

TOWARDS GENDER EQUALITY: GENDER AWARE IT

Maria Samoshkina

*Dissertation submitted as a partial requirement for the conferral of the
Master in International Studies*

Supervisor:

PhD Ricardo Miguel Almeida da Silva Falcão, Integrated Researcher
CEI-IUL - Centre for International Studies (ESPP), ISCTE-IUL

Co-Supervisor:

Professor Luís Nuno Valdez Faria Rodrigues, Associate Professor with Aggregation,,
Department of History (ESPP), ISCTE-IUL

ACKNOWLEDGEMENTS

First and foremost, I would like to express my most profound gratitude to my wise master dissertation advisor, Ricardo Falcão. The greatest supervisor, who have always been extremely helpful, always available with suggestions, always providing valuable feedback, supportive and encouraging throughout the writing term. Dear Ricardo, thank you for helping me shape my research path with your incredible knowledge, thank you for guiding me all the way through to the right direction, for your patience while dealing with my emotional issues, for your enthusiastic encouragement and for every edit you have done.

I want to express my deepest gratitude to the whole team of Jiggen Tech Hub and, precisely, to the Training Lead, Ndeye Coumba Diouf. Dear Coumba, thank you for your valuable inputs, priceless information, fast coordination and time. It was incredibly motivating and empowering to learn your insider views on gender equality in the context of Information Technology in Senegal. I can state with certainty, that JTH inspired me to do a volunteering work.

Given the complexity of the research steps, circumstances and my type of personality it was a difficult process, with ups and downs, so I want to thank the ones who were always there to support me and did not let me to give up.

The completion of my dissertation would not have been possible without the support of my friends, who had to deal with my complaints and tears during the study process, specially before the deadlines. Kristina Shmeleva, thank you for sharing the love for Africa, pushing me through all the difficulties, for your emotional encouragement, entertainment and care. You are the most true friend and I will never forget, what you have done for me.

Nino Gozalishvili and Mariam Zibzivadze, your contribution to this work is outstanding. I cannot find the right words to express how I appreciate your incredible help, chocolate aid, library sessions and continued empowerment throughout this difficult period.

It is a pleasure to thank the family of José Paulo Afonso Esperança and Maria-Conceição Santos and Pedro in particularly. I am happy that I have chosen ISCTE-IUL for my Master degree. Without you it wouldn't have been possible. Thank you for all your help and support.

Finally, deep and sincere gratitude to my family for their continuous love. Especially, I want to thank my mum, who was always there for me with the right words despite of the distance. And special thanks to my brother, Misha, who kept asking when I am finally going to finish my thesis every day.

SUMÁRIO

Esta dissertação foca-se no desenvolvimento tecnológico e desigualdade de género na África subsariana. Parte de uma análise geral sobre a situação da tecnologia nesta região e de uma análise das políticas, usando um quadro analítico onde as tecnologias de informação e a desigualdade de género dialogam. Nestes termos, problematiza o acesso limitado e desigual distribuição de oportunidades aos mercados de tecnologia por parte das mulheres, particularmente vinculados no continente. Analisando os grandes determinantes socioeconómicos e culturais, esta dissertação faz a ponte para o caso do Senegal através do estudo da iniciativa Jiggen Tech, lançada precisamente para dar resposta à complexidade das desigualdades. Jiggen Tech fornece um exemplo relevante para outros Estados e sublinha a possível adopção de mecanismos desenvolvidos nos diversos projetos analisados nesta dissertação. Finalmente, a dissertação sumariza e avalia criticamente os impactos positivos destas iniciativas relativas à questão da desigualdade de género.

Palavras-chave: Igualdade de género, Senegal, TIC, STEM, mulheres

ABSTRACT

This dissertation focus around the issues of technological development and gender inequality in sub-Saharan Africa. It departs from a general analysis on the tech situation in SSA and focus on policy analysis using an analytical framework where the subjects of information technology and gender inequality come into dialogue. In these terms, it problematizes limited access and unequal distribution of opportunities in technological markets for women, strikingly strong in this region. Outlining the main socio-economic and cultural determinants for this type of situation, this dissertations intends to provide a link to Senegal's case. Jiggen Tech initiative launched in Senegal address the complex inequality issues quite comprehensively and offer a valuable example for other alike states to adopt the mechanisms developed through the variety of projects closely analyzed in the thesis. Finally, the dissertation summarizes and critically assesses the positive effects of these initiatives on gender inequality issue.

Key words: Gender equality, Senegal, ICT, STEM, women

TABLE OF CONTENTS

SUMÁRIO	3
ABSTRACT	4
TABLE OF CONTENTS	5
ACRONYMS	7
1. INTRODUCTION	8
Methodology	11
2. LITERATURE REVIEW	13
2.1 Technology in Africa	13
ICT Infrastructure in Africa	13
Mobile technology usage	15
Influence of the Mobile Technology	16
Development and ICT	17
Mobile technology and Development	20
Education, ICT and development in Africa	21
2.2 Gender & Technology	25
Gender inequality in Sub-Saharan Africa	25
General questions on gender digital divide. Barriers.	27
Gender inequality considering tech. Gender and education in STEM.	31
Gender, Development and Tech in International Development. Positive influence of ICTs. Women empowerment.	32
Gender and Projects of International Organization	35
3. Case Study: Senegal - Jiggen Tech	38
3.1 Diarniadio Project	38
Digital Technology Park	42
3.2. Case Study: Jiggen Tech	44
How and why did they start?	45
Trainings	47
Outcomes	49
Student's statistics	50
Barriers	51
Partnership	52
Equipment	52
Network	52
Students reviews	54
Interview highlights	54

Future targets and plans	56
4. Conclusion	56
BIBLIOGRAPHY	58
SOURCES	63
CURRICULUM VITAE	69
ANNEXES	
CURRICULUM VITAE	

