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# **The Growth of ICT4D**

## Impact in Educational System In Developing Countries

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## Abstract

Problems in developing countries have been an issue for a long time. ICT4D was initiated to solve these problems, at least to ease the current problems to make living standard a bit better. ICT4D stands for information and communication for development, which uses advanced technology to bring opportunities for the people in many fields, such as in education.

The term “developing countries” is hard to define, since it is defined by people from developed countries, but in this thesis, I will go through the definition and variables that defines the term. People think that money could solve the problem, but in fact it cannot stop the problems, but by using it to educate people, we can make use of the knowledge learned and thus improve people’s future.

In this thesis, I will introduce ICT4D and the evolution of ICT4D, what kind of changes it has gone through to become what it is now. I will also define developing countries from few points of views and also defining human development index (HDI) and means for a better living standard. Next, I will talk about the education and how it could improve the living standard when implementing it properly and how ICT4D is having and could have an impact on the education in developing countries. Also, I will introduce few challenges that could be problematic but not impossible to solve and how huge of a digital divide is between developing and development countries. All of these affect the educational system in developing countries, and is considered as a highly important matters in digital economy, fortunately we have many movements such as ICT4D to tackle these issues

### *Keywords*

ICT4D, ICT, education, developing country, development, digital divide, technology

### *Supervisor*

Associate Prof. Marianne Kinnula

## Foreword

I have always been interested in travelling, meeting new people, and learning about their culture. After spending half a year in Japan as an exchange student and travelling in Asia for couple of months, I somehow knew I wanted to write my bachelor concerning the developing countries. The current situation in developing countries have always been interesting to me and I already have some clue of their educational system and how bad it can be in some part of the world. I want to thank Prof. Marianne Kinnula who guided me and introduced me to this current topic.

**Vuong Bui Le Ba**

Oulu, April 16th, 2020

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# 1. Introduction

Technology has always been an important driving factor in changing people's living standards by making lives easier in many levels. The rapid growth of information and communication technology has always had an impact not only on minor scales, but also on wider scales. When we talk about impacts on wider scales, we talk about how technologies have influenced the cities or even the countries and how it has been one of the critical factors in industrialism. There are many necessary conditions needed to spawn an industrial revolution, such as development in education, development in information and communication technology sector, stable government, stable economy, and natural and human resources. (Nagy, 2011.) Usually these conditions are lacking or even missing in developing countries. It is acceptable to acknowledge that the absolute goal of many countries is to increase the quality of lives of its people, besides nation's prosperity. So why is it that some countries prosper more than others in term of the conditions mentioned before?

Living standard in developing countries have improved over the years although they still lack far behind when compared to developed countries. As mentioned before, these countries lack many critical factors that could make it possible for them to move up the economic ladders. Besides these obstacles, developing countries also have other problems, education being one of them. Education is seen as an important factor everywhere, and by the lack of the availability in education, developing countries stay the same. Improving citizen's learning and knowledge is very important, since it produces a qualified and knowledgeable labor force. These forces will then work towards developing and improving their country through discovery and innovations. To achieve this state of development, countries must take advantage of opportunities given by technology in use. (Delponte et al., 2015.)

Technology and its impact in developing countries is quite a wide topic to talk about. I start by introducing information and communication technology for development, from now on known as ICT4D. ICT4D movement has had a great impact in improving developing countries by giving them the access for computer and the Internet. The main focus here besides ICT4D is the education in developing countries and how ICT4D is improving this factor but before this I must open the term "developing countries" through few criteria that classifies developing countries. Human Developing Index (HDI) is also introduced, since I find it important to understand by reason of it being associated with ICT4D to some extent. Factors for better living standards will also be introduced and what brings people to that state that they are in. It is clear, that the accessibility of technology and the Internet varies between developing and developed countries, and the link between education and access to ICT are almost directly linked. Thus, Digital Divide is also being introduced in second section, which is related to both distribution of ICT between countries.

In this literature review, I focused on ICT impact on developing countries. As I found it quite difficult to just talk about ICT4D without preparing readers to have some information about developing countries, I included a whole section about definition of developing countries. My main headword is ICT4D, but I also included many other thoughts that play an immense role in specifying the role of ICT in developing

countries. Using databases offered by University of Oulu eased my work a lot, Also Google Scholar gave me plenty of verified articles to read from and using exact keywords, I was able to find more specific literature. RefWorks was also a lot of help when creating references.

Since implementation of ICT in developing countries are such a wide topic, I decided to not focus on every point that ICT could improve, but only focus on the education in developing countries. My goal here is to write a clean text from a viewpoint of those that are new to this topic and those who just want to learn more. In the next section I will introduce you to the acronym “ICT4D” and its impact on daily lives of people living in developing countries. This section has few subsections that explains the human development index, digital divide and how ICT4D will continue to evolve in this world where technology is present everyday and everywhere. The third section will introduce the readers to education in developing countries, why this is very important and what ICT4D is doing to improve it. After this section, we will go to discussion and implications and discuss our findings. Finally, I will conclude everything and point out all the important parts of why ICT4D is needed and how it affects developing countries.

## 2. Impact of ICT4D

Digitization, modern computers and growth in the amount of data consumed, shared and created has transformed the world greatly. We are living in the world that is constantly changing and the main reason for the change is the Internet. Information and communication technology, also known as ICT, is widely accepted to mean all the devices that connect people all around the world digitally. Usually ICT system components encompasses of mobile devices and internet-enabled devices that are powered by wireless networks. Information technology (IT) can be confused with ICT, but it is not as broad as ICT, after all ICT represents more inclusive list of all the components that are linked to digital technologies. These technologies include the Internet, broadcasting technologies, computers and telephones and are said to expand access to a more united networking.

