From Vision2020¹⁴, a number of programs and policies have been formulated and implemented in several key sectors, such as agriculture, investment, tourism and ICT.

g. Money supply

Money supply represents the aggregate total of all money that a country has in circulation. It takes into account all physical currency such as bills and coins; demand deposit savings and checking accounts; traveler's checks; assets in retail money market accounts and small money market mutual funds.

Formula 2: calculation of aggregate M2

$M2 = \text{aggregate M1} + \text{Time deposits}$

Where M1 is currency held outside banks plus deposit money on demand (checking accounts).

h. Consumer Price Index (CPI)

The CPI measures changes in the prices paid for goods and services by urban consumers for the specified month. The CPI essentially a measure of individuals' cost of living changes and provides a gauge of the inflation rate related to purchasing those goods and services.

The CPI does not include income, social security taxes or investments in stocks, bonds or life insurance. But it does include all sales taxes associated with the purchases of those goods and services.

¹⁴ Vision2020 is a government development program in Rwanda launched in 2000. Its main objective is to transform the country into a knowledge-based middle-income country, thereby reducing poverty, health problems and making the nation united and democratic.

i. Producer price Index (PPI)

The PPI is a group of indexes that measures the changes in the selling price of goods and services received by a country's producers over a period of time. The PPI tracks price changes in virtually all goods-producing sectors, including agriculture, forestry, fishery, mining and manufacturing.

In Rwanda, PPI is published on a quarterly basis, but it highlights monthly PPI for each of the three months of the quarter under review, the quarterly PPI and the annual PPI. It presents price changes for all combined products, products for local sales and that for exports. It covers a sample of 114 establishments and 402 products spread countrywide, both in Kigali capital city and in rural areas.

Table 4 - Monthly, quarterly and annual changes for PPI for all Rwanda

	2013			2014			2013	2014
	Apr.	May	Jun.	Apr.	May	Jun.	Q2	Q2
All Rwanda index	108.85	108.39	108.20	109.74	107.78	107.31	108.48	108.28
Monthly/quarterly change (%)	-2.50	-0.42	-0.18	-1.47	-1.79	-0.43	-4.02	-1.93
Annual change (%)	-2.13	-2.68	-1.54	0.82	-0.56	-0.82	-2.12	-0.19

Source: NISR 2014

As the above Table 4 shows, on a monthly basis, in April 2014, the index decreased by 1.47% compared to March 2014. The index for May 2014 decreased by 1.79%, while the index for June 2014 decreased by 0.43%.

j. Current Employment Statistics (CES)

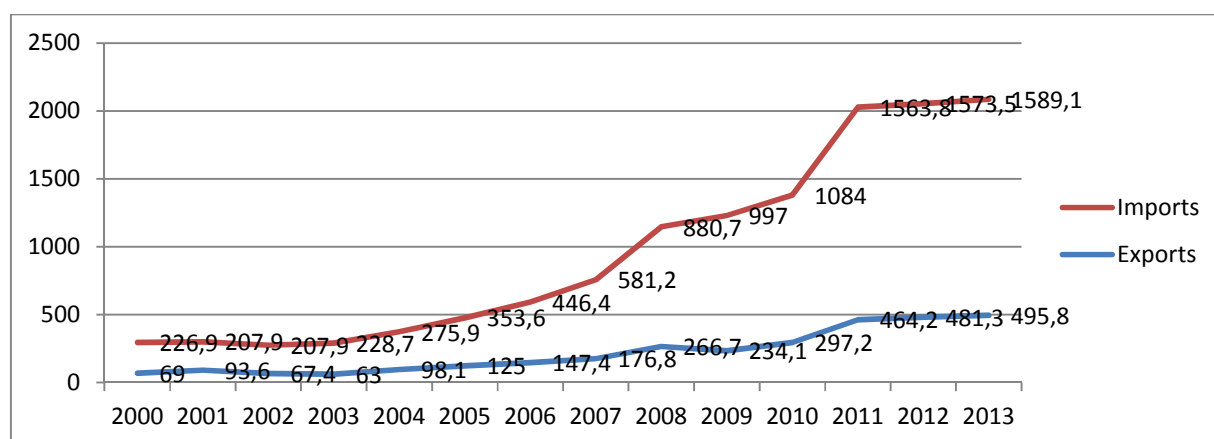
CES provides comprehensive data on national employment and wages and earnings data across all non-agriculture industries, including all civilian government works. The rate of unemployment therefore calculated as a percentage by dividing the number of unemployed individuals currently in the labor force. This rate in Rwanda continues to go high day after day. The rate of unemployment is evaluated at 15%, whereas you can also find a large number of people who works in a career that is totally different from their education. The basic net salary is 285 USD. Comparing to neighboring countries, the difference is not that big: Tanzania (290 USD), Uganda (285 USD), Burundi (205 USD), Kenya (330USD).

k. Imports/Exports (I/E)

The amount of goods that a country imports and which it exports shows its capacity to sustain itself, the more a country imports the weaker the national industries are. The more a country imports the weaker its economy is. When exports are higher than imports we assist to trade balance surplus, the opposite case generates trade balance deficit.

Rwanda's exports have increased significantly the past decade, reaching USD 495 million in 2013, led by the tourism, tea, coffee and mining sector. As stated earlier, imports have grown more rapidly, from USD 69 million in 2008 to USD1589 million in 2013. This unsustainable deficit needs to be addressed by increasing exports and reducing or substituting specific imports though competitive measures, not least because ODA and international transfers, which currently subsidize this deficit, are themselves being reduced (Figure 11).

Figure 11 - Imports/Exports balance in Rwanda in USD million



Source: Author according to National Institute of Statistics of Rwanda

Exports represent less than 10% of Rwanda's total GDP compared to an average of 32% for Sub-Saharan Africa and 47% in the EAC, with Kenya accounting for 47% of exports and Tanzania for 36% (Eyakuze, 2012). Exports are rising but growth is still less than 5% and only just above the average for Sub-Saharan Africa. Measured on a per capita basis, Rwandan export performance is even weaker – annual exports are just 18 USD, while the Sub-Saharan average is 145 USD. Closing this gap will depend on expanding production, based on niche products and services for specific needs of target markets (Malunda, 2012).

ICT contribution to GDP during the last two quarters of 2014 stood at 2.7%, ahead of agriculture and mining exports combined. In terms of foreign direct investments, the ICT sector has worked as a magnet, attracting 45% of the total in-flows which is more than the next 5 sectors, including trade, financial sector, mining and manufacturing (*Smart Rwanda Days Report, 2014*).

A recent study by ITU revealed that ICT contributes 3.7% in advanced economies whereas in Africa, ICT contribution to GDP is at a growing 1.1% on average. ICT is a central engine to driving Rwanda's transformation to a knowledge based economy, a fact Rwanda has acknowledged by allocating a budget to ICT. The amount of money that a country invest in a certain sector compared to others, gives it a tone on how much it cares about it.

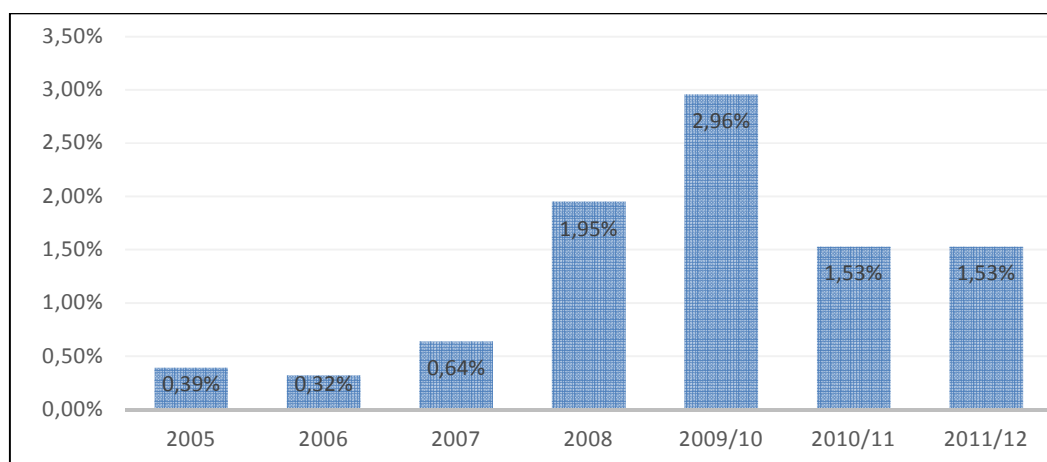
5.3 Technological environment

The ICT industry in Rwanda is a growing field since last 10 years. Policies which have been put in place give it a major target by the Rwandan government as a channel to drive other key sectors which are being implemented. The contribution of ICT to the overall country development is as well remarkable factor which must be taken into consideration. Despite a global economic recession resulting in an average global growth rate of 2.6%, Rwanda has managed to show the highest annual economic growth rate of 8.2% the last 3 years. This continuous growth has enabled in part by the government's aggressive investments in Information Communication Technology and the rapid expansion of the mobile telecommunication sector. Furthermore, being landlocked has made it imperative for Rwanda's continued development and investment in ICT (*NICI, 2010*).