ACRONYMS

ICT - Information and Communications Technologies

IT - Information Technology

JTH - Jiggen Tech Hub

MDG - Millennium Development Goals

STEM - Science, Technology, Engineering and Mathematics

UNAIDS - The Joint United Nations Programme on HIV and AIDS

HTPs - Harmful traditional practices

UNESCO - The United Nations Educational, Scientific and Cultural Organization

PES - Plan for an Emerging Senegal

1. INTRODUCTION

In the modern world technology has become an integral part of everything we do. An ability to work with Information and Communication technologies is becoming as essential to education, life and workplace success as reading, writing and arithmetic. Information and Communication technologies is the future and STEM related subjects contribute to the sustainable development not only in economics, but to everything in our everyday life. When we refer to STEM, it is not just about programming, it is about manufacturing, food production, health care, everyday things we simply cannot live without. However these innovations are hardly accessible for equally across different genders. The education in STEM should not be considered strongly from the school or university perspective. Adopting a rather normative stance on the issue, I would suggest, it is something that everyone should be equally enjoying the benefits of. STEM and IT related jobs continue growing and will perhaps carry on in the same manner. Artificial Intelligence, machine learning, cyber security keep driving ICT innovation forward. Moreover, STEM jobs are well paid. Generally, people from IT careers earn roughly almost double, than people in other non-IT. And, in case of programming, it allows to work remotely, which is beneficial for the people willing to combine work with domestic responsibilities or child care.

The following research will focus on the role of technology in advancing education, with the special emphasis on the role and representation of women in this field.

At the same time with the increasing growth and advancement of technologies all over the world, the shortage of women in STEM education and especially in STEM employment remains quite sharp. Social norms, gender stereotypes, cultural and economic barriers, lack of access to ICTs - all these factors cordially impact women in very practical sense by depriving them of potentially highly - paid careers and opportunities. Beliefs, that women cannot become successful entrepreneurs, business analysts or programmers, head posts of the companies that are held by representatives of superior sex. Businesses are bypass by not having females in influencing positions, however leadership cannot be successful without the participation of the half of the humanity. Women's input to the development of technology is crucial since women representing half the its users.

As a brief introduction of the reason I pursued this subject, I would like to put it forward, that I am a female developer myself. After earning my degree in Human Resources

in Moscow, I spent a year travelling around Southeast Asia. During my trip, apart from exploring new countries, I thought about my aspirations for the future, and I came to the realization that professional development is of a key importance for my personal growth. However, job opportunities related to my field of study were not as forthcoming as I had expected. I had no proficiency in any language spoken in Asia, nor did I have any practical skills for that matter. However, I was surrounded by people who were programming and were able to easily find remote jobs that allowed them to travel and earn much higher salaries than anybody I knew. Hence, I started thinking about entering an IT field and acquiring the same skills that my male fellows had. I wasn't sure that STEM was my field of interest, as I had never met any female developer in my life. However, coding appealed to me because there are plenty of resources available online, so I completed an online course by Codecademy. Yet, I can admit that it was not quite enough for me to just do an usual job searching and apply my theoretical knowledge in the field of interest. The lack of the female role models in the IT sphere that I had experienced was unfortunate and overwhelming. I had a chance to attend the single gendered Moscow Coding School course for programming. This course made me feel more comfortable among like-minded people who are still an apparent minority in a male-dominated field. Mentors of the school, young, motivated female graduates in STEM, inspired and advised, contributed a lot to my empowerment and confidence in the programming field and provided guidance for future development. Nobody from the student group was ashamed of asking questions regarding coding processes, but they noted that this would not be the case in the mixed-gendered class. At that time, I had not realized it, but I faced a common gender-based barrier, when gender stereotypes subconsciously lead girls and women to a conclusion that ICTs is strictly male-oriented domain. Thus, this type of atmosphere facilitated entering the field for me.

For the same reasons such as providing a “safe” and inclusive platform for the women learners, there are various programs aimed for women's empowerment and support in STEM education and employment all over the world. However, the focus of this study is on Senegal.

Gender digital divide in STEM, specifically in urban-rural areas in Sub-Saharan Africa is outstanding. However, Senegal, where Internet's contribution to Africa's overall

GDP is 3.3%, the highest of any African nation¹ makes is a perfect success example, the path of which other African states should adopt. Government's policy towards emergence of the country, their frameworks for economic and social development and contribution to ICT sector makes it possible. The way Senegal is promoting the inclusion of women and girls in the tech sector, contribute in Senegal being a formidable tech ecosystem. In order to shape their innovative future Senegal targets sciences, technology, engineering sciences and maths and makes a big accent to the gender equality issue: lot of activities across are being organized to encourage girls to pursue careers in the technology sector. Senegal pays a lot of attention to entrepreneurship, technology and innovation, and growing ICT Initiatives in the areas of eGovernment, digital divide, research, infrastructures and education on the national level. The new "Senegalese Silicon Valley", planned by the Emerging Senegal Plan, Diamniadio is being built - a mega digital centre - with ultra modern buildings, data centres, high education centres, but also an incubator and accelerator for technology entrepreneurs. Senegal recognizes the importance of ICT for business and making huge investments in projects improving ICT infrastructure. Elaborating more on these policies and their intended aims, I will try to categorize the means and possible ways to eliminate gender inequality within the specific labor domain.

Thus, the focus of this thesis is a Senegalese initiative Jiggen Tech Hub. Their objective is to encourage, inspire and introduce more women to integrate the technological ecosystem in Senegal through networking, training, coaching, mentoring and sharing. JTH gives visibility to female entrepreneurs and help them get funding for their projects, giving them access to the opportunities. I perceive it to be one of the leading projects because it empowers and helps the women to get more opportunities within the technology field. Many of female entrepreneurs aren't technical, but that doesn't mean they don't know what problems exist and they don't have a solution to fix it. Coding is a universal language and it is a language of solving problems. Jiggen Tech's goal is to assist women entrepreneurs development of modern technologies and information networks, which will undoubtedly contribute to the development of business and increase the income of enterprises.