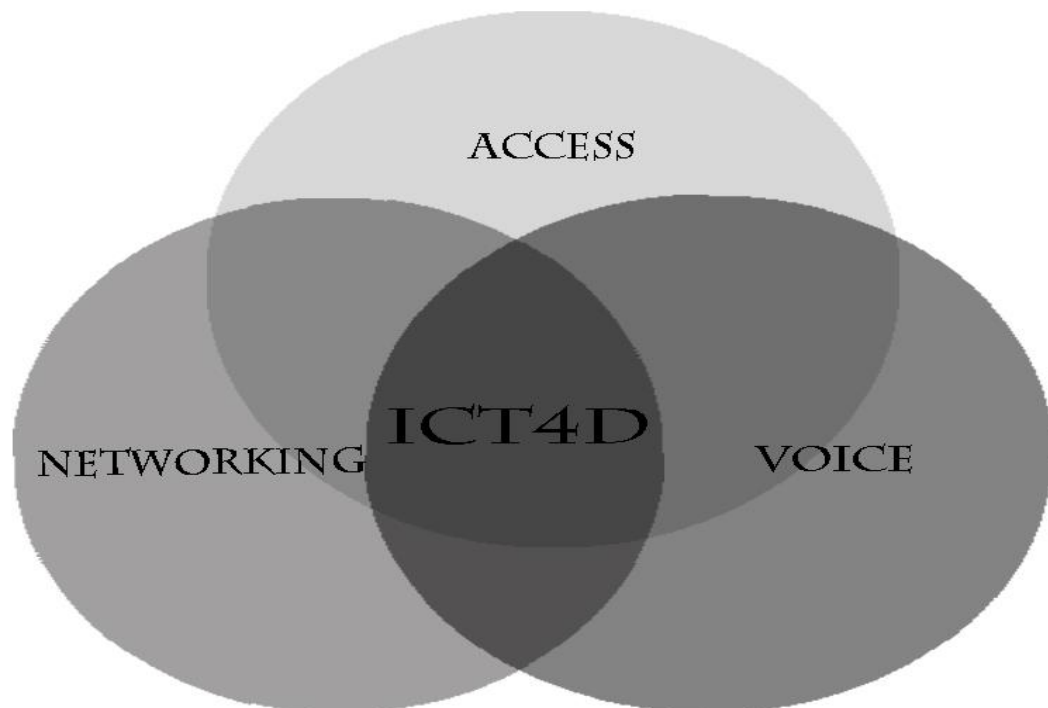
Nagy (2011) mentions that the impact of ICT is examined in several areas related to community development, public sector and poverty reduction. This impact covers many fields, but most importantly it covers cultural, regional and urban development, education, health and poverty. Meaning that, with a positive impact of ICT, it is also accompanied by downside risks such as: wasting limited resources for development; worsening inequalities; strengthening existing power distributions; and controlling, rather than empowering individuals. (Nagy, 2011.)

### 2.1 What is ICT4D

ICT4D is an initiative to bring closer the gap of digital divide between developing countries and developed countries, which is usually interpreted as the use of technology to improve the quality of lives of people in developing regions. The main factors that affect the development consists of natural resources, human resources, capital formation, technological development, and social and political factors. For example, the case in Syria, where development was shaped by the constant change in economic and social changes created many opportunities but also new challenges for young people from entering labor market. Still, the unemployment situation dropped from 25 percent to 19 percent in 2005, but still remains higher than the average percentage of unemployment which is 14 percent. By sharing an existing technology to those part of the world where it is yet unattainable, could gain a positive outcome, but only if it is used effectively. The point is to deliver on the aspirations of the poor and to communities which are marginalized so they may influence the lives of the people and livelihoods positively. (Yafi, Nasser & Tawileh, 2015).

From conflict and terrors to climate changes, from disease to lack of resources, developing and under-developed countries suffer the most. They also suffer from poverty, with nearly half of population living on less than 2\$ US dollars per day. This is one of the reasons why ICT4D exists. It was initiated to tackle these problems and to bring opportunity for a change in macro-level. Nowadays economic, social and political life orbit around technology, meaning the 21<sup>st</sup> century will be increasingly digital. Those without ICT seems to have a slower progress in developing these main factors that define developed countries. (Heeks, 2008.)

Since ICT4D is an acronym, it might turn away many people who don't recall themselves as a fluent technologist. When looking at the first letters of the acronym I and C, they stand for information and communication. Which covers most of the ICT since understanding the information and communication of people and organizations is the most important step before jumping into the letter T, which stands for technology. Technology involves many digital devices and services including: mobile devices, connectivity, digital data collection, computers, satellites or even smartphone applications. Thus, information and communication influences technological choices, and vice versa technology informs possibilities and new opportunities of information and communication. The last two letters 4 and D, are an acronym of "for development". None of these previous letters should take place for its own sake, rather it should help to achieve the goals set to the programs that choose to improve livelihoods, educations and healthcare of developing countries. (Walsham, 2017.) Weigel and Walkdburger's framework of ICT4D is presented in figure 1.



**Figure 1.** A framework of ICT4D's key dimensions (Weigel & Waldburger, 2004, p. 22)

In figure 1. we can see that ICT4D consists of 3 key dimensions: (i) access, (ii) networking and (iii) voice. According to Weigel and Waldburger (2004) there are great relationship between communication technologies and information technologies and on the other hand, development and poverty reduction. This arises specifically through these three dimensions: (i) **access** which is to promote exchange and use of knowledge and information for equal opportunities, (ii), **networking** to simplify communication between people within organizations, and (iii) **voice**, for people to have in democratic



processes and other decisions that could affect their living standard. When combining three of these dimensions in a sensible way, we have the structure for ICT4D.

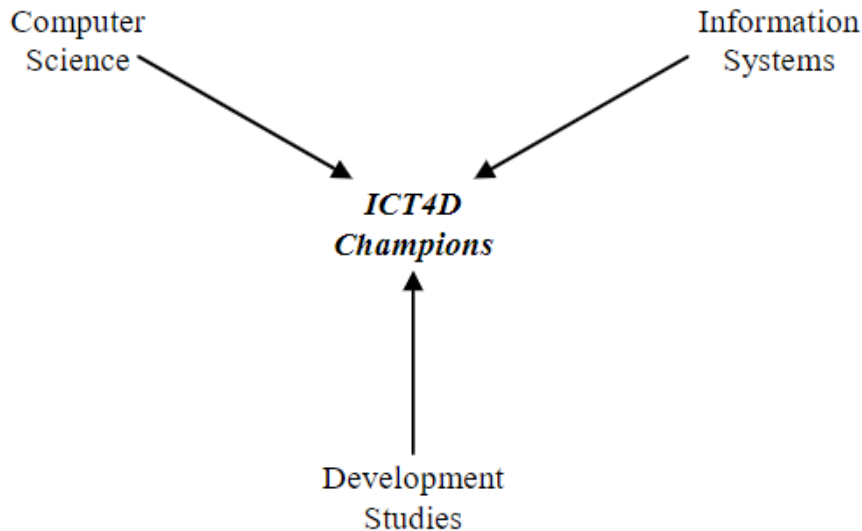
ICT4D initiative was made to bring many improvements by the rise of technological advantages to such countries that are lacking behind in e.g. human development index (HDI), which will be explained later. Heeks (2008) explains the evolution of ICT4D from 0.0 to 2.0 in his article "ICT4D 2.0: The next phase of applying ICT for international development". ICT4D 0.0 was born by simply installing the first computer in Kolkata in 1956 at the Indian Institute of Statistics for scientific calculation work. Heeks mentions two things that gave birth to ICT4D 1.0 in 1990s. The First thing was the growth of interest in ICT and how ICT could be applied in developing countries. The second thing was that international development began to move back up to political agenda. This move came out as the International Development Goals (IDGs) in 1996, then formalized as the Millennium Development Goals (MDGs) by 2000. It mainly sought to reduce poverty while increasing the livelihood, health, educations and gender equality all over the world. (Heeks, 2008.)