5.4.1 R&D expenditures

Research and Development comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge (including knowledge of man, culture and society) and the use of this knowledge to advise new applications. R&D covers three activities: basic research, applied research, and experimental development. In 2005, Rwanda invested only 0.39 of its GDP in R&D which increased slightly in the following years until 2007. There has been a significant increase in in 2008 whereby it reached 1.95% and reached a biggest boom of all times in the financial year 2009, thus reaching 2.96%.

Figure 12 - Investment of GDP in research and development



Source: Author according to IPAR

5.4.2 Patents in Rwanda

The new law No. 31/2009 on the Protection of Intellectual property is now in full effect in Rwanda following its publication on 14th December 2009; moreover, the official fees have finally now been promulgated by way of Ministerial Order No 006/2010. Inter alia, the new law requires the payment of annuities on both new patent applications and existing applications, and similarly requires the payment of renewal fees on design applications/registrations. For patent cases, annuities are payable on the first of a month and each anniversary of the local filing date after 14 December 2009.

Everyone who wants, or specifically investors can get a patent, the requirements are to present their power of attorney, claims and abstract of the business. The grant is for 20 years and no fees are due for renewal. It is important to note that all documents must have a French translation as mandatory.

5.4.3 Rwanda ICT national strategy

According to the Ministry of youth and ICT, the national ICT strategy was redesigned into a special framework called “Smart Rwanda”. The national strategy, ICT sector strategic plan 2013-2018 requires a review and reorientation aligned to the new initiatives of SMART ICT as defined in the

Smart Rwanda conference held in June 2012. These efforts have as yielded a new national ICT strategy, the Smart Rwanda Master Plan (SRMP) replacing the ICT SSP. It is this SRMP that underpins the current national socio-economic development policies, strategy and provisions as well as ICT development, deployment and use in the country through a baseline study. The SRMP also identifies the progress made and the developmental challenges of the country and makes the case for accelerating the march towards a knowledge economy and society as a way of addressing these challenges.

The Smart Rwanda Master Plan includes:

- Expansion of the mandate of the national ICT steering committee;
- Establishment of a board that is representative of the key economic and social sectors and members from private sector;
- Relocation of the SRMP governance and management responsibility to Rwanda Information Society Agency(RISA) from Rwanda Development Board where it is currently managed;
- Re-assignment of the M&E function from RDB to MYICT;
- Centralized management of government ICT under RISA to a drive common standards, infrastructure and capabilities strategy.

5.4.4 The effect of digital divide

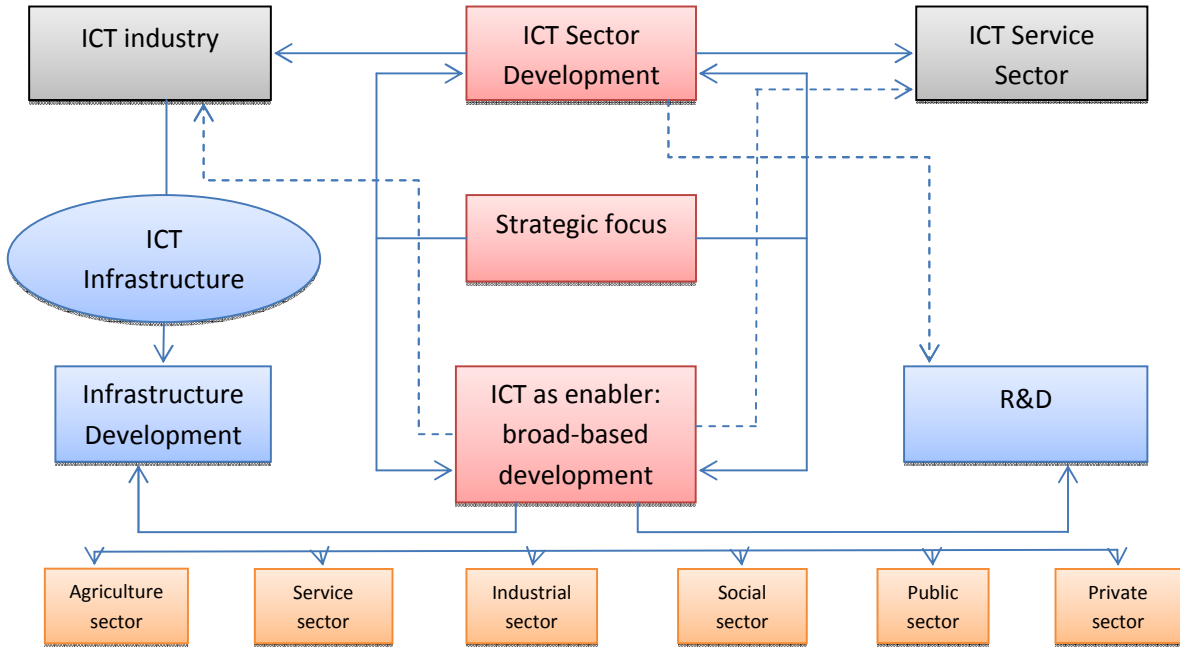
The differential between countries in access to and use of information and communication technologies (ICTs) - the digital divide- has long been a significant concern of governments and the international community (*Information Economic Report, 2013*). Over time, its nature has changed. The gap in access to basic telephone services, once very substantial, is now significantly diminished and expected to shrink in the next few years to come. In its place has come a gap in access to the internet and particularly, in access to broadband services. The digital divide in broadband capacity and quality leads in turn to a divide between countries and regions in the extent to which individuals, businesses, economies and societies are able to take advantage of new ICT innovations and applications.

Even though developing economies are still facing problems related to the quality on broadband services, they are also investing a lot in cloud technologies to make their services available to

everyone without a big effort. Those are: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and software as a Service (SaaS). One of the techniques that are in practice to lower the digital divide is the use of the above ways (IaaS, PaaS and SaaS). Though the speed is not so fast, there is a remarkable progressive improvement in the past 2 decades, whereby now ICT is contributing 2% of the GDP, the aim being 10% by 2025.

The government of Rwanda views ICTs as a major means of lifting the country out of poverty and has developed a National Information and Communication (NICI) plan. These rolling five-year plans began in 2001 and cover a twenty-year period in the nation’s Vision2020. The goal is to transform a mainly agricultural economy into a predominantly information-rich, knowledge-based economy (ITU, 2012). The recent plan has a dual focus: to build up an export-oriented ICT industry and to use ICTs to boost development across all sectors (Figure 13). The Rwandan Information Technology Authority (RITA) is a key agency for implementing NICI plan. It aims to promote pro-ICT development by pairing local ICT companies with international players.

Figure 13 - The dual focus of Rwanda’s ICT plan



Source: NICI plan 2010, Rwanda

5.4.5 Economic impacts of ICTs on economies

Information and communications technologies have turned into the key technology of the past decade. The rapid diffusion of the Internet, mobile telephony and of broadband networks all demonstrates how pervasive this technology has become (*OECD, 2013*). The question remains: How precisely does ICT affect economic growth?

Capital deepening through investment in ICT is important for economic growth. It establishes the infrastructure for the use of ICT and provides productive equipment and software to businesses. ICT investment in OECD countries rose from less than 15% of total non-residential investment in the early 1980s, to between 15% and 30% in 2001. Since investment mechanically adds to the capital available to workers, it contributes to labor productivity growth in GDP and labor productivity over the 1995-2001.

The second important economic impact of ICT is linked to having sector producing ICT goods and services. Having such a sector is important to growth, ICT production has been characterized by rapid technological progress and very strong demand. The sector has therefore grown very fast, making a large contribution to economic growth, employment and exports.

5.4.6 ICT trends in Rwanda

Mobile Money: Telecommunication companies ease money transfers and have changed the way of doing business by creating a cashless environment, using mobile money payments. Most of common services such subscriptions and money transfers can be done automatically from everyone's gadgets without necessarily going to banks. Though the country has good internet, everyone is not able to buy a computer but they are able to have a cellphone, which can be as cheap as 15USD. This low price influences that everyone is connected to at least GSM. This last provides push and bulk messages with operators' servers and enable different users on the same network to transfer and receive money to each other.

Figure 14 - A mobile money outlet in Kigali/Rwanda



Source: www.mtn.co.rw

Internet: In just a few decades, internet is transforming the way we live, work, socialize and the way countries develop. The United Nations, in its Millennium Development Goals (MDGs) lists internet penetration as a key metric in efforts to reduce poverty and encourage rational development. According to the 2011 McKinsey report, more than 2 billion people now use internet in every country, in every sector, in most companies, and almost 8 trillion USD exchange hands each year through e-commerce and these numbers are still growing. Three e-commerce websites such as Amazon, iTunes, and Google Checkout have transformed the global business transactions.