¹McKinsey Global Institute,
<https://www.mckinsey.com/industries/high-tech/our-insights/lions-go-digital-the-internets-transformative-potential-in-africa>

Women need support to get a chance to demonstrate skills and abilities, since everyone is equal in their rights and opportunities. The activity, organized by Jiggen Tech include computer programming courses, weekend bootcamps, mobile app development contests, and opportunities for girls to meet with government agencies and tech companies. All of this, while being role models for women who have already entered the tech sector and who are still in education and for those, who are making their way up.

I depart from analyzing the technological development in Africa and placing the gender inequality in the center of issue. Proceeding from this to the exploration of the Senegal Diamniadio Project and its significance in terms of influencing the emergence of initiatives like Jiggen Tech. Hence, I move to in-depth, multi-faceted exploration of the case study of my interest - Jiggen Tech Hub.

For achieving my aims of the thesis I collected info via interviews and questionnaires. I have categorized main academic perspective in the field in order to outline the major arguments. Proceeding from the analysis of the relevant literature, I attempted to complement my analytical material via conducting semi-structured personal interviews with the respectful team members of Jiggen Tech Hub. That enabled me to get close to case and qualitatively valuable insights about the matter under the scrutiny.

Regarding the constraints I faced while doing this study - perhaps - recruitment of the participants of the survey was more challenging than expected, and this has slightly affected my expectations and underpowered results. There were also some restrictions on language ability involved.

Methodology

This is a qualitative study in the field of technology and gender inequality. Literature review can be used as a useful tool for gathering information about existing policies, initiatives, projects and practices related to the topic. The first chapter of the research paper is dedicated to technology in Africa. In order to obtain both theoretical insights and secondary data, which is being analyzed, a comprehensive review and analysis of the existing literature retrieved through websites, academic databases and publication holdings was made.

The research strategy for this dissertation is a case study, which aims to collect empirical feedback on the subject. As a research method, case study methodology is well

established in the Social Sciences. The case study is focused on the Senegalese organization, Jiggen Tech Hub, which empowers women to pursue careers in STEM related subjects.

The methods used in collecting data for this study consisted of personal interviews, conducted on phone, questionnaires, examination of reports, articles and personal observation. A literature search plan was developed to incorporate different searching strategies: literature databases, customized Google search engines and targeted websites. Research process obtained information from different academic studies, reports, program evaluations and documents that investigate different aspects of technology in Africa, gender and technology issues and women's participation in STEM education in African countries.

For the second part of the research, participants of the survey, members and students of Jiggen Tech Hub received questionnaires and personal phone interviews with them were also conducted. The interviews were made through audio calls, volunteers who have participated in the interviews, were informed about the study purpose and procedures, as well as risks, benefits, and confidentiality measures. During the interview, the personal background was investigated, as well as professional experience and motivation to join the Jiggen Tech on the volunteer basis. Opinions and values regarding ICTs and women empowerment in Tech, as well as gender-based obstacles and gender digital divide were obtained. Goals and plans towards future development were addressed. Members of JTH were asked questions about the beginning of Jiggen Tech, their motivation to start the hub, the way the first training was made. Processes such as trainings arrangements, schedules, bootcamps organisations were explained. Suggestions and possible solutions for women and girls, interested in pursuing a career in STEM and programming were discussed.

2. LITERATURE REVIEW

2.1 Technology in Africa

ICT penetration and utilization on the African continent experienced a significant growth in recent years. While some African countries manage to move toward the implementation of electronics, most of African states are among the least developed countries in the world in terms of the level of presence and usage of ICT (Kayisire and Wei, 2016). “Digital divide’, in other words, “the inequality between developed and developing countries regarding access to information technologies” (Alzouma, 2005) is expressed with the limited access to ICT services, primarily fixed broadband Internet, rarely high-speed. Africa is also characterized by a huge intraregional "digital inequality" due to sharp differences in the level of economic development, the possibilities of investing in the industry, in the level of education and literacy and the gender, culture and identity issue in the cyberspace (Toussaea-Oulai and Ura, 1991; Wallsten, 2005).

ICT Infrastructure in Africa

Since the second half of the 1990s the industry has been growing at an unprecedentedly higher rate than the world average, which has made it possible to talk about a "digital revolution" in Africa. The ICT boom in investments in telecommunication infrastructures fell on the early 2000s, which led to the almost ousting of fixed line networks and replaced nowadays with mobile Internet (Mark et al. 2011). Yet, the development of fixed broadband is still limited due to the underdeveloped infrastructure. Low quality and shortage of the fixed line infrastructure have obstructed the process of development of the Internet market, which caused the take up of the mobile and data services. The ease of deployment and use of mobile services brought convenience to people living in urban and remote areas (Minges et al., 2008). As a result, more than 90% of all internet connections are operating via mobile networks. However, a continuing progress is being made to increase landline telephone connectivity. Key markets for these developments include South Africa, Kenya, Nigeria, Ghana and Tunisia (Lancaster, 2017: 171).

The broadband connections in numerous new cities and towns appeared thanks to the growth of fiber coverage (Kayisire and Wei, 2016). However, mainly coastal countries have the ability to connect to the global network with high speed due to fiber-optic communication with high broadband potential along the western and eastern shores of the continent and on

island states². In rural areas and in some urban areas the access is being limited by the fixed-line networks, since the investment in fixed-line infrastructure is being side-lined in favour of mobile infrastructure. However, the quality of the networks is being strengthened by the operators by changing from 3G to LTE-based services. Growth from a low base is expected to be strong in most markets in coming years (Lancaster, 2017: 171).