While the development actors involved in ICT4D had a lot of pressure on them regarding the tangible delivery, they sought a quick solution that could be replicated in poor communities. To give an evidence of achievements, they built a building or a room with an Internet-connected PC, since it could be installed fairly quick. This was called the telecenter projects, but sadly it did not go as planned and often resulted in failure, anecdote, and restriction. However, each of these outcomes led to lessons and new watchwords: sustainability, scalability, and evaluation. In the end, these failures brought ICT4D 2.0 to existence. Even though there is no general agreement on what ICT4D 2.0 looks like – that discussion is still ongoing. Despite the contrary, we can sketch some of its component parts (Heeks, 2008). Many models were tested but proved to be too costly to be sustainable or scalable. Therefore, it needed innovations in several areas to push forward the Internet-connected PC, such as terminals, telecommunications, and power. Heeks thinks that Terminal -area seems to be a central part of ICT4D 2.0, since its focus is on developing low-cost, low-spec and robust terminal device that could work in large numbers of poor communities.

One great example is Africa and its use of telecommunications. Rose (2014) mentions in her writing that six out of ten fastest-growing economies in the world are based in Africa. By telecommunications, we talk about wireless devices such as mobile devices and the continent of Africa is the second-largest mobile market in the world. Since the education in Africa is not as advanced as the education in Western countries, they need to invest in education for its youthful population to develop required skills to handle ICT in general. Also, when given more attention to primary and secondary school educations, it will lead to a greater literacy then there is a greater chance of moving on to a tertiary education such as business and to develop training in ICT sectors. (Rose, 2014.)

In conclusion, there are three intellectual domains – information system, computer science, development system - that need to be put together in order to offer ICT4D-field something for development. The needed space has not yet been achieved, and still remains as one of the key challenges during ICT4D 2.0. In practically ICT4D 2.0 projects need a combination of these three intellectual domains for it to succeed. It can be interpreted as meaning multidisciplinary teams.

### Figure 1: Creating ICT4D 2.0 Champions



**Figure 2.** "Tribrids" champions (Heeks, 2008, p.11).

Figure 2 shows the case where we must find an ICT4D Champions who are "Tribrids" (*An organism, object, or method comprising three disparate individual components*). They must understand their field enough to draw key solutions and lessons to interact with and to manage the domain professionals. Still, it stays a question of how these Tribrids ICT4D Champions are created (Heeks, 2008).

## 2.2 Human development index

Human development is all about the realization of human freedom to its full potential, not just of few nor of most, but of every human life in every corner of the world. This universal way of approach gives human development its uniqueness. However, the principle of universalism is easy when it is not put in practice. Over the past centuries, there has been a huge development in the lives of people, with people living longer, people getting needed educations, lesser people being malnourished and more people rising out of poverty and even though, the development has not been even, and human deprivation still persists. Still, there are many programs that are looking for solutions to these problems and the 2016 Human Development Report is one of them. The report analyzes who are being left out in the progress and why. It argues that mere mapping of locations and nature of deprivation is insufficient in case to ensure the development of human. It also identifies the key strategies to achieve the basic human development and to protect and sustain the gains. (Jahen, 2016.) As mentioned before, HDI can tell enough of country's advantage in many fields, one being technological advantage.

In brief, HDI is the way to measure country's average achievement with three aspects of human development: access to resources, longevity and knowledge. Thus, it broadly covers basic aspects of material well-being, bodily health and literacy. Achievement in health was measured by the rate of births and how long the newborn is expected to live. Knowledge was measured by the educational achievements with a mixture of literacy rate and gross enrolment rate. Lastly, material well-being was measured with a logarithm of the per capita GDP. (Seth & Villar, 2017.) It is simply made to rank the countries and regions by their level of human development: low, medium and high. The Human Development Report Office intends to review the participation and

contributions in measurements of human development, which will also be a great time to considerate the key challenges facing the human development, for instance the freedom of making choices, or how to acknowledge the differences that characterize development in a better way (Gallardo, 2009). Human development focuses more on the richness of human lives rather than on the richness of economies.

Certainly, all three dimensions of HDI does not cover all the facets of developments. The word sustainability is essential and thus should be incorporated into the index among few others. Although there might be few problems when increasing the number of dimensions because with more dimensions, it is more difficult to collect the data and more variables makes selecting the accurate weighing-scheme more complex. One great variable and maybe the most needed one is definitely measurement in education. Seth and Villar (2017) mentions in their article that the Human Development 2010 replaced the old combination of gross enrolment states and literacy rate with more suitable indicators of measurements for educations, which consists of the geometric mean of “average years of education” (among adults) and “expected years of schooling” (among children) (Seth & Villar, 2017). Although, the way which the composite education variables are formed presents disadvantages worth dealing with. The indicators’ impact in HDI is less transparent when the geometric mean which was created for composite variable of education is put in use. Therefore, only modest part of improvements in children’s schooling are reflected in the index of education, thus giving it less reason to invest in education. In other words, to explain the differences in development, the empirical evidence suggest that it is the quality of education that should be taken into account, not the years of schooling (Seth & Villar, 2017). Improvement of HDI is considered in ICT4D, since it indicates how far the country must go to achieve certain goals, which is also what ICT4D is trying to pursue.