Figure 15 - Rolling out a fiber optic cable in Rwanda



Source: internet

In 2010, 40 Broadband VSAT companies were operational in Rwanda. It is pretended that the use of VSAT will be drastically reduced due to increasingly affordable Internet resulting from the deployment of broadband through the national fiber optic backbone that been rolled out in the country (over 2,300 km). In 2010, internet penetration in Rwanda was 5.3% compared to the African average of 10.9%. From 2008 to 2010, Rwanda registered one of the highest internet user growth rates with 8900% compared to the continent growth rate of 2450% and the world average rate of 444%. In 2010, more than 38.9% of Rwanda's public sector (ministries, agencies, provinces and districts) and 34.5% of the private sector had web presence (*MYICT, 2013*).

Mobile applications: there is an increase in demand of mobile applications for all startup and already existing companies. Cause of a big movement of using mobile phones, investors also want reach clients from whatever possible devices preferably portable ones, that it is why the demand is going higher and higher.

Outsourcing: like so many countries which are trying to make a step forward, it is important to find skilled people who are able to imagine new project and initiatives which will help their respective companies. Reports have shown that most of university graduates don't find easily jobs after finishing their studies. Outsourcing of help-desk services, desktop management, data-center services, and on-the-spot support services are on the rise. It is creating new job opportunities in the IT industry, stimulating the need for progressive and innovative strategies to connect employees from continent to continent.

Nelson Hall, a global outsourcing research firm, estimates global demand for Business Processing Outsourcing (BPO) services at 250 USD billion annually and it is projected to 750 increase to USD billion by 2020. Demand for BPO services in Rwanda is estimated at 50 USD million, which will increase to almost 200 USD million by 2020 with regional market potential predicted to be 1900 USD million in 2020.

Information Security: Information security is increasingly becoming of critical importance given the need to secure critical information currently available online. This is a result of advanced and repeated cyber-attacks to government and private companies that are actually spending more on security technology, assessments, training, and certification. Rwanda is investing, and must

continue to do so, in IT and information security to ensure that Rwandan's information is not compromised.

Cloud Computing: There is a shift in the global service model in which service providers are leveraging cloud computing technologies to offer “everything-as-a-service”. This is a new and swiftly growing approach to service provision. Gartner, a leading cloud computing research firm estimates that the global market for cloud computing will reach USD148 Billion by 2014. Today, Rwanda has constructed a national data center that is fully capable of maximizing the potential in cloud computing, paving the way for increased services development.

Among others, companies like Korea Telecom (KT), Olleh Rwanda Services, Broadband Services Corporation are now ready to start offering cloud computing services with the recent launch of 4G LTE network in late October 2014.

Green ICT: A host of trends, including rising stakeholder awareness, increasing environmental regulations and rising energy costs stimulated many executives to “green” their companies. Through reduction in CO₂ emissions, the IT industry can save billions of dollars and gain more money in electric utilities rebates. Benefits and incentives are being offered to businesses in countries like the United States as reducing carbon emissions has become a pressing issue. Governments in countries like Canada and South Africa are refurbishing ICT equipment.

Figure 16 - A tele-center in a Rwandan rural area



Source: RITA Rwanda

Tele-centers: Tele-centers are small ICT centers in remote areas equipped with about 5-15 computers. Due to a lack of connection to electricity, they use solar panels and neighboring citizens can get cheap use of them since not everyone is able to buy their own for home use. They generally access them for checking news, sending emails or general information as free library or get free basic IT training for beginners.

Social Networks: social networks are used by different organs of the public and private sectors as a way to transmit cheaper and faster information. Citizens are no longer interested in long articles, but prefer regularly updated headlines. As a matter of fact, the recent 2015 Forbes researches, showed that the president of Rwanda, Paul Kagame (@PaulKagame), is the most followed president of Africa with around 900,000 followers on Twitter. Most ministers

5.4 Social and cultural environment

5.5.1 Health

The health sector, kept its leadership in the use of ICT for the delivery of health services across the country, using ICT. The percentage of health facilities connected to the internet reached 93.8%. This continued development brings health information systems and medical records systems closer to health facilities and continue to help them provide better timely reporting. Furthermore, the medical assistance call center supported better delivery of health services at the community level with more than 25000 calls for ambulances, received by December 2013(MoH, *Strategic Plans 2014*).

As a supplement to traditional patterns of health care delivery, telemedicine and e-diagnosis in all university teaching hospitals improved the way medical professionals share medical expertise. Numerous benefits resulted from usage of telemedicine and e-diagnosis, ranging from creation of a network of specialists; improving access by health care practitioners to specialists, to improving the quality of diagnostics and treatment (*MYICT, Rwanda ICT Profile 2013*).

5.5.2 Agriculture

The utilization of the flagship eSoko system (electronic Market in Kinyarwanda¹⁵) has been on the increase, continuing to empower more farmers with timely crops market price information. eSoko supported more than 11,000 farmers to make informed market pricing decisions. In November 2013, the Ministry of Agriculture in partnership with the Centre for Agriculture and Rural Cooperation (CTA) organized the ICT for Agriculture (ICT4Ag) conference, which brought over 500 delegates in Kigali the capital city of Rwanda, to discuss ways to promote the application of information and communication technology in the agriculture sector with particular emphasis on the value chain, advocacy and policy development (*MYICT, Rwanda ICT Profile 2013*).

In parallel, a hackathon was organized with IT developers challenged to create applications to address a specific agricultural issue. Several mobile applications were awarded at the end of the hackathon and are being promoted to other parts of the world facing the same challenges.

5.5.3 Education

In the education, the distribution of XO Laptops (a MIT project by Professor Negroponte¹⁶) reached 203,763 units, covering 407 schools in January 2014. Digital contents were also deployed in these schools, allowing primary school students to access courses in a digital format and then improving the quality of education and their learning experience. In Africa, Rwanda remains the country with the largest deployment of laptops under the One Laptop per Child initiative (OLPC).

In a bid to address the current demand of smart devices in education sector, the Government of Rwanda and Samsung completed and launched a pilot *Solar Powered Internet School (SPIS)*. This initiative, which is part of the larger goal of Rwanda of using ICT to enhance learning and teaching in the classroom will be expanded to the secondary education segment.

¹⁵ Kinyarwanda: it is a wide spoken language in Rwanda which derives from the Bantu group of languages

¹⁶ Nicholas Negroponte is a Greek-American architect, he is the founder and chairman of the Massachusetts Institute of Technology's Media Lab and the founder of the One Laptop per Child (OLPC).

5.5.4 Finance and business

This sector has perhaps the most remarkable development in terms of utilization of ICTs and value creation, which made it the choice of this of ICT sector profile. By December 2013, Rwanda had a total of 2,538,651 mobile payments subscribers. Compared to 2012 there was a net increase of 1,098,110 new subscribers in just a period of 12 months. As a direct effect, the volume of transactions increased more than doubled, reaching 57,147,777 transactions during last year alone (*NISR, 2013*).

This remarkable sustained growth was also seen in the utilization of Point of Sales (POS). Statistics show that the value of POS transactions grew exponentially during the year 2013, reaching close to 20.4 million Euros, while in 2012 the value was 9.6 million Euros. Data show that the consumers' behavior is changing with time, with people preferring to use payment instruments such as debit and credit cards in lieu of cash. This is the result of the collaboration between the Government of Rwanda, local banks and Visa Rwanda. They jointly stepped up their efforts to increase financial literacy, increase payment systems quality, reduce and prevent fraud and increase interoperability of the mobile financial services ecosystem that addresses the financial needs of all Rwandans.

The value transactions taking place using mobile payments also followed the same trends. By December 2013, more than 37.4 million Euros were transacted through Mobile Telecommunication Networks (Tigo, Airtel and MTN Rwanda). Using mobile payments, subscribers were able to purchase prepaid services such as phone credit, electricity and conduct other types of transactions.

5.5 Political and legal environment

5.6.1 Governance

ICT has contributed a lot in the way governance is conducted and monitored in most of successful developing countries, the way citizens get services from offices and how transparent they are. In 2014, the governance sector continued to be a large consumer of ICT for the service delivery to the citizens. One key highlights of the financial year 2013-2014 was the completion of the

videoconference network, currently deployed at all districts, provinces and ministries. This has dramatically reduced the number of trips of local leaders to other cities, which has translated into several gains such as reduction of fuel expenditures, time savings and more importantly additional time to serve better citizens. Another big project which will be implemented in the financial year 2014/2015 is the introduction of the *Rwanda Online* which will establish an integrated public service platform that will exclusively offer Government to Business (G2B) and Government to Citizen (G2C) services in the country. It will be accessible via PC and mobile devices (*MYICT, Rwanda ICT Profile 2013*).