Activity and investment in subsea infrastructure aimed at providing the necessary backhaul capacity to support fixed line. Moreover, a mobile traffic is also actively developing (Lancaster, 2017: 171). In this sense, it is being supported by the international submarine and terrestrial cables networks. These cables are providing the required high-speed data transmission line that provides networking facilities to relatively small but high-speed Internet service providers all around the world and support the growing flow of data. Prominent projects include cable connection between Angola and Brazil, with onwards connectivity to Miami, as well as the Liquid Sea cable being built by the pan-regional infrastructure provider Liquid Telecom along the continent's east coast (Lancaster, 2017: 173). Another 5,000-km fibre-optic undersea cable deployed along the east and south coast of Africa is the East African Marine System (TEAMS³), which connect Kenya with UAE. Another ones are submarine fibre-optic cable systems EASSy⁴ and SEACOM⁵, which service data, video and internet in South Africa with Sudan⁶.

Adoption and usage of ICT in Africa are associated with different socio-economic determinants, such as GDP, income per capita, school enrollment, poverty rate, and literacy rate (Kayisire and Wei, 2016). The ICT infrastructure in Africa has generally displayed continual growth. Nevertheless improvements are being seen in all countries, several have shown a more notable enhance than others and all African countries still have very low ICT

² Submarine Cable Map, <https://www.submarinecablemap.com/>

³ TEAMS (Kenya) Ltd owns 85 percent of the cable and the rest belongs to communication company Etisalat of the United Arab Emirates (UAE). The TEAMS (Kenya) Ltd holdings in the percentage of the fund's total assets: 32.5% – Safaricom Ltd, 23% – Orange Kenya Ltd, 20% – Government of Kenya, 10% – Liquid Telecom Kenya Ltd.

⁴ EASSy is 90% African-owned although that ownership is financed by a substantial investment by Development Financial Institutions (DFIs) including World Bank/IFC, EIB, AfDB, AFD, and KfW with the total of \$70.7 million. Major investors from South Africa in EASSy are telecommunication companies like Telkom/Vodacom (\$18.9 million), MTN (\$40.3 million), and Neotel (~\$11 million).

⁵ SEACOM, privately funded submarine cable operator, which belongs to: 76.25% African investors; 23.75% Herakles Telecom.

⁶ Internet source: African Undersea Cables, July 2017 (Version 47), Available at: <https://manypossibilities.net/african-undersea-cables/>

Development Index (IDI) scores⁷ (Measuring the Information Society Report, 2015). So, in fact, “digital divide” still takes place around the African continent and result in a limited access to ICTs for some areas (Kayisire and Wei, 2016). Subsequently I will proceed with analyzing mobile technology and its influence in order to demonstrate the general picture on the region under the scrutiny. The analysis will inform my discussion about the case and enable me to locate it in the bigger context.

Mobile technology usage

The Internet is usually accessed through computers. However, computers take for their use significant procurement, access, training and maintenance costs (Abdul Rahim et al, 2005). Development of Internet technologies moved personal computers away from the market, where now mobile is undoubtedly the device which dominates on the African continent. Mobile devices provide Africans with easy and affordable access to the Internet (Aker et al, 2010). Wireless high-speed Internet technologies have given African countries the opportunity to enter the global network without huge investments in the infrastructure (Aker et al, 2010). The price of wireless access is much lower compared to a fixed connection, what lead to an unprecedentedly high growth of mobile Internet users. The transition from fixed-line broadband Internet networks to mobile access networks is a worldwide trend, however, Africa is ahead of all other regions of the world in the growth of mobile Internet traffic (GSMA, 2017). Six African countries (Zambia, Sudan, Nigeria, Zimbabwe, Ethiopia, Kenya) are in the top ten countries in the world by the share of mobile traffic in the overall web traffic (Aker et al, 2010). The number of users are up by more than 20 percent year-on-year, with the reported number of internet users in Mali increasing by almost 6 times since January 2017. The number of internet users in Benin, Sierra Leone, Niger, and Mozambique has more than doubled over the past year too (Hootsuite report, 2017). The further growth in internet use on mobile phones is predicted. Sub-Saharan Africa Ericsson Mobility Report 2014 shows that it will increase 20-fold in the next five years – double the rate of growth in the rest of the world. Internet penetration rates may still be low

⁷ There are several major composite ICT development indices, such as Digital Access Index (ITU), ICT Diffusion Index (UNCTAD), Network Readiness Index (World Economic Forum), Digital Opportunity Index (ITU).

across much of Central Africa, but these regions are also seeing the fastest growth in internet adoption (Ericsson report, 2014).

As Nyamnjoh noted, that there are more telephone lines in Manhattan than in all of Africa. It has been observed that Manhattan has more telephone lines than the whole of sub-Saharan Africa (1999:43). The statement was corrected by a World Bank report, which notes: ‘Unless New Yorkers and their commuter friends have 12 phones each, Africa now has many more telephones than Manhattan’ (ABC News Online, 2005). Indeed, due to the very rapid expansion of ICTs and particularly cell phones, the gap between Africa and the rest of the world has started to diminish rapidly in the last 15 years. According to the International Telecommunication Union (ITU), Africa is now ‘the world’s fastest growing mobile market’ (2005: 1). Sub-Saharan Africa report from 2017 shows, that at the end of 2016, there were 420-million mobile users, or 43% of the population. There is a projected growth in the cell phone subscribers up to 500m by 2020 according to the GSM Association (GSMA Report, 2017).

Mobile technology is connecting individuals, information, markets, and services in rich, as well as in poor classes (Aker et al, 2010). However, mobile phones in Africa are shifting from being simple communication instruments into life transforming tools (Aker et al, 2010). Thus, I will focus on this argument more thoroughly and attempt to deconstruct the actual influence that mobile technology has on African regions.