### 2.3 Digital divide

First of all, what is digital divide and how is it associated with ICT4D? The origin of it starts at the early nineties, where American studies on the Digital Divide, noticed the risks when excluding some social groups from ICTs. The phrase itself became popular only when Long-Scott (1995) showed some proof of the risks of excluding the poorest people and minorities from ICT with regards to the participation in democratic life (Rallet, 2007). European countries were the first ones to take up the Digital Divide message, to emphasize their delay compared to the USA. The goal here was to enable Europe to take advantage of Internet opportunities and promises of New Economy. Furthermore, for many European country, it was to fill up the gaps between regions, cities, organizations, individuals and social groups following the US initiatives (Rallet, 2007). Wherever the field it may be applied, the term Digital Divide refers to the idea of the division between two groups: those who benefit from the digital economy are called the *Haves* and those who are excluded from these benefits are called the *Have-nots*. In short, the term “Digital Divide” refers to the gap between individuals, businesses, households and even geographic areas at a different socio-economic level, regarding the opportunities in both sides to access the information and communication technologies and the use of the Internet in variety of activities. There are many questions concerning the so-called “Digital Divide”. Where does it occur? Whom does it affect? Why it occurs? What are the causes? How wide is the digital divide? What needs to be done to close these gaps? These questions are recently raised so it is not possible, yet, to answer all these questions with any certainty. (OECD, 2001.) The same questions are also presented in ICT4D movements, which is why digital divide and ICT4D moves hand in hand.

Because of the rising interest in these issues concerning digital divide, OECD has begun its efforts to measure digital divide. Besides communication infrastructures, important factors seem to be availability of computers – potentially the availability of access to TVs or mobile phones – and Internet access. It also seems like that the digital divide among households depends heavily on income and education. Education has a direct link on digital divide, since higher the education, higher the salary, and thus more likely they are to have access to ICTs in both at home and at workplace. Given the importance of education and its link to improving computer/Internet literacy, and to build the related skills needed for a digital era are especially important over the long run (OECD, 2001.).

To evaluate the Digital Divide, several types of indicators must be taken into consideration. As mentioned before, level of education within the population is one of the indicators that include: school attendance and literacy; familiarity with computer; second language learning, especially English. Other indicators are e.g. skills and know-how in ICT sector and access to infrastructures and equipment. Other variables that affect these indicators are e.g. age, gender, location, household, linguistic and racial backgrounds. To fully make the most use of technology to create possibilities for the people to gain knowledge and learn, depends a lot on businesses, countries and individuals; which are also one of the many indicators. (Rallet, 2007.)

Although the digital gap is still huge between developed and developing countries, there are possible ways to diminish the digital divide. OECD gave few potential routes for poor people to access the internet, one of them being TVs, because of its accessibility, low cost and ease of use. This may provide an alternative non-PC route to the internet. Television being a familiar household appliance and nowadays smart TVs bringing potentially internet access to its interactive services could help bridge the digital divide. Services could be educational for the poor and less well-educated that does not have the access to attend school. Other possible way to bridge the gap are the mobile telephony, since it is also inexpensive and accessible. The only problem, however, is that mobile internet access is still relatively expensive in developing countries (OECD, 2001.)

Rallet (2007) also mentions in his study that the issues relating to digital divide varies depending on its scale. The problem between developed and developing countries are the hardware costs and weak development of telecommunication networks that affect the access to computers and infrastructures. On a regional scale, the digital divide is essentially because of unequal dispersion of telecommunication networks on national territories. National territories are separated into three types. First one is towns, where the size and density is justified by private financing in broadband infrastructure or where mobile network are accessible through competitive operators. Second areas are called the “grey” areas, where only one operator shares the broadband access, in this case, access is not the problem but the cost of this access due to lack of competition. Final area are the rural areas where no access is available due to distance or lack of equipment. (Rallet, 2007.)

## 2.4 The continuing evolution of ICT4D

The increased supply and capacity have resulted in fall of prices in software, telephone services and computer functionality. Computers have become more powerful; wireless technology, satellite and optical fiber has increased transmission capacity; and software developments has eased the work of digital materials such as computer simulations, educational materials and even electronic games (Bates, 2001). This growth has resulted

in some countries to leap beyond the previous stage of technologies. For instance, nowhere has the impact been greater than in mobile industries. Mobile phone technology has increased the growth of telephone access in China. Hard-wired networks are slowly decreasing as result of wireless technology increasing, after all wireless technology avoids the need for hard-wired circuits into offices and homes (Bates, 2001). Mobile phones are being used for financial services in many rural areas, where it is difficult to access banks directly. These services can also be used to transfer money, receive remittances from overseas or collect savings (Walton, 2010). This step-in evolution of ICT has simplified lives of poor people and has proved to be very useful in places where a trip to banks are difficult or almost impossible by the cause of rough terrains.

Tony Bates have listed several conditions surrounding this rapid growth of ICT which can be summarized as follows. ICT growth has never been equal between countries nor even between different socio-economic groups. This inequality is usually referred as digital divide; the gap between people who have the skills to use ICT appropriately and those who do not have these skills. Despite the late adjustments to world stock markets, the forecast to ICT is predicted to continuously grow. This means that access, applications and bandwidth will continue to increase into a foreseeable future (Bates, 2001). Lower labor costs in manufacturing and in industries such as forestry and agriculture has forced many former industrial countries to move from hard-labor works to more knowledge-based business mostly heavily dependent on ICT. Thus, there has been exponentially growth in software development, e-commerce, and hi-tech designs (such as digital routers, digital telephone switches, computers and micro-processors), entertainment (such as computer and video games, films and television) in development countries (Bates, 2001).