5.6.2 Telecommunication

Last but not least, the Rwandan telecom sector has shown particularly a strong growth in recent years, buttressed by a vibrant economy and a GDP which has sustained growth of between 7% and 8% annually since 2008. As a result, the country is rapidly catching up with other markets in Africa, with increased penetration particularly evident in the internet and mobile sectors. Rwanda's internet and broadband sector has suffered from limited fixed-line infrastructure and high prices, but developments in the fixed network market are improving connectivity and reliability. The operators are rolling out national fiber-optic backbone networks which also allow them to connect to the international submarine fiber-optic cables that landed on the African east coast in 2009 and 2010. These cables have given the entire region fiber-based international bandwidth for the first time and brought to an end its dependency on satellites.

Interest from investors in the country's ICT sector remains strong, particularly during the last few years. An existing deal with Korea Telecom to build a national fiber backbone was supplemented in September 2013 with a deal by which Korea Telecom will built a national 4G LTE network, for which it has secured spectrum and an exclusive license to operate the network for 25 years.

Table 5 - Estimated market penetration rates in Rwanda's Telecom's

Market	Penetration Rate
Mobile	65%
Fixed	0.44%
Internet	25%

Source: RURA March, 2014)

5.6.3 Legal and regulatory updates

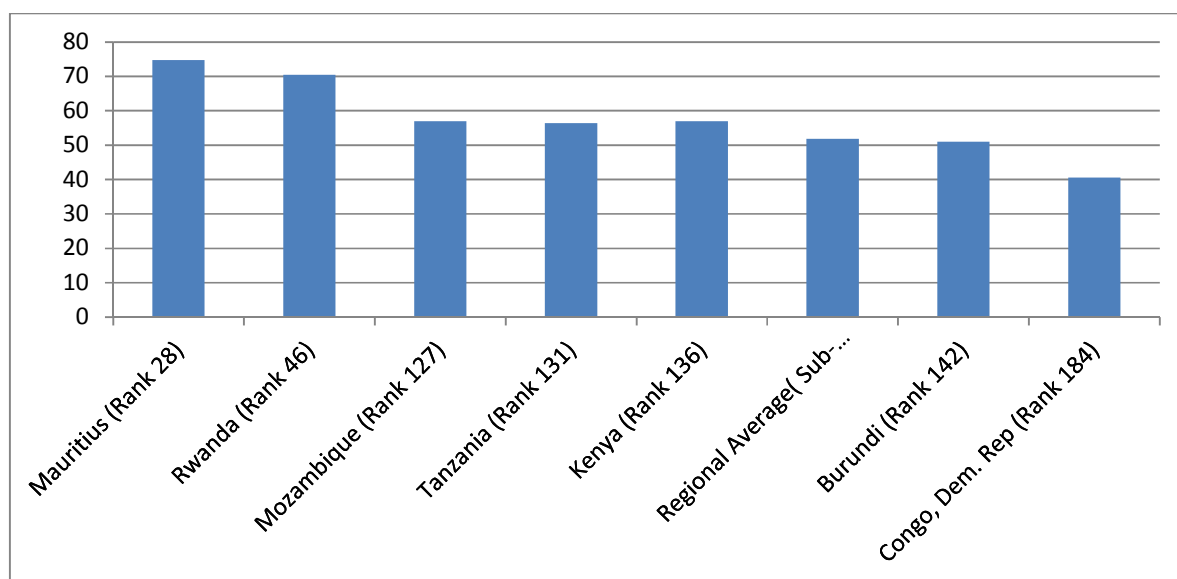
In October 2013, Rwanda hosted the TransformAfrica¹⁷ 2013 Summit, during which all participants committed to support the socio-economic transformation of Africa through smart implementation and application of ICTs and adopted the Smart Africa Manifesto, which embodies five principles and the implementation framework of Smart Africa. On the local policies development front, the cabinet's endorsement of the National Broadcasting of Rwanda Policy in 2011 paved the way from the migration of analogue to digital broadcasting across the country. The analogue system switched off completely on July 31, 2014. The Government of Rwanda also endorsed its' first National Broadband Policy and the approval of this policy has allowed the introduction of an infrastructure-sharing regime by way of wholesale only 4G LTE network services provisioning since September 2014 by the South Korean Telecom.

5.6 Competitive advantages of investing in Rwanda ICT sector compared to East African countries

Rwanda has an advantage to be invested in ICTs than other East African countries, because its facility to launch a business. In fact, it takes only 6 days to register a business and start to run it, thus everything being done via an online platform. In the Doing Business Report 2014, no other country in the neighboring countries came in front of Rwanda.

¹⁷ The TransformAfrica conference aimed to pool together international participants to set a new agenda for Africa to leapfrog development challenges through the use and uptake of Broadband and related services.

Figure 17 - Comparison on ease of doing business in some Sub-Saharan countries



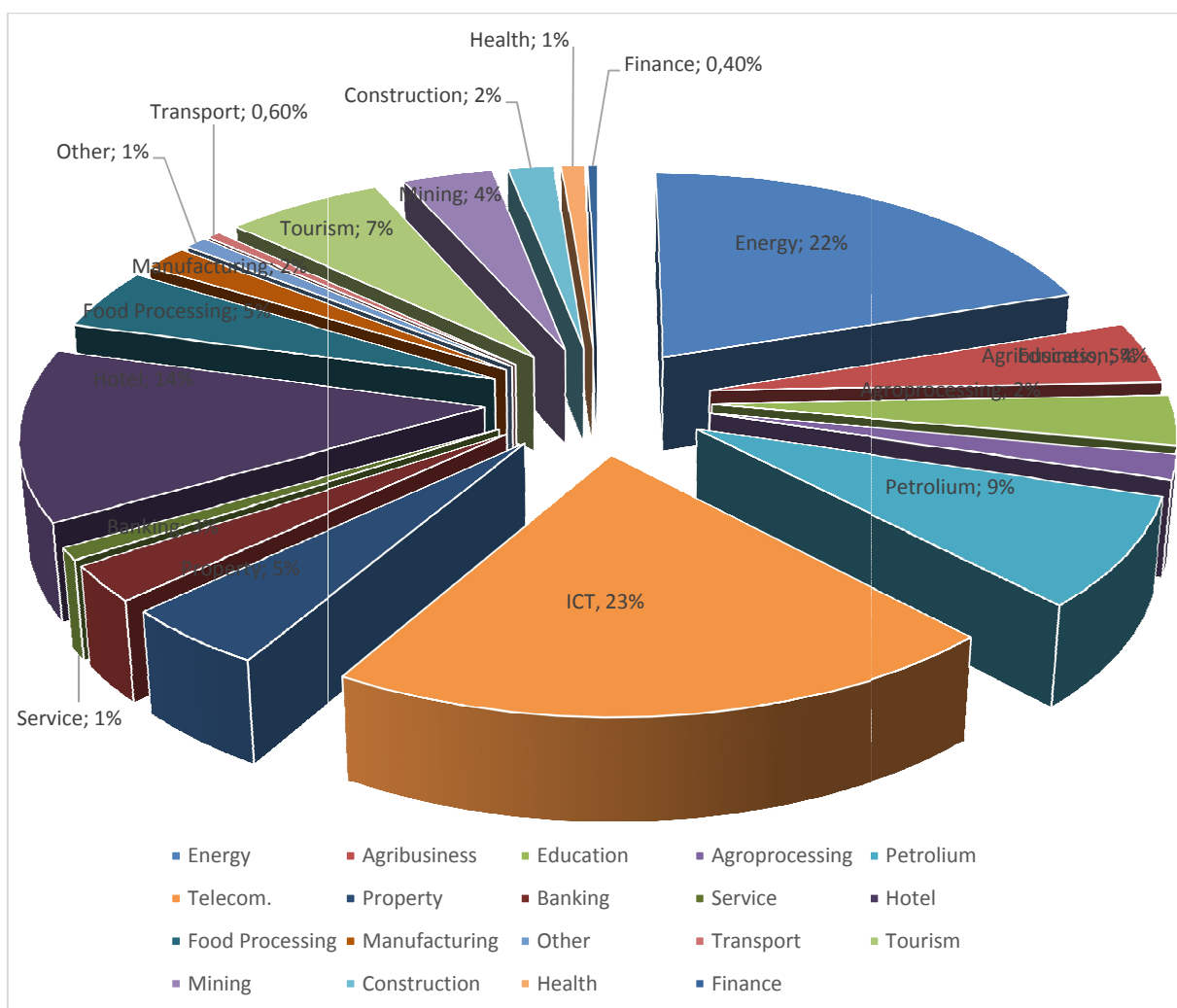
Source: Doing Business Report 2015

The area in which foreign investors focus in is ICT (Figure 18), because the market is completely new. There are possibilities of starting almost anything and be sure of not facing big or any competitors.