Influence of the Mobile Technology

Mobile phone as a device has become an inseparable element of people’s lives all around the world. People use their phones in their daily activities ranging from accessing help and health care, useful economy-related mobile applications and services (credit distribution), as well as for keeping in touch with family, relatives and business partners, and, moreover, in terms of identity construction and feeling of safety (Brinkman et al, 2009).

It is extremely important to highlight the influence of the rapid diffusion of mobile devices on the family connection case. Comparing to mobile, usage of landline phones was expensive and complicated, which was an obstacle for maintaining the kinship bonds. Brinkman *et al* highlight the frequent example of students, who felt alone and isolated in the new environment far from home. However, nowadays, sons send their parents a mobile telephone so that they can remain in close contact (Brinkman et al, 2009).

To sum up, mobile devices represent new form of freedom. People, who were limited in the social exchange possibilities get to feel a sense of privacy, “combined with more leverage over the conditions of social interaction” (Brinkman et al, 2009). However, this idea is not entirely supported all over the world and representatives of some cultures, including people from Africa, chose to oppose this given in their everyday lives. Falcão, for example, shows how senegalese parents in rural areas see these new forms of freedom in an ambiguous way (Falcão, 2016) because these have been appropriated alongside new bodily practices (Falcão, 2014).

Even though the African parents might be contradicting this universal usage of mobile devices in everyday practice, this area that has certainly been transformed by the use of mobile phones and its related feeling of safety (Pelckmans, 2009). The mobile phone can be key element in emergencies and can be seen as a form of security to be able to call the police or the ambulance, for instance. What is more, the phone is intensively used for reassurance about the safety and well-being of loved ones (James, 2015). In this context, also, an example from Pakistan shows, that as families realised that having a mobile phone meant they were always within reach, they stopped being against girls using mobile phones for educational purposes (GSMA, 2010).

Evidently, mobile devices are not just tools for messages and calls or using as a photo camera or audio player. In her research in the geography of things Julia Pfaff found out, that mobile devices play a crucial role in individual expression and identification: “It changes identity according to the specific person and the context in which it finds itself, where its social appropriation and vice versa become visible in the object itself: the SIM card it has, the messages sent, its position in the room, etc” (Pfaff, 2009). Hence, the increasing influence of the mobile devices is only apparent for the region. The illustration of the increase in usage of mobile devices serves to not only capture its growth quantitatively in the region, but to also identify the bigger social influence the process has in the world and particularly within the studied region.

Development and ICT

If the earlier studies regarding the influence of ICT on development were mostly concentrated on closing the digital divide through providing connectivity and access for Africa’s population, throughout the contemporary studies the focus moved to analyzing an

impact of these ICTs on transforming societies and economies (eTransform Africa, 2012; World Bank, 2012). The impact of ICT on development has been widely studied and debated. Studies show that ICT contribute positively to social and economic development, global participation and competitiveness, and ultimately, growth in most developed countries. As for developing countries in particular ICT can be beneficial in socio-economic development in a ways like providing higher quality communication to communities, increasing access to education, providing easier access to information, better market reach, enabling educational programmes and facilitating access for medical personnel in rural and urban areas (John, 2005). I subscribe to this idea and suggest that while technological improvement facilitate everyday life in the modern world, they also notably transform it. Particular cultures are comparatively more vulnerable to these transformations considering uniqueness of their cultural features, traditions, gender practices and lifestyles.

In his research “The relationship between modern Information and Communications Technologies (ICTs) and development in Africa” Ambe J. Njoh highlights five main ways by which mobile phones affect development in Africa (2017). These include facilitated access and use of information, which reduces search costs. Also, it increases communication, create jobs and other income-generating opportunities in the ICT sector in general and the mobile telephony industry, promote interaction among societies and reduce the exposure of households to risks. Mobile phones can affect economic development by facilitating services delivery in such economy sectors as agriculture, health, education, finance (Njoh, 2017). A lot of attention was paid to the use of ICT in developing countries in the program "Millennium Development Goals" (MDGs), adopted in 2000 by the UN General Assembly, which analyzes wider adoption of innovative technologies in all areas of the economic and social life of African countries.

In the book “Access, Empowerment & Governance: Creating a World of Equal Opportunities with ICT”, Abdul Rahim stated that investments in technology can provide instruments for population to achieve wealth, success, better life quality, but he noted that the appropriation of ICT involves unique challenges due to specific cultural, social and economic context of the societies (2005).

The research “Impact of new information and communication technologies on socioeconomic and educational development of Africa and the Asia-Pacific” by Levi Obijiofor and Sohail Inayatullah with Tony Stevenson argues that there are serious barriers,

particularly acute in African states, to the use of ICTs in educational and socioeconomic development, “such as issues of infrastructure support, access to it, training and skills development, and hierarchical social relations which determine who has access to ICTs” (2000).

As mentioned earlier, ICT and mobile phones in particular can be used as an excellent tool for socio-economic development in developing economies. Relatively low-cost mobile technology is considered as significantly important for existing businesses (Brinkman et al, 2009). It helps to reach new markets and set up different ways of organizing trade by simplifying the connection between customers and traders and by issuing new opportunities and access to services and support, which were not previously available (Boateng, 2010). These include services such as mobile banking, mobile advertising, mobile applications and other local services (Boateng, 2010). Hence relative deprivation to access these technological advancements affect one’s opportunities of success in the circumstances of the modern-technologically advanced world.