We can deduct from the growth of ICT that it will continue to open many job opportunities in developing countries. In Asia countries, such as China, India and the Philippines, ICT services have created many employment opportunities especially for women. For instance, in the Philippines and in India, workplaces form of respectively 30% and 65% of the total female technical and professional workers in IT services. Apart from being employed in call centers, women in India and the Philippines also have a great number of highly paid IT jobs (Delponte et al., 2015). Since women face many challenges in developing countries, such as lack of education, gender bias, lack of maternity benefits, safety and security at workplace and in many developing countries, role of many women remain that of a homemaker. Widening the access to education has been a major goal for many organizations and by doing that, it has opened many benefits for girls and women, also for boys and men and the evidence of the benefits are overwhelming. Education have the benefit of improving health and productivity and thus the poorest gain the most (Hill & King, 1993)

There are many organizations that have and are still contributing to the cause of creating the sustainable world. For instance, Union Institution and Member States, but the EU is the organization with the highest effort and level of expenditures world-wide. The European Union is one of the main actors in development assistance and international aid. Together with Member States, these two organizations have provided some 55 per cent of total international Official Development Assistance (ODA) and additional two third of grant aid (Pedrelli & Reggio, 2001). To acknowledge how differently ICT can affect different countries, the EU has to progress within a rather complicated international scenario. The top-down approach is typically made by larger organizations (e.g. World Bank, UNDP, G8...), and usually results in heavy influence on political choices. This approach is a must to create the wanted environment for the use of ICT

(Pedrelli & Reggio, 2001). The other approach is called the bottom-up approach, which are usually adopted by Non-Governmental Organizations (NGOs), which are usually collaborating with local (often non-governmental) entities, such as hospitals, businesses, schools and many more. The aim of this approach is to carry out projects that have a direct impact on local stakeholders. Both approaches are equally crucial in order to support the ICT capacity-building in these countries. The top-down approach influences largely governments and regional organizations, in favor to create favorable political and regulatory environment, whereas bottom-up approach works with local stakeholders to locally develop ICT capacity (Pedrelli & Reggio, 2001). The bottom-up approach is where EU is really making an impact by allowing empowerments of the locals and thus giving them the necessary technical and organizational skills to individually develop the future projects without any foreign help.

Mudziwepasi et al. (2014) say in their studies that most of ICT4D studies and projects have been aimed to improve the economic well-being, such as livelihoods. It is clear that the future work of ICT4D will broaden the definition of well-being beyond economics. But there are still many issues that needs to be improved such as systematic poverty, equality for women, healthcare and many more. One of the solutions was to deploy ICT4D platforms to spread information to the community, such platforms are e-Commerce, e-Health and e-Judiciary. In 2010, e-commerce platform was set up for the Dwesa community, in South-Africa. This shopping portal enables customers buying online to get points and with these points, customers could then trade for rewards. E-Health system aimed to deliver important information about health around the community. This again provides Dwesa community with a number of beneficial solutions to their problems by maximizing the potential knowledge by sharing and delivering western medical knowledge, indigenous knowledge and traditional knowledge to the people. E-Judiciary platform's primary objective was to support the traditional justice administration, due to lack of legal environment in Dwesa community. The people were provided with an understanding and knowledge about their judiciary operations and services. These platforms have not only served as a tool to spread information, but also helped to eradicate their level of illiteracy by educating and providing information. (Mudziwepasi et al., 2014.)

### 3. Education in developing countries

Only few children graduate from secondary school in developing countries, many do not even finish primary school. There are various reasons of why children are having difficulties to go to school, such as the cost of schooling and poor quality of education, which is why ICT4D is needed. Even nowadays there are many challenges regarding education in developing countries, but also in developed countries, nevertheless there is a reason why schools everywhere are investing heavily in ICT. The role of technology, in typical traditional school environment, is to ease, through increased effectiveness and efficiency, the education of various skills and knowledge. ICT has reshaped teaching and learning processes in higher education and it is more critical today than ever. As a result of technology emerging and increasing in almost every organization and company, employees must have some level of knowledge of today's technology to some extent. This chapter will include the benefits of ICT in education and the factors that influences teachers' adoption of ICT in their teaching and learning processes. Ultimately, technology is to serve as a tool to increase student achievement in schools.

#### 3.1 Defining developing country and means for a better living standard

Countries with low human developing index and industrialization are termed as developing countries, but the term "developing country" can be criticized since it is very Western oriented, and the development is mostly viewed from the western's perspective. Developed countries provides secured and healthy atmosphere to live whereas developing countries are usually far behind by the lack of these factors. (Kasteng et al. 2004.)

There are two general approaches that can be distinguished when talking about situations in developing countries. The first one is the fight against poverty, this approach focuses on hunger, poverty and misery and what can be done to reduce poverty in developing countries. One characteristic in this approach is a strong involvement on an inhabitant level. Second one is the analysis of social economic and long-term economic. This approach concentrates on the developments between different countries, historical periods and regions to gain a better insight of factors that could be used to have a better understanding to create a long-term effect on the dynamics of socio-economic development. (Szirmai, 2015.)

Cities all over the world are growing day by day, but developing countries are having most difficulties in managing the ongoing change and to reach to the stage where livable conditions are achieved. Fast growing countries such as Vietnam, Bangladesh, Pakistan, etc. are developing, but cannot be considered to have achieved that livable condition yet. There are about 400 cities that have over million inhabitants and over seventy percent of the cities are located in developing world. Even though the increasing rate of urbanization is great for economy, it comes with many challenges to ensure the sustainable use of space. The growth of population is clearly visible in fast-growing cities of developing countries, these countries usually face many unfortunate challenges when trying to improve the quality of lives. While trying to deal with these challenges, the living standard of these cities usually declines. According to World Bank report in

Sakkhor (2018) article, these countries must be ready to house an additional 2.7 billion people between now and 2050. (Sakkhor, 2018.)

Although the rise of ICT is not a cure for poverty nor improving living standards of people. However, with right tools and information, ICT can help in finding a solution for these issues. One great example is presented in Weigel and Waldburger's research. India used to face a major issue regarding the food front, but after the use of biological technologies, Indian farm scientists worked hard to transform food-deficient country into a food-surplus country in just a few years (Weigel & Waldburger, 2004). Of course, the success wouldn't have been possible with only science and scientists; the farmers had to rise to the occasion, to try out newer varieties and farm practices. These drastic changes can not be done only by the power of technology but requires the change in people and enlightened political leadership. Many of developing countries remain poor since the knowledge of digitalization is lacking and, in this manner, they let the Industrial Revolution pass them by. To achieve the success of industrial revolution, these countries need to understand few key elements. Technology and techno-infrastructure doesn't mean having only computer and the Internet, it requires much more. What is needed is a careful but rational blend of modern technologies depending on what current issues developing country is facing. Secondly, people should understand the value of information they get from these technologies and how information can be used immediately to improve their day-to-day lives. Also, the content must be in their local language for a better understanding and user-friendly use. People also needs to understand that men and women doesn't need to have the same kind of information. *"It is important to operate on the principle of social inclusion including the poorest and the most underprivileged"* – Weigel & Waldburger (2004). These are few factors that must be understood to achieve the digital happiness.