According to the Rwanda Development Board, most of foreign investors are interested in ICT sectors (Figure 18), such as telecommunication, cloud computing services, ISPs and so on. This is meaningful because a direct profit made in this area, and by the fact that IT items don't pay any taxes while entering the country.

Rwanda is becoming a regional center for the training of top quality ICT professionals and research. A robust ICT industry creates wealth, jobs and entrepreneurs. New developments in Rwanda's scene include kLab, a youth innovation hub; Think, a technology hub in Kigali, Rwanda Media Hub; The Office; and YouthConnect which connects the youth to role models, resources, skills and employment opportunities. The new Kigali Innovation City has first attracted the first Carnegie Mellon University campus in Africa. This is an opportunity for real estate developers and tech multinationals.

Figure 18 - Areas for foreign direct investment



Source: Author according to RDB/RIEPA

The 2015 Global Information Technology by the World Economic Forum measuring how economies use opportunities offered by ICT for increased competitiveness and well-being has the majority of African countries at the bottom of the rankings, given high poverty and poor infrastructure. In Rwanda, the informal sector accounts for 79% of all non-agricultural jobs, and many of them are in small trading and services, therefore the business demand of technology as critical component of operations is lower.

5.7 Plans and way forward

The ICT plan of Rwanda is summarized in what is called SMART Rwanda; this is divided into three principles:

- Establishing a Service-oriented, Modern, Accountable and Real-Time (SMART) government that drives Rwanda's global competitiveness and job creation.
- Becoming a highly competitive, agile, open and innovative smart economy with the most favorable business climate that attracts large-scale investments, rewards entrepreneurship and enables fast growth and exports.
- Leveraging powerful ICT innovations such as open data, big data analytics, cloud computing, and mobile apps to transform society into a smart society (SMART Rwanda Master Plan, 2012).

Although there is a digital divide, the government of Rwanda works hard to make sure that at least everyone becomes computer literate. The future lies in the human resource development by the use of services.

5.8 Rwanda's ICT SWOT analysis

In order to have a clear and a summary of the ICT sector, it is always good practice to make an analysis which will be divided below into four parts as specified by SWOT analysis. In fact, SWOT analysis is used as a tool to characterize strengths, weaknesses, opportunities and threats respectively.

Table 6 - SWOT matrix of Rwandan ICT industry

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> - Strong political will in support of ICT - Existence of national ICT Policy - ICT sector budget is on par with OECD countries at 1.6%, far above the African average - The small size of the country would facilitate ICT network infrastructure - Strong institutional organizations (RDB, RITA, RURA...) - ICT being the most attractive in terms of foreign investment - E-government and e-governance 	<ul style="list-style-type: none"> - Lack of necessary technical and professional level of human resources - Insufficient of electricity which is a prerequisite to the ICT accessibility - Inadequate financial resources - High cost of communication in comparison with neighboring countries - Lack of awareness about ICT and the benefits of e-government in both urban and rural areas
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> - Regional Communication Infrastructure Project (RCIP) - 4G LTE connectivity available in Rwanda only in the region - Kigali Metropolitan Network and Wibro Mobile WiMax Technology - Rwanda National Backbone Project - National Data Center 	<ul style="list-style-type: none"> - Existence of strong competition in the region. Each EAC member is aiming to become in ICT hub. - Potential of ICT crimes and difficulties to control them - The distance between houses is sometimes big which involves more investments in connecting them.

Source: Author (2015)

6. Questionnaire Analysis and Discussion of Results

6.1 Introduction

The purpose of this thesis has been to identify the potentiality of ICT sector as a backbone pillar to a sustainable economic growth in developing countries. However, this is not a task that the researcher can discuss basing only on the information gathered in books, searching in national databases; real time personal views are also necessary, thus by collecting information from different personalities. The statement of problem in Chapter 2.4 expands the rationale behind this study. The author used the descriptive method of collecting data, and a questionnaire served as an instrument to this. The percentage of participating individuals stands at 81% of the overall invited people.

The questionnaire was distributed from 9th September 2014 and results were started to be analyzed on 15th January 2015. The way of distribution was invitation via Facebook, Twitter and respondents' personal emails.

6.2 Questionnaire discussion

As stated in the above paragraph, data were collected in forms of a questionnaire distributed to different people by emails and social network invitations but with the main focus Rwandans. The next section of this thesis will discuss the outcomes and interpret respondents' answers according to their personal views.

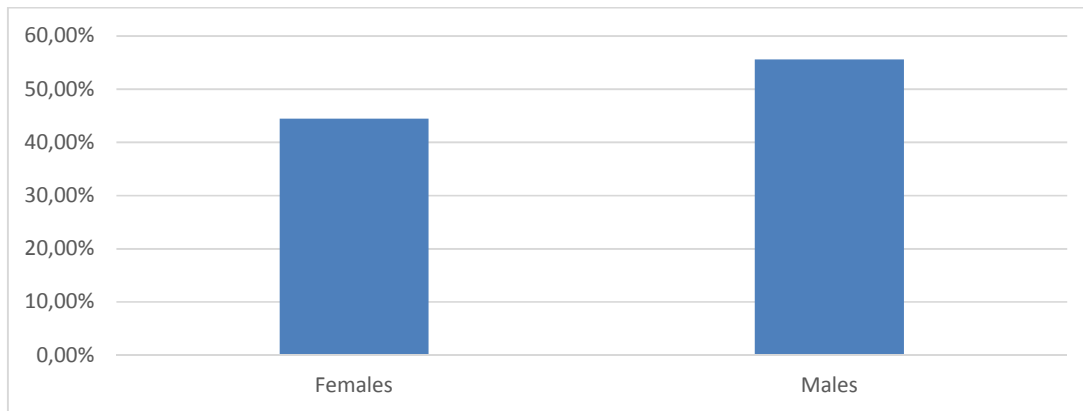
The platform of collecting data as stated in Chapter 2 is Survey Monkey, an online based tool, which allows a maximum 10 questions for its free version of use. Some questions are open and others require respondent's comments. It contains also questions with Likert scale¹⁸. This format is used mainly in training course evaluations and market surveys, Likert scales usually have five potential choices (strongly agree, agree, neutral, disagree, strongly disagree) but sometimes go up to ten or more. The final average score represents overall level of accomplishment or attitude towards the subject matter (*Jamieson, 2004*).

¹⁸ The Likert scale is a psychometric scale commonly involved in research that employs questionnaires. It is the most widely used approach to scaling responses in survey research, such that the term is often used interchangeably with rating scale.

Question 1: The gender of respondents

Attempting to know the physical background and their careers, a total number of 70 questionnaires was distributed, among those 54(77.14%) of people answered the questions. The following graph shows how many participants responded, and each characteristic was evaluated separately.

Figure 19 - Respondents by gender



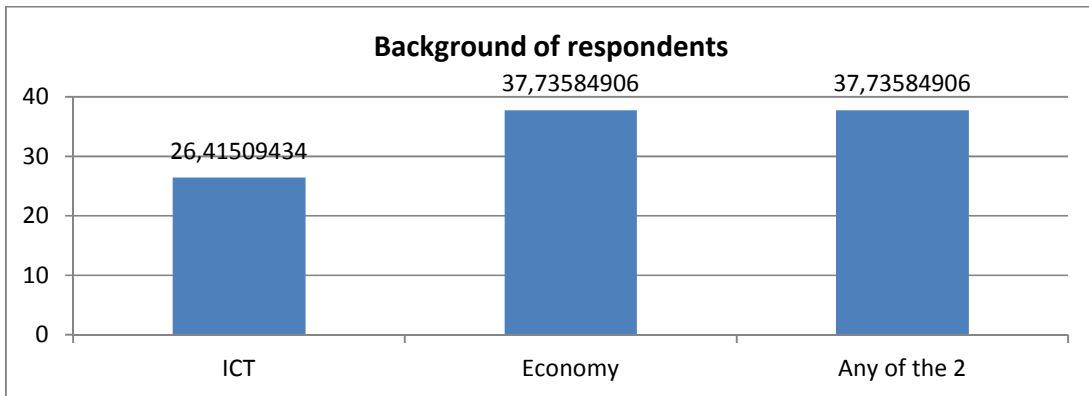
Source: Author

Though the questionnaire was distributed in equal number considering their gender (40 on each part), only males were more interested in answering the survey questions. None can predict what can be on the basis of this, but simply the author can say that females were less attracted by the questionnaire compared to their male counterparts, even if the difference is not that big. For statistics, females answered at an extent of 44.44% against 54.56% of men.

Question 2: Which of the following careers describe you the most? (Careers being ICT, Economy, or Any of the two)

As depicted in the Graph 20 above, there was a significant balance amongst respondents, though those with ICT were lower (26.4%) compared to the two others (37%.7). The interest of this is that the author got not only the views from expert people in the two selected fields namely IT and Economy but also views from other people who don't have anything to do with the above careers. Finally, people who live in a country have different backgrounds, therefore a view of everybody counts regardless their initial affiliations.