One of the most important directions in the African development strategy is informatization of the banking system. In African countries, Internet banking and mobile banking are increasingly developing, as are ways of remote banking services. With the rapidly growing use of mobile phones, mobile payment and transfer services are gradually being introduced. Emergence of financial applications “m-money” or “e-banking” provided Africans the opportunity of financial transactions via mobile phone, including paying bills and transferring money between individuals (Porteous, 2006). As an example, a mobile banking system ‘M-PESA’ was introduced In Kenya in 2007 (M for Mobile and PESA for Money in Swahili). This service allows users to store and transfer money through their mobile phones⁸- speaking of the money services in Senegal, Wari⁹ is the leader on the local money transfer market, due to its accessibility - ID card is all what is needed to send money. This has undoubtedly helped to democratize and modernize the service throughout the country. The other leading money transfer services in Senegal that allow customers to send money safely and pay bills at gas stations and banks, are Orange Money¹⁰ and Joni Joni.¹¹

⁸ M-Pesa, <https://www.mpesa.in/portal/>

⁹ Wari, <https://www.wari.com/>

¹⁰ Orange Money, <https://www.orange.sn/2/particuliers/1/3/homepage-1.html>

¹¹ Joni Joni, <https://www.jonijoni.net/index.php/fr/>

In addition to development of remote services that facilitate everyday life through online transfers, the role of Africa as a seller and as a buyer in the world of electronic commerce is becoming more visible gradually. In this regard, ICT helps to facilitate movements of goods and services. Increasing number of small local “e-commerce” services are appearing on the digital market. Sen Boutique is one of the example, relatively modern counting less than a decade of functioning¹². According to the e-commerce index presented by UNCTAD in the Information Economy Report 2015, the highest values among African countries are in Mauritius, South Africa, Tunisia, Morocco, Sierra Leone, Zambia, Madagascar, Zimbabwe and Mali (United Nations, 2015). However, even against this background, the dynamics of growth are constrained by the low level of introduction and use of ICT in comparison with other regions of the world. In the world ranking of countries in terms of the level of ICT development and the network readiness index, most countries in Africa are taking the bottom places of the list (United Nations, 2015). The development of intracontinental and national sales, especially for small and medium-sized enterprises, is hampered by the several factors: underdevelopment of the information infrastructure, limited use of electronic credit cards, and insufficient purchasing power. Furthermore, some social and political reasons, such as the low level of literacy, awareness and knowledge associated with e-commerce and the habit of the population to use cash are playing crucial role in the development of the advanced field. At the same time, the regulatory framework is still very poorly developed, reflecting the level of trust among the ordinary people and enterprises' in network operations. Nevertheless, purchases and sales through the network are growing, new e-commerce firms are being created, new services are opening up, facilitating access to the market, in the form of payment portals, applications and platforms.

Mobile technology and Development

In varieties of sections such as agriculture, health, education, emergency response, and governance there have been created mobile phone-based projects and applications for development. Mostly in pilot projects, but mobile phones have been used as a tool for monitoring and tracking epidemics (Granot, Ivorra, and Rubinsky, 2008). Also, as a regular part of election campaigns around the world, mobile devices help to provide voter education and citizen-based monitoring of the government (Aker, 2010). Promoting literacy for children

¹² Sen Boutique, <https://www.senboutique.com/>

and adults through mobile applications and games is being practiced in some African countries like Senegal (Aker, 2009). A lot of these useful applications and programs are being created by young STEM¹³ students, which proves that providing ICT for education has significantly good influence for development.

Education, ICT and development in Africa

Sustained development as an insurer of full and productive lives is impossible without good education. Poverty, gender, race, class and location of residence play a crucial role in quality education. The overall education quality remains a challenge for African countries. Despite considerable progress, millions of children still remain absent from schools and most never acquire basic literacy skills. The overall statistics are grievous, however, in sub-Saharan Africa the numbers are outrageous: only 4 in 10 children participated in primary education in the year prior to the primary school. (United Nations, 2014). In addition, Sub-Saharan Africa and Southern Asia accounted for over 70 per cent of the global out-of-school population at every level. Furthermore, according to the United Nations' and the Sustainable Development Goals report, "Sub-Saharan Africa has the lowest percentage of trained teachers in all three levels of schooling: 44 per cent in pre-primary, 74 per cent in primary and 55 per cent in secondary education" (MDG, 2014). Influenced by the deficiency of trained teachers and appropriate school facilities, affected by poverty, geographical isolation, minority status, disability, both, male and female children are not being able to receive proper education.

However, in addition to these obstacles, in sub-Saharan Africa, girls and women are suffering from a range of gender-based obstacles and deprivations of women rights. Even though, gender equality and women's empowerment have overall improved over the decades, in sub-Saharan Africa the inequality question remain sharp and basic women rights are frequently being violated. Slowly declining, but remaining high child marriage, critical index of childbearing among adolescents, early marriage and pregnancy obstruct women from participation and benefits of education process.

One approach towards accelerating elimination of this inequality could be increasing role of modern technology in educational process. Digital technologies are unique resources with great potential for education and development. They provide opportunities for learning

¹³ Science, Technology, Engineering and Mathematics (STEM)

materials, new methods of teaching (Abdul Rahim, 2005). Studies show that children from the developing countries have impressive capacity to learn innovative technologies (Rahim et al, 2005). Regarding to that fact, Clotilde Fonseca suggests that investment in ICT and programs to develop intellectual and technology skills for young children and youth is perfect way to approach the development (Fonseca, 2005). However, as author stated in the research paper “Access, Empowerment & Governance: Creating a World of Equal Opportunities with ICT”: “Investments in technology in education projects need to be conducted in ways that allow countries and educational communities to profit from the thrust of innovation and change. No transformation in skills development will take place if the poor and the marginalised, particularly children and youth, continue to be trapped in rote technological training and in mechanical reading and writing exercises” (Fonseca, 2005). The statement once again stresses the importance of the equal distribution of the technology in order to achieve sustainable results. Moreover, unfortunately, available learning materials or laboratory equipment have a significant influence the learning process and participation and performance in education. According to the statistics, there is on average 1 reading book for 2 students or more in sub-Saharan Africa and 1 mathematics textbook for about 3 students (UNESCO, 2016)¹⁴. The ICT and Internet access seems like a possible solution: just by having the computer and Internet pupils can have all the information in e-books, online learning and open educational resources, which radically increases the efficiency of the education process, gives flexibility in skills acquisition and more affordable than traditional courses (Lee, 2009: 4).