Another issue that developing countries face are promotion of local content and knowledge. The availability of development information, educational materials and other important resources should be in their local language to encourage the use of these contents. In other words, before applying ICT on larger scales, the content must be evaluated to identify suitable model for each region. Salaam Diakite, of the African Academy of Languages (ACALAN), felt that the teachers needed to be educated through in-service, and pre-service training for them to fully understand their role in society and to create curricula following development strategies while taking advantage of technologies (Weigel & Waldburger, 2004). UNESCO has listed various examples of tools that are involved in numerous steps in knowledge sharing. These steps have evolved over time as a mean to create, record and distribute knowledge.

Creation	Preservation	Dissemination	Utilisation
<ul style="list-style-type: none"> <li>- Oral creation</li> <li>- Pen/pencil</li> <li>- Computers</li> <li>- Software</li> <li>- Cameras</li> <li>- Mobile phones</li> <li>- <b>Internet (applications)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Paper / printing</li> <li>- Recording devices</li> <li>- Magnetic tape</li> <li>- Hard drives</li> <li>- <b>Internet (storage)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Oral dissemination</li> <li>- Paper / printing</li> <li>- Photocopier</li> <li>- Telephony</li> <li>- Broadcasting</li> <li>- <b>Internet (hosting)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Computers</li> <li>- Mobile phones</li> <li>- Televisions</li> <li>- Radios</li> <li>- Education</li> <li>- <b>Internet (access)</b></li> </ul>

**Figure 3.** Examples of tools used in various steps of knowledge sharing (UNESCO, 2011, p. 15).



### 3.2 ICT4D in education

The adoption and integration of ICT into teaching provides students and teachers a better opportunity to work in a digital age. ICT has a potential to play an important role in education be it in developed countries or developing countries. It offers exceptional potential for both students and teachers to harness the power of ICT to not only improve the teaching and learning but also to build a stable future. Many developing countries have recognized that by enabling students to connect to knowledge available in wider worlds they become more active processors with the knowledge rather than a passive recipient of learnt knowledge. (Peeraer & Petegem, 2010.)

For students to acquire desired skills in this field, they need someone with a lot of knowledge and skills of today's technology to instruct them. Lack of teachers with proper skills is one of many challenges in developing countries, fortunately there are many projects that aim to improve the level of information technology expertise among youth. One of the successful projects is called SPARK (Youth Movement in Information). The purpose of this project is to improve the IT expertise among youth and to encourage volunteering. It supports young people to develop needed skills to participate in the new information-based global economy and to make them realize their full potential in networking and IT skills. Explained in the case study; "ICT education for development – a case study" written by Tas (2010), advanced and experienced IT technicians; master instructors, are volunteers from Cisco NetAcad e-learning system and their duty is to train other volunteers so that they could then pass their knowledge to other young people outside the project. The duration of these courses are about 70 hours, each class consists of 10-15 people depending on the demand and the instructors are present this whole-time giving instructions and deciding how to program along with participants. Volunteers are then encouraged to open "instructor trainings" locally to continue to spread and sustain the teaching process in the future. In the end of the class, every participant receives a certification of graduation from SPARK. (Tas, 2010.)

The project was initiated in 2006 and by 2008 the project has trained over 1300 young people in over 20 cities in Turkey and in Baku. The method in the class is peer-to-peer training. Since the participants and instructors are close in experiences, ages, educational levels, it makes the teaching method even more efficient. With similarity in many personal identities it is easier for participants to bond with the instructors, thus receiving and improving the technical expertise of all concerned. According to Tas (2010) the best way to learn is to teach and considering the small size of classes, presentations are being held to not only improve their communication and verbal skill, but also improving their teamwork in groups. This way local instructors gain the confident and experience before they begin their professional work life (Tas, 2010).

Service Learning is another method to implement the ICT in meaningful community services. For instance, ICT4D Project is used as a tool for Service Learning in Barcelona School of Information of UPC-Barcelona Tech. Working in these projects, students gain new perspective on life, values and will have a real impact of technical solutions outside the familiar environment. In these projects, engineering students offer time and knowledge to develop the projects, usually refurbishing old-fashioned or broken computers, or developing new software as part of their bachelor's or master's thesis. In return, they receive the broad education necessary to understand the impact of engineering solutions in global, economic, environmental and societal contexts. (López et al., 2012.)

According to Courville (2011), technology can aid people in educational achievement in two main methods: the utilization of knowledge, rather than its retention and removal of physical barrier to learning. The growth of information and the development of searchable databases are accessible on even remote handheld devices, meaning that it will change the way learning objectives are defined. People does not need to memorize information anymore, rather they can develop their skills to utilize e.g. online databases for improved research. Technology can be used to develop different databases that could alter professional development for teachers. One growing database technology is known as EPSS, electronic performance support system. This technology provides job related assistance information whenever one may need it. For example, instructions can be found from EPSS, if a teacher is having an issue related to writing lesson plans according requirements of school district. (Courville, 2011.)

The removal of physical barriers allows teachers and students for a greater accessibility in regard to graduate education. As reported in Courville's paper, before the Internet, engaging in a learning community and distance learning required the users to have a close degree of physical proximity amongst community members. Nowadays many educational programs have shifted into programs that allow distance learning. The use of distance learning is not limited to only university settings, but can also be found in e.g. district, school sites, and state levels of professional development for teachers, in a form of web-based seminars and conferences (Courville, 2011). In addition, students and teachers may create their own learning communities by sharing information found from the Internet, giving them no restrictions even if one is in another country.

### 3.3 Education as a common challenge

Education has been one of the main aspects to focus on when talking about creating sustainable world; at least in developing countries. Creating the working educations system with available resources to fully support and provide young people with much needed skills to work and participate in the global economy has been an ongoing struggle. Even though the quality of education has grown extremely by utilization of ICT, it is still fairly behind when compared to developed countries. There are many factors that affect the education in developing countries, such as poverty, rural areas, socio economic status or even lack of teachers. (Aleed, 2016.)