Figure 20 – Career background of respondents

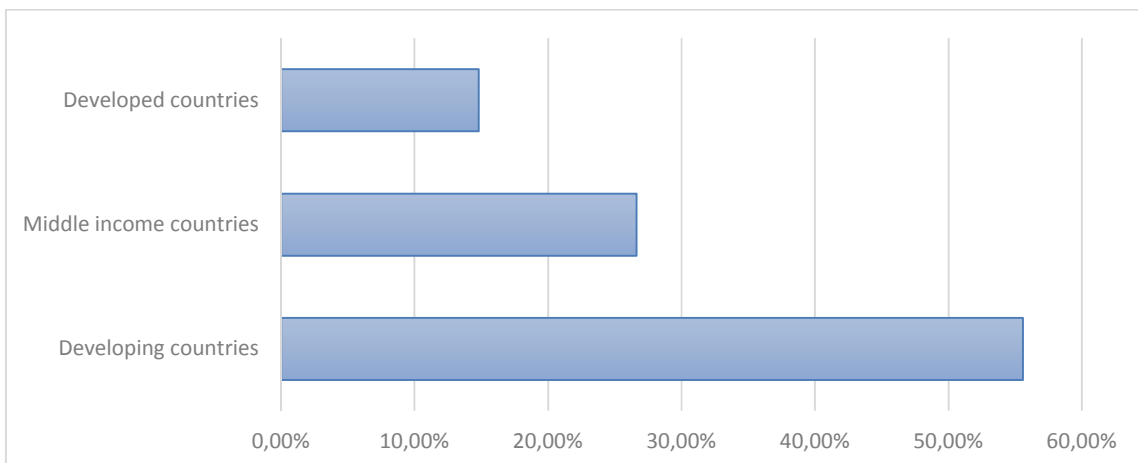


Source: Author

Question 3: What is your country of origin?

Knowing the country where respondents come from helps in screening what they think about their homes. Evaluating that, it is important to consult those who have a direct interaction with the case study place, namely developing countries. Distributing the questionnaire, most of the respondents come from Rwanda, though some other nationalities were involved as well.

Figure 21 - Respondents' countries of origin



Source: Author

Having interest in the original countries of my respondents, strengthen the matter of knowing how they view what is going on in their countries. I didn't undermine people who came from other countries as well, because their view were as important as the one of developing economies. Proportions were like: Developing countries 55.56%, Middle income countries 29.63% and developed countries 14.81%. Having a bigger percentage of respondents who were born or who live in developing countries is vital because they basically know how the business is done there. The views of respondents who come from economically better countries other than developing ones are also a big contribution because it helped not only on how they regard ICT in others nationalities but also what they think would contribute to the well-being of respective inhabitants.

Question 4: In your perspective, is ICT an important pillar to economic growth?

According to the preceding Literature Review in Chapter 3, the author mentioned that ICT and Economic growth are not separable. In fact, the good use of one stimulates the profitability of the other and vice versa. It was therefore to know how respondents react to this principle.

Table 7 - Respondents' perspectives on ICT

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total	Weighted Average
(no label)	7.41%	0.00%	7.41%	40.74%	44.44%	54	4.15
	4	0	4	22	24		

Source: Author (2015)

Examining the table depicted above, respondents were satisfactory with how much ICT is important to economic growth. In fact 40.74% of them responded “Agree” whereas 44.44% responded by “Strongly Agree”. The fact that the big percentage of respondents (see Figure 21) were from developing countries, and the fact that most of them believe ICT as in important tool, gives hope about the future of Africa’s ICT and Economy. It starts by citizens who later change their mentality and start to implement whatever they want to achieve.

Question 5: How do you rate the importance of ICT to economic growth?

On this question, not all the respondents participated to answer, out of 54 respondents who managed to answer at least all questions of the survey, only 50 of them attempted this question. The table below shows the summary of their views.

Table 8 - Respondents' ICT importance to economic growth

	1	2	3	4	Total	Score
ICT is compulsory	64.00% 32	24.00% 12	4.00% 2	8.00% 4	50	3.44
ICT is a potential alternative	32.00% 16	64.00% 32	0.00% 0	4.00% 2	50	3.24
ICT is not very necessary	4.00% 2	12.00% 6	80.00% 40	4.00% 2	50	2.16
ICT is not necessary at all	0.00% 0	0.00% 0	16.00% 8	84.00% 42	50	1.16

Source: Author (2015)

If we examine the average score in column 7 of Table 8 above, we remark that almost of respondents are in line with the fact that ICTs are compulsory. The fact that most people now believe in the strength that Information communication Technologies have, is a good sign that there will be a huge change in the way people do business. It is also true that some citizens of developing countries think that ICTs are not for them, during the 1990s in some cases and in greater earnest during the 2000s, many developing countries have placed information and communication technologies high on their national development agendas and high on their list of investments priorities (UNCTAD, 2008). The assumed model has been one in which ICTs are the means to deliver an “information society” which is itself a means to economic and social development. However, while there are strong signs of ICT investment and diffusion in many developing countries, the actual developmental effects are currently much less clear (Heeks, 2005; Furuholt & Orvik, 2006).

Question 6: How would you describe economic growth?

The aim of this question, is to understand personal views of participants on what economic growth means for them without consulting any official documents. They tried to describe it in their own words, and this helped to author to gain more creative views on the research main topic.

Interpretation:

Among received answers, most of respondents underlined that economic growth is when a country moves from being dependent to or towards an economic autonomy. A more or less compilation in the table showing some of the answers can be seen in Appendix 2. This question was to evaluate an individual perception of different people on what they understand some principle concepts of the thesis main objective. Despite the fact that the sample came from different backgrounds as seen in Question 2, the answers that they gave were satisfactory.

Here are some sample answers:

“I would describe economic growth as a countries growth in terms of goods and services compared to different periods of time”.

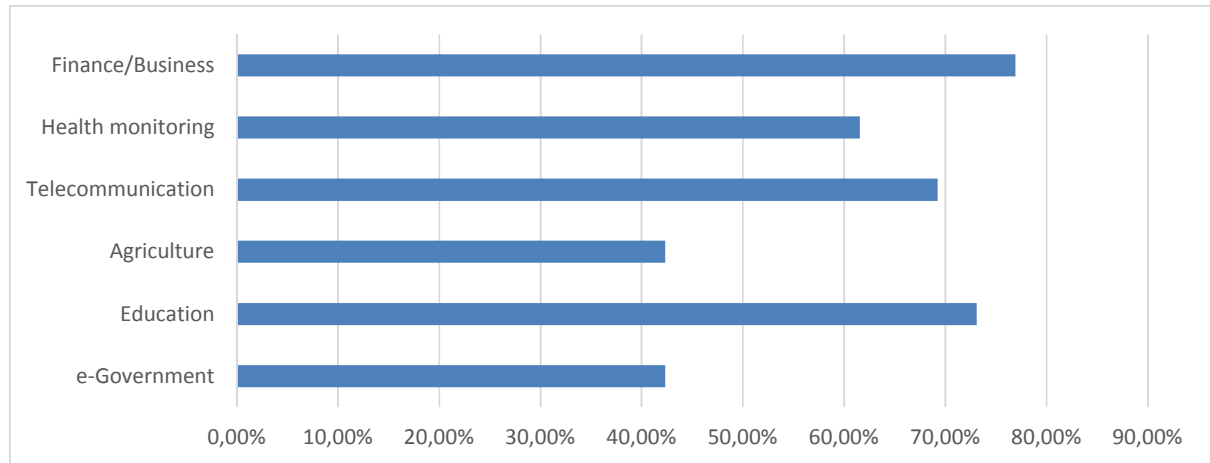
“For a low income country, economic growth should mean less dependency on foreign aid to meet national budget needs”.

“Economic growth is the increase in market value of services produced by an economy over time”.

The importance of asking this kind of open question is that they allow a respondent to express himself without being influenced by the researcher (Foddy, 1993); this has several good consequences for the quality of survey data. The advantages of the open-ended questions include the possibility of discovering the responses that individuals give spontaneously, and thus avoiding the bias that may result from suggesting responses to individuals, a bias which may occur in the case of close-ended.

Question 7: Which of the following sectors do you think contribute more to a healthy economy?