However, one of the main challenges for technological innovations in education is that minority of African population has Internet access, as well as the availability of the computer is even more problematic. There are the organizations such as *Computers for Africa*, which are supplying refurbished computers and laptops into education and humanitarian projects in African countries¹⁵. Equipping students with the technology and ICT - based materials helps to increase the education level and support their work in a global environment.

¹⁴ School resources and learning environment in Africa, UNESCO Report, 2016, <http://uis.unesco.org/sites/default/files/school-resources-and-learning-environment-in-africa-2016-en/school-resources-and-learning-environment-in-africa-2016-en.pdf>

¹⁵ Computers for Africa, Organization, <https://computers4africa.org.uk/>

Nevertheless, it is also worth considering that, even the access to information does not necessarily mean access to knowledge. In order to be meaningful and useful, information, which ICT is providing, must be provided in a way that insures that individuals are able to understand the data (Abdul Rahim, 2005). To solve that issue, from the very beginning of the penetration of the Internet onto the continent, universities and organizations took an active role in its use, where computer literacy and information have become important elements of modern studying training. Special programs are being implemented to use ICT in order to improve the quality of education. This is being a precise objective of Senegalese women's initiative Jiggen Tech, a case study of this research, hence further in this paper this will be discussed in more detail. As another example, African Virtual University provides face-to-face and online courses "ICT Integration in Education" to "know how to use ICT as a tool for designing new learning environments for their own subject-specific purposes to help their future students to use ICT"¹⁶. They are providing all kinds of ICT software which is necessary for a learning process¹⁷ (The Virtual University of Senegal, 2003). However, according to some scholars, in behalf of educational methods, it should be noted that traditional way of education, which include communication with the teacher will still play the main role comparing to technology-based education (Graham, 1997). Which underlines the scale of challenges: let it be purely technical or coming from cultural roots, which ICT implementation faces in this country.

Another apparent example on the instant benefits of using ICT in learning for development is the research by Charles Maguire and Jiping Zhang "Effective Blended Learning for Development" where they highlight following major points. Despite the revolutionary advances in distance learning, ICT allow to immediately retrieve the need for learning information and knowledge, for example by using online searching tools. Also, they highlight, that ICT can significantly reduce learning costs comparing to traditional face-to-face model (2016).

Consequently, we can sum up that offered examples support an argument that ICT implementation in educational processes makes development fast forward, but it is accompanied by numerous challenges such as granting access to technology to wider

¹⁶ African Virtual University, <http://www.avu.org/avuwweb/en/courses/ict-integration-in-education/>

¹⁷ www.unesco.org/iiep/eng/focus/elearn/webpub/index.html

population. Moreover, to distribute these benefits equally within this population through gender terms, which will be more precisely explained in the following chapter.

2.2 GENDER AND TECHNOLOGY

Gender inequality in Sub-Saharan Africa

Gender inequality remain being a significant issue of social development in sub-Saharan Africa (SSA). From the point of view of their socio-economic situation men and women still have unequal opportunities. Despite some progress in overcoming these issues, gender discrimination still affects access and use of resources, economic opportunities and level of participation in the political decision-making processes. Meanwhile, level of gender equality is one of the main indicators of the sustainable development of any country.

The problem of gender relations is that psychological differences and values are multidimensional. Gender differences are the subjects of study not only for sociologists and psychologists, but also for politicians. In the one hand, democratization processes imply the formation of equal opportunities for individuals regardless of nationality, age or gender. But on the other hand, stereotypes regarding social norms and roles are embedded in the minds of men and women.

Most of the population in Africa is employed in the agricultural sector, from which women do about 70% of the agricultural work¹⁸ (World Economic Forum, 2018). However, according to the World Bank Reports, their contribution to this area is practically not taken into account in the distribution of income.

To obtain the information about gender parity in three important aspects of human development, such as reproductive health, empowerment, and economic status, the Gender Inequality Index (GII) has been used¹⁹. The gender gap is measured by four indicators: economic participation and opportunities (salary level), educational attainment, political empowerment, health and survival²⁰.

In most countries of the SSA Gender Inequality Index varies from 0.546 to 0.747 on a scale where "1 point" (or 100%) means complete gender equality, and "0" (or 0%) is the maximum inequality (Human Development Report, 2013). From the period of seven years, (2006 - 2012), when the Gender Inequality Index data was calculated, its highest rates were recorded in sub-Saharan Africa: in Chad (0.5594), Côte d'Ivoire (0.5785), Morocco (0.5833), Mali (0.5842) and Egypt (0.5975). The highest level of gender inequality in health care,

¹⁸ <https://www.weforum.org/agenda/2018/03/women-farmers-food-production-land-rights/>

¹⁹ <http://hdr.undp.org/en/content/gender-inequality-index-gii>

²⁰ <http://reports.weforum.org/global-gender-gap-report-2016/measuring-the-global-gender-gap/>

according to data for 2012, was observed in Mauritius, Lesotho, Gambia, Uganda, Mauritania, Cape Verde and Cote d'Ivoire, in education - in Botswana and Lesotho (Global Gender Gap Report, 2012). The share of unpaid female labor in the countries of tropical Africa reached 20.1%, self-employment - 39.2%, and female employees - 40.7%. Tropical Africa is the only region in the world where the proportion of women working for free has not declined, but even increased during the 2000s by 3.6% (Global Gender Gap Report, 2012).