There are many reasons why education in developing countries are so bad. Aleed (2016) mentions in his report few issues that are affecting the quality of educations. The first reason is memorization, which is the traditional method used in many countries. To get a better understanding of things learned, one must be able to associate the learnt knowledge with everyday situation rather than memorizing the facts without fully understanding the meaning behind it. Another problem of the traditional method is that the curriculum is taught in their native languages instead of international academic language of English. Aleed (2016) quoted Almazrouni and Almekhlafi (2012) in his report that according to them "it was found that studying the course in the native language led to the lack of technology resources." Using the traditional ways of teaching particularly with their native languages, creates a communication barrier between them and the international academic community that then complicates students from participating in quickly globalizing society of today (Aleed, 2016). Although, this claim could be criticized, since teaching in their native language allows them to understand it fully, without leaving them questioning the small details missed when taught in English.

Besides the poor quality of education, there are also technological problems that are slowing down the progress of development. The first reason is that modern technology in classrooms are not so common in developing countries. According to Aleed (2016), the ratio of students to computer can be 20 to one, which creates a gap in learning between students. It is proven that technological advantage does not only have a positive effect on students' attitudes but also achievements in all subject areas and with educational technology the instructions are more student-centered (Aleed, 2016). One of the reasons why developing countries have technological problems is that because of the high cost of technologies. Even if the technology is low-cost there are not enough experienced teachers who can operate and teach using these technologies. This then leads to a slow progress of education for students when teachers are not equipped with the experiences and skills that could be used to get the information across the classroom in a proper way.

As Courville (2011) mentions in his paper that major issues in the use of technology in education can be divided into three main areas: integration of modern technology into existing education programs and learning theory, the evaluation of technology effectiveness within education environment, and trials of successful technology integration into related fields. Technology can be merely a distraction to the educational process which could be awfully costly in terms of finance and time, unless it can be supported by learning theories. Throughout the history, learning theories have been built through all kind of researches and design principles to explore their assumptions and tenets. Learning theory provide teachers insight into how individuals learn and thus provides a base for designing an effective lesson plan. Even if learning theories are supported by researches, it should be taken into account that those theories may not keep up with development of our modern technologies. However, any new development of technology could be compatible with learning theories, as long as technology is used as an educational purpose, instead of merely for the sake of technology. (Courville, 2011.)

Still, we cannot assume that every new technology compatible with learning theories are increasing effective learning. To ensure the effectiveness of implementation of technology into education, one must evaluate instructional design using certain empirical methods. Courville (2011) points out in his paper, that one empirical method that focuses on training programs is known as the Kirkpatrick Four Level Model; which is composed of four levels of a training program: reaction, learning, behavior, and results. Which can be seen in a form of pyramid, in a figure 4.



**Figure 4.** Four levels to measure results by Donald Kirkpatrick (Courville, 2011).

This model consists of four levels which starts from the bottom in figure 4 and slowly gets progressively more important as it rises to the next level. In reaction model, employees; in this case teachers, will react to the training they receive, and their initial reaction will be measured to gain an understanding of the training program. After the reaction level, the information absorbed during the first level will be measured by post-tests or hands-on assignment which will show participant's learning during the previous level. On behavior level, the use of new skills during participant's day-to-day jobs will be inspected whether participants did incorporate it into their behavior. After the success of tests and discoveries, the results can be seen in an improvement and effectiveness of participant's work (Gog & Seet, 2017). Thus, when faced with new educational program, we can analyze the development of teachers through the model and see its effectiveness in the change of teachers' behaviors and their performance.

Another issue, while implementing technology for educational purposes, concerns the use of technology within other fields of education. One must understand that the education is not the sole monopoly of our primary, secondary, nor university educational system. Instead, it is a lifelong process of development to improve one's performance, advancement in career and learning of new important information. For example, healthcare, business and the military have found various methods to meet their constituent's needs by using technology, along with unique challenges that comes hand in hand by using technology for educational purposes (Courville, 2011). In business field, two trends are being followed regarding the use of educational technology to train and to develop staff: the increased use of technology in training and the global use of training. The increased use of technology within training programs are often the matter of the need for fast development and delivery of training sessions. Many companies have branches in different countries and regions, with different learning language and culture, thus technology is allowing customizable lessons that can be edited to break the language barrier to fit into local cultures (Reiser & Dempsey, 2007).

Another common phenomenon is the gender imbalance in educational institutions. Since chances for education is being denied from women for many reasons: gender stereotypes, costs, gender-based violence, legislations, policies, budgets, etc. While many efforts are put into action to rectify gender imbalance, there are still number of works to be done across all of the educational system. According to Teferra and Altbach

(2004), efforts have been made in Ethiopia by lowering the cutoff in the grade point average for the admission requirement to improve the female enrollment rate (Teferra & Altbach, 2004). To break the cycle of female deprivation from education is to educate girls, not only does it provide them with economic benefits, it also generates much larger social benefits. Education has a huge social impact in their lives, since it gives them the extra income they need, the knowledge and awareness to choose the right decision and the extra leverage it affords them within the family. Although the gender inequalities do not only occur in developing countries, for instance, in a report published by UNESCO (2012), it presented that “gender disparities and inequalities are prevalent within the schooling process in both wealthy and poor countries”. To decrease this inequality, one must understand to de-stigmatize the importance of education and make sure it is equally reachable for both genders in all the world (Aleed, 2016).

## 4. Discussion and implications

I studied ICT4D to broaden my own view and to learn more about its impact in developing countries. Information in this thesis can be used by user of every age to gain more knowledge of ongoing issues in developing countries. When writing this thesis, I made few observations. First, the imbalance of technology gap divided around the world is still huge, although it is narrowing as the digital devices and the use of Internet becomes more available. Second, the education in developing countries still lack behind with numerous problems that could be fixed. Third, it takes more than time and research to fix these problems, people must be willing to accept the changes that could be beneficial on economic and social scale. (Aleed, 2016.) This final observation is in my opinion remarkably important, since the changes must come from within individuals. If people are not willing to accept helps that certainly require changes, then it is not possible for them to make any progress in development.

The main research questions here were following: implication of technology in educational system in developing countries and ICT4D's role as a mean to improve lives. Many solutions were introduced in this thesis, but as we saw, not many were that effective in fixing the problems. When implementing technology in educational systems, we must first evaluate many variables to identify the suitable model for each region. Even if a suitable model is found, it is not enough if the teachers are not skilled enough in specific field to teach their pupils the skills needed for them to establish a steady life (Aleed, 2016). Finding proper educational model is hard, even in developed countries, but the problems in educational system of developed countries are small compared to the developing countries. Technology are not fully taken advantages of in developing countries, which have an impact in their educational system. Many reasons were mentioned in this thesis, such as high cost of technology, bad way of teaching, teaching in native language, etc. but when taking a closer look, there are many more reasons that affect the education in developing countries (Aleed, 2016). One main goal for ICT4D is to improve the education system in developing countries. Better education could provide better opportunities to work in growing digital age and to offer potential to harness the power of ICT to build a more stable future. Although it might sound easier than it usually is, there are great number of problems that must be taken care of to somewhat head in the right direction.