Figure 22 - Key sectors which contribute to a healthy economy



Source: Author (2015)

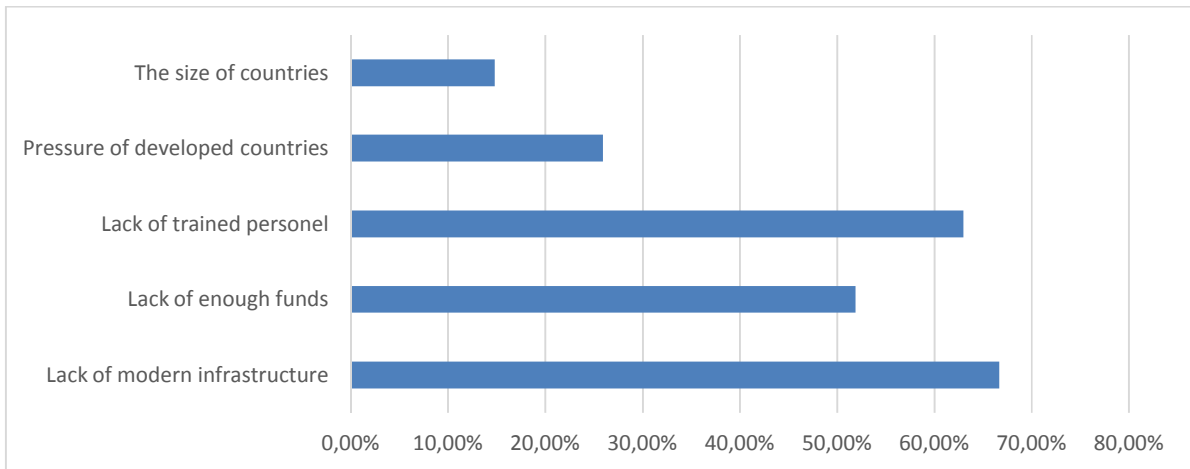
After collecting data in SurveyMonkey, the following figures were obtained: Finance and Business was screened to be a top priority with an overall 76.92% votes. The second being Education with 73.08%, Telecommunication 69.23%, Health monitoring 61.54%, Agriculture and e-Government 42,31% respectively. All of these were weighted based on the total 54 participants.

The reason behind Finance and Business as the major part to be invested in, is that many people believe in the launching their own businesses as entrepreneurs. Thus this sector is seen as the most prosperous by a majority of people. Education in developing countries is still a problem, a lot of citizens still face the problem of illiteracy, investing this doesn't not only opens the eyes of them but also help them to think about themselves and see what they want to live a better life.

Question 8: Which of the following factors do you think affect the most the implementation of ICT policies in developing countries?

As discussed in Chapter 4 about challenges that hinder developing countries to implement their policies, there are a number of those which were highlighted. In fact, sometimes, governments fail to run these complex programs not only because they don't want to make it a priority, but also because of some discussed factors here below as depicted in the Figure23.

Figure 23 - Factors which affect ICT policies implementation



Source: Author (2015)

Developing countries have many priorities so that sometimes it becomes hard to decide by which to start. It seems that they want to contribute to all of them which results in failures, and they don't have an option to focus on one and ignore the others. Even though there are many priorities, according to the respondents, some of them were shown to have a high need to be worked on so that they be used as a support to others. Those are namely the lack of modern infrastructure which was evaluated at 66.7%, lack of trained personnel 62.9%, lack of enough funds 51.85%, the pressure from developed countries 25.93%, the size of country 14.81%.

There is hope that the problem of lack of modern infrastructure will be alleviated little by little, but the one of lack of modern infrastructure continues to deepen since there is nowadays a remarkable brain drain due to non-sufficient salaries, and this keeps talents from developing countries still moving around, though some of them make a powerful diaspora which send home money to support the country in other ways of life.

Question 9: To which extent do you rely on ICTs?

Reliable software must include extra, often redundant, code to perform the necessary checking for exceptional conditions. This reduces program execution speed and increases the amount of store required by the program. Reliability should always take precedence over efficiency for the following reasons:

- Computers are now cheaper and fast
- Unreliable software is liable to be discarded by users
- System failure maybe enormous
- Unreliable systems are difficult to improve
- Inefficiency is predictable: programs which take a long time to execute and users can adjust their work to take this into account.
- Unreliable systems may cause information loss: information is very expensive to collect and maintain; it may sometimes be worth more than the computer system on which it is processed.

Considering the above facts, the researcher wanted to know on which extent the respondents have confidence in software used around the country and found data in the Table 9 below.

Table 9 - Respondents' reliability to ICTs

	Fully support	Support	Neutral	I don't rely on them	Total	Weighted average
My Choice	44.44%	44.44%	11.11%	0.00%	54	1.67
	24	24	6	0		

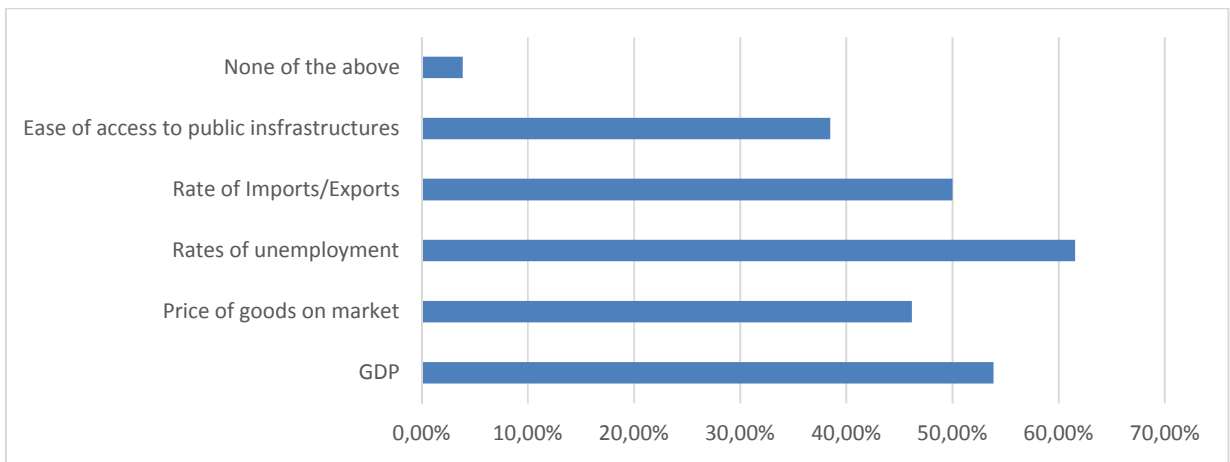
Source: Author(2015)

Despite the fact that previous studies, for example in a work by Jane Wangari Njuru, Ph.D. on “*Implications of e-government on Public Policy and Challenges adopting Technology, 2014*” showed that older people still have difficulties of migrating from paper based management to IT based one, there is an increasing thirst on how business are adopting software in their daily activities. In the table above, we remark that most respondents, fully support or support the reliability of ICTs though there must be a need in data protection against scammers who might be interested in data phishing.

Question 10: According to you, which of the followings show better the economic growth of a country?

There are a number of economic measures which are taken into measure as specified in Chapter 4.3. This question was attempted by all respondents whereby they tried to rank every criteria according to the importance they give it. The summary of collected data is depicted here below:

Figure 24 - Sectors that shows economic growth of a country



Source: Author (2015)

People individually see and judge in different ways, opinions don't represent often the reality nor must be taken as a universal truth. Saying the results above, most of respondents ranked the rates of unemployment as a key factor to measure economic growth with the highest score of 61.54%. GDP comes on the second place with a total vote of 53.85%, then follow the rate of Imports/Exports with 50%. On another hand prices of goods on markets come with 46.15%, the ease of access to public infrastructures takes 38.46%, whereas on the bottom of the list comes the lowest percent of 3.85% of respondents who believe that none of the above is appropriate to measure economic growth.

6.3 Summary

The previous section discussed into depth different personal views of respondents, it shows how they think things should be done to achieve the so called goals which can help economic growth have a base to ICT. It segmented major problems and angles which should be taken into priority, thus by examining how they can help to the growth by rating them or by showing their significance level in the way they should be given priorities. However, it doesn't mean that the least rated are to be taken into consideration; rather, they should be assigned an importance according to how they will help the top rated into achieving a common goal.

The results got from this survey screen out the general understanding of people without necessarily basing on raw facts and principles found in books. In the fact, they give a scope of answers to various questions that other researchers/entrepreneurs might ask them when they want to go this domain. The author understands that the questionnaire can be more meaningful if it is broadened and reach more participants, but the working condition didn't allow it, though results got are also satisfactory to monitor the ICT environment and its use in developing economies.

7. Recommendations and Conclusion

7.1 Recommendations

After a deep study of the research question of this work, the author made an attempt to show that ICT is at the basis of development in all countries despite their status of being developed or not. Moreover, the study focused a lot on developing countries and how they adopted ICTs to move faster. In fact, some key principles should be highlighted than others to make sure that there is a smooth progress in the matter of implementing all policies. Not only that, governments should enhance collaboration with the private sector as a way to attract investors in the field of ICT since they need basically some pre-designed infrastructures and design according to the vision of each individual country. Moreover the following should as well be considered:

- . Development of network infrastructure technologies especially in rural areas
- . Basic infrastructure needs a rapid improvement as a prerequisite to ICT development
- . Capacity building and training: ICT skills, training and awareness
- . Retention policy for trained staff with high skills in ICT
- . Investment in terms of software production and their commercialization
- . Dissemination of information and research related to ICT in order to share experiences and to avoid duplication and waste of time.