The global gap in pay between men and women puts women at greater risk of facing severe poverty. Traditional women responsibilities such as household chores and child-care, significantly limits their access to employment. In this case the financial support of women from the state would play a big role for women, and, consequently, would mean assistance to their families. According to the paper “Impact of the global economic crisis on women, girls and gender equality”, “economic policies that put women's role in the first place and their interests in protecting the welfare of children can significantly mitigate the effects of economic crises.” (UNAIDS, 2012).

One of the most effective tools for achieving equal opportunities for men and women is education. However, in countries with the lowest educational indicators for women and with high infant mortality rates (Chad, CAR, Mali, Niger), girls much more often than boys stop their studies because of the inability of their families to cope with financial difficulties. This significantly affects not only the implementation of MDG-3(overcoming gender inequalities in education), but also negatively affects the implementation of MDG-4 (improving children's health) and MDG-5 (maternal health) (Millennium Development Goals, 2017). Practices that perpetuate gender inequality, early marriage and the low social status of women and girls exacerbate the consequences of gender discrimination for the whole society.

Sociological studies have revealed that the education of girls is a key factor not only in personal development, but also in the eradication of poverty. Girls who graduated from school and have not entered into an early marriage are likely to have fewer children and maintain better health. It is likely that, earning more than illiterate women, they will provide an opportunity for education for their daughters. However, early marriages and adolescent childbirth serve as an obstacle to school attendance by young women. Such situations in Africa are far from uncommon, and due to lack of literacy, the vast majority of such women are destined to have a low-skilled work.

The low level of education among women is one of the causes of gender inequality, for example, in Mali. Girls are much less likely than boys to attend primary school. Only 25% of women over the age of 15 can read and write. In Côte d'Ivoire, 11% of men and 6% of women have higher education. The reason for the illiteracy of a significant part of the population in Chad is the weak involvement of girls in the educational process: almost 75% of pre-adolescent boys and slightly more than 50% of girls are enrolled in primary school. The majority of female students for various reasons (unwillingness to study, early marriage, prohibition of parents) leave school without receiving a secondary education; only 5% of young women go to higher education institutions.

Currently, there are many international organizations that advocate for the elimination of gender inequality. One of them is Global POWER Women Network Africa, which is actively fighting for the rights of women on the continent by taking measures against the spread of HIV infection, and protecting sexual and reproductive health²¹.

Gender inequality, like any other, not only slows development, but also entails significant social and political costs. Therefore, in many developed countries (in Africa - in South Africa) this problem is taken into account when forming the state budget, which makes it possible to use the available human resources more efficiently.

General questions on gender digital divide. Barriers.

Gender digital divide refers to gender imbalance in terms of access, control and content of ICTs (Mottin-Sylla, 2005). Issues related to gender digital divide have been prevalent in discussions of the information society. However, the lack of gender-specific quantitative available data and statistics makes it difficult to give a fair evaluation for the gender issues in ICT policies, especially in developing countries (Nafkin, 2007). Anywise, studies have proved that women are more disadvantaged than men in accessing and using the ICTs (Nafkin, 2002). As Nancy Nafkin stated in her research “Women and Gender in ICT Statistics and Indicators for Development”: “If ICTs were gender neutral, affecting men and women equitably, it would not be necessary to pay special attention to women“ (2002).

ICTs are therefore of cross-disciplinary importance for the achievement of the Millennium Development Goals and for poverty reduction. The latest international

²¹ <http://www.unaids.org/ru/resources/presscentre/featurestories>

documents recognized the existence of ICTs hidden bias regarding women, and created a new challenges and milestones, such as teaching women new skills, possession of information technology, the growth of their competence and expansion of the access and use of ICTs (Robins and Hilliard, 2002).

In Africa, home access to computers and Internet is spread only among sections of the population with higher income levels or who belong to educated urban elite (Primo, 2003). According to the finding of the World Bank World Development Report 2016, 71 percent of households, which are in the 40 percent of the bottom of their countries income distribution don't have access to the internet (2016).

If women still have access, they have use a computer mostly at workspace to do a routine clerical work (Robins, 2002). Women usually work in the less prestigious and lower-paid jobs with little technological competence requirements (Robins, 2002). Even fewer women are employed in IT and STEM related jobs and rarely make decisions in this industry. In Uganda and Senegal, female Internet users make up about 31.5% and 12%, respectively (0.1% of the total population in their cases), whereas in South Africa, female users have 19% of the total number of Internet users (0.3% of the total population).

Studies show that most women in developing countries restrict use of ICTs to email usage only and women “do not exploit their digital ICT skills fully, in spite of potential benefits in relation to e-governance, e-business and online banking” (Hilbert, 2011). This has been a challenge ever since and changes are still very slow. Researches, conducted almost 15 years ago, stated that: “very few African women have used Information and communication technologies for business development, entertainment, educational purposes (Primo. 2002). Moreover, considering that the prevalent language in the Internet is English, it becomes another obstacle for women and girls are also less likely to know the international languages (Robins, 2002).

Women's ability to harness the potential of ICT are limited in different regions in different ways. According to Antonio and Tuffley (2014) there are four interconnected barriers, which can influence access and use of ICT, such as material, psychological, socio-cultural and and political barriers. Some of these barriers, like technical infrastructure availability, connection costs, computer literacy and proficiency in languages, are equal for female and male settlements. However, women are in more adverse conditions due to other factors like traditional factors, gender stereotypes, hierarchy, social rules, stereotypical

representation of gender roles, limited women's access to professional careers (Robins, 2002). Scholars highlight four factors that are most common obstacles to women's access to and use of ICTs: 'exclusion from technology education and design; limited free time; social norms favouring men; and financial and/or institutional constraints' (Antonio and Tuffley (2014), Gil et al. (2010)).

Material barriers