ICT4D movement has had an enormous impact in this subject, since its main objective is to improve the problems mentioned in this thesis. Of course, the goal of this movement is not merely to improve one field. It has countless goals in their sustainable development goals, such as: ending poverty and hunger, gender equality, clean drinking water, decent work and economic growth, reduced inequalities, climate action, etc. (Aleed, 2016). It seems to me that ICT4D could risk the initial motive by focusing on countless goals at the same time. Although, some may argue that it is beneficial from researchers' point of view, by researching different fields, we may possibly implement other field's findings to another field to reach objectives one by one. According to literature used in thesis, the link between technology and living standard is obvious. Technology brings many opportunities for not just the people but the economics of the country. Not only can ICT be used in education, it can improve the systems in many other fields, such as healthcare, since computers are becoming more powerful, wireless

technology advancing, satellites and optical fibers' transmission capacity increasing, and software developments facilitating many works digital materials This growth will open many job opportunities for people in developing countries, especially for women. Many current ICT4D projects are aiming to improve the economic well-being but will in future broaden the definition of well-being beyond economics (King & Hill, 1993). People must be "taught out" from their traditional ways to make way for a more suitable one. Having an open mind and good education is a step forward to achieve the sustainable world in this digital era (Mudziwepasi et al., 2014).

When we talk about the term 'developing country', there are many definitions for it. Although we must keep in mind that it can be easily criticized since the term comes from developed countries and it is very western oriented. Few criteria for developing country were listed in the paper by Kasteng, Karlsson, and Lindberg, such as, classification on the basis of GDP per capita, common characteristics, net trade positions, geographic location and finally basis of human development (Kasten, Karlsson & Lindberg, 2004).

Figure 3 provides few examples of tools used in four different categories of knowledge sharing and how these tools fit into the stages of local content development. Although there a many tool used, we only break it down to few of the most common tools applied these days. Mobile phones have become one of the most common communication tools used in the entire world and according to UNESCO, mobile subscribers reached to almost 6 billion in 2011. The growth and use of mobile devices have made voice communication possible throughout the world and it is available in almost every country in the world. Maybe the most important content creation tools these days are computers. Ever since the introduction to computers, people have been using it to create new content every day and it has become people's general-purpose machines for not only content creation but also for consuming. The Internet plays an important role in present day's content sharing and consumption. As figure 3 bolded text, the Internet is the only technology that supports all four steps of knowledge sharing and content creation. We can come to that conclusion that the use of ICT in developing countries can improve people's daily lives in many aspects, but only when the proper training is given, and the content is in their own language. (UNESCO, 2011.)

## 5. Conclusion

Based on previous research, we can assure that the issues related to education in developing countries are real. Even if there are many movements and projects that are trying to diminish these issues, it is not a one-day-job. It takes time to fix the problems which occurs not just among citizens but could further reach to much larger scales. ICT4D being one of the movements that are still active and have succeeded at some point, to eliminate few of the problems.

As technology keeps growing, many countries benefit from what technology offers. Technology has known to give all kind of benefits in almost every field, such as in education, healthcare and even in politics. But the problem is that the diffusion is not equal, even though the gap is closing frequently. Limitation of ICT in developing countries have created many issues that are affecting not just the individuals but even the economics of the country. Thus, as mentioned before, ICT4D is correcting these issues in several ways. The impact of ICT4D is examined in various areas related to many factors, which covers different fields, but most importantly it covers cultural, regional and urban development, education, health and poverty.

In this thesis, I focus on the impact of ICT4D in developing countries, more precisely the education within these countries. ICT4D is a movement that focus on reducing numerous issues that occur by the lack of digital knowledge, education, etc. ICT4D 0.0 originated in 1956 in Kolkata at the Indian Institute of Statistic for scientific calculation work by an instalment of the first computer. ICT4D 1.0 was initiated after that in 1990s by the growth of ICT and spread of ICT within developing countries, although the outcome was much of a failure. Failures then led to the existence of ICT4D 2.0. By learning from previous mistakes, it took another turn to push forward the main purpose it was meant to do. There are still no general agreements on what ICT4D 2.0 looks like, but one thing is certain, it is continuously evolving.

As the world is digitalizing, the adoption and integration of ICT is very important to keep up with the rest of the world. Therefore, developing countries must integrate ICT into teaching to provide student and teachers for a better opportunity to work in this digital age. It is recognized that by enabling students to connect to information on the web, they become more active processors with wider knowledge rather than traditional way of teaching. One reason for these issues regarding education was the lack of teachers with proper skill and knowledge, fortunately there are many projects and movements that aim to fix these problems, one of them being SPARK.

Few problems were mentioned in the paper, such as the way of teaching in developing countries. In many schools instead of fully understanding the meaning behind the teachings, students rather memorize everything what has been taught. People in developing countries also have problems engaging in international matters, since the education is usually in their native language, which creates communication barrier between them and international communities. This could further on be problematic when applying for jobs. One ongoing battle has been gender imbalance in education institutions, women are denied education in developing countries for various reasons: gender stereotypes, costs, gender-based violence, legislation, budgets, policies etc. If



this cycle can be broken, it could benefit the country on economic and social level. Thus, many projects aim to fix these problems, such as SPARK, which has trained over 1300 young people in over 20 cities in Turkey and in Baku within two years. It is clear that the distribution of technology is not equal. Division between two groups that benefit from digital economy and those who does not is one of many definitions of the term Digital Divide. Many questions could be asked concerning the digital divide although not every question can be answered with any certainty, therefore ICT4D exists; to find answers to these questions and possibly find solutions for current issues and upcoming ones.

Some limitations to this study include that this is literature review of the topic; thus, no empirical research methods were used. This study only focuses on the education in ICT4D, and that is a limitation as well. Possible topics for future research could be ICT4D but by expanding the scope from education to healthcare and other bigger factors that affects the lives of people around the globe.

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