The author would as well recommend researchers in the similar field to make more detailed studies on new strategies and approaches to promote and integrate all possible ways to make Information and Communication Technologies a daily duty to everyone. A positive change in will is also needed, starting by the way of thinking and creativity of top CIOs and their teams, their imagination and creativity. In fact, ICTs profitability don't depend only on available software but also on the capacities of interacting them, how to design them so to meet on-site problems. There have been a lot of mismanagement in a number of organizations and organs of the government of Rwanda, not because they lack the systems but because they lack trained users, thus leading in losses of big amounts of money to pay expats who can interact with the so sophisticated systems.

7.2 Comparison of this thesis to other similar works

Implications of e-government on Public Policy and Challenges adopting Technology, case of Kenya

In this work, Jane Wangari Njuru, Ph.D. discusses the role of e-governments implications on public policy formulation and implementation in Kenya. Like in this thesis, Jane discussed as well the challenges of adopting technology and organizational change. Similarly, she stated that most challenges of adopting new technologies include resistance to change particularly among the elder members of the society – research showed this challenge can be overcome through creating awareness and providing detailed information. Other challenges pertain to lack of skills, competences, and expertise can be overcome by extensive training in order to ensure that an integrated e-government system works effectively and efficiently for the greater good. In addition, training and provision of public computers could reduce the challenge of digital divide and encourage the e-have-nots not to be left behind. In addition, technology raises security and privacy-related concerns as information provided can be hacked by scammers and cyber terrorists.

Good Practice on ICTs for Economic Growth and Poverty Reduction

This work by Mr. Simon Batchelor and Mr. Nigel Scott gives an overview of what DAC¹⁹ members currently know about how ICT use in developing economies can stimulate economic growth and poverty reduction. It draws attention to the cross-cutting applications of ICTs, to their role as tools, not goals, and links their use to development co-operation. As this thesis, it also has three key discussions where it considers the contributions of ICTs to pro-poor growth, the contribution of ICTs to the MDGs, drawing attention to the processes that lead to the goals. Moreover, it looks specifically at poverty-reduction good practice and relates what is currently known to the role of ICTs. The results that came out of this work underline the role of ICT as a backbone pillar that countries in developing economies and that it shouldn't be taken as a substitute but a must. Basically the two works discuss that ICTs are unique in having an impact beyond individual user's welfare. ICT infrastructure offers economies of scale that stimulates network building and

¹⁹ Organization for Economic Co-operation and Development's (OECD) Development Assistance Committee (DAC) is a forum to discuss issues surrounding aid, development and poverty reduction in developing countries. It describes itself as being the "venue and voice" of the world's major donor countries.

consequent spillover benefits. Finally they discuss that ICTs enable interactive communication unhindered by distance, volume, medium or time.

7.3 Thesis conclusions

This study served to screen out what is happening in developing countries vis-à-vis to the actual world speed of development and ICT use, however more studies are still to be done on the ground. In fact, there is still a problem in those countries to put all information on the web. In addition, even though the sample size was not big enough to make a deeper study, participating people showed a general picture of what the situation is like. There is a promising progress compared to past years that for example developing countries are using mobile technologies more than developed countries since they use less data, and by the fact that mobile gadgets are cheaper than PCs. This sector has a significant meaning on the way businesses are conducted, and precisely the promotion mobile payments proliferates a cashless environment for instance.

The study will serve as a baseline to what is going on in the developing countries especially in Rwanda, it is intended also to be important tool for other researchers who might be interested in the same field. It will showcase the potential of ICT in Rwanda as a tool to trust and use in economic growth. It was limited mostly on Rwanda, but the techniques used can as well be applied on any other country of similar economical and IT characteristics with only slight modifications. The study was mainly challenged by the fact that some information in the case study country were accessed remotely, which can result in non-timely response to given inquiries and updates by respective people in charge.

As stated in chapter 3, the research question was to prove how the Rwandan government is tackling IT related issues. Along this work, the author discussed several points which show the goals being met though also some challenges are slowing down implementation. The existing ICT infrastructure facilitates potential investors and is as well a suitable launch pad for those who would like to start something from scratch. Different statistical data discussed in this work show how the country is moving forward compared to the past years; and by the help of ICT, the country's vision is to make its population the first source of economic power through services.

The main reason for adopting ICTs is that they are cost and time saving decision tools and their flexibility as discussed all over this work. Looking at today's speed of working, everyone can recognize that they are a reality for many firms and governments and that most of them are migrating at least a big part of their way of doing business either using POSs or other relevant tools in relationship to what they do on a daily basis. The research shows that ICTs provide companies with new options for managing infrastructures and new business models.

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Appendices

Appendix 1

The Survey questionnaire

ICT for economic growth in developing countries


Questions for Master's research

This short questionnaire is about to understand the effectiveness of using ICT in developig countries as a way to enhance and boost up economy. A case study was focused on Rwanda, an fast-growing economy in the Sub-Saharan Africa. Please do help me to know different views, all your data will be kept confidential and will be only used for the research's purpose.

Thank you,

Leandre Mundere

1. What is your gender?

 SurveyMonkey Audience

Female

Male

2. Which of the following careers describes you most?

ICT

Economy

Any of the above

3. What is your country of origin ?

Low Income country

Middle Income country

Developped/Industrialized country

4. In your perspective, is ICT an important pillar to economic growth ?

Strongly Disagree Disagree Neither Disagree Nor Agree Agree Strongly Agree

5. How do you rate the importance of ICT to economic growth?

ICT is compulsory

ICT is a potential alternative

ICT is not very necessary

ICT not necessary at all

6. How would you describe economic growth ?

7. In which of the following sectors do you think ICT can be used more as way towards a healthy economy ?

- e-Government
- Education
- Agriculture
- Telecommunication
- Health monitoring
- Finance/Business

Other (please specify)

8. Which factors do you think affect implementation of ICT policies in developing countries?

- Lack of modern infrastructures
- Lack of enough funds
- Lack of trained personnel
- Pressure of developed countries
- The size of countries

9. To which extent do you rely on ICTs ?

My choice Fully support Support Neutral I don't rely on them

10. According to you, which of the following shows better the economic growth of a country?

- Gross Domestic Product (GDP)
- The prices of goods on markets
- The rates of unemployments
- The rate of Imports/Exports
- The ease of access to public infrastructures
- None of the above

Appendix 2

Some of the answers on how respondents define economic growth, their personal details were kept confidential.

Time received	Respondent's view
14/11/2014	I would describe economic growth as one country's increase in capacity, in terms of goods and services comparing to different periods
13/11/2014	It is the welfare of the individual inside a given society
08/11/2014	Economic growth is changing every day and ICT became very important to economic growth. My idea is that economic growth depends a lot on technologies.
08/11/2014	It means increase of money in a local economy, investments, support for services and business.
05/11/2014	For a low income country, economic growth means less and less dependence on foreign aid to meet national budgetary needs.
04/11/2014	It is a better environment for citizens, better healthcare and less poverty
04/11/2014	Economic growth means economic development and less relying on agriculture so to focus on industries and services
03/11/2014	Economic growth is when the country's GDP increases due to national productions
04/11/2014	It is about being able satisfying and needs and saving for the future
04/11/2014	It is a raise in saving a lot of money

Document for registration DIPLOMA STUDENT'S THESIS

Submits:	ADDRESS	PERSONAL NUMBER
Mundere Leandre	Avenue de L'armee 0, Kigali	11300114

TOPIC IN CZECH:

Potenciál ICT sektoru pro ekonomický růst rozvojových zemí,
Případová studie Rwandské Republiky

THESIS TITLE IN ENGLISH:

Potential of ICT sector for economic growth in developing countries,
A case study of the Republic of Rwanda

SUPERVISOR:

Mgr. Ing. Petra Marešová, Ph.D. - KE

RESEARCH PLAN:

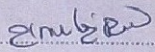
Objectives: To assess the strength of ICT infrastructure and policy available in Rwanda and take advantage of them to maximize its use to boost up the country's economy.

Contents:

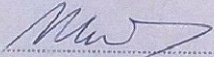
1. Introduction to the concept of ICT and development
2. Theoretical background
3. Objectives and methodology
4. Current Situation in developing countries
5. Potential of ICT sector and Economy in Rwanda
6. Questionnaire Analysis and Discussion
7. Recommendations and conclusion
8. Bibliography

List of recommended literature:

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 H. Lancaster (2014): Rwanda: Telecoms, Mobile and Broadband, Market insights and statistics.

Student's signature: 

Date: 02/04/2015

Supervisor's signature: 

Date: 02/04/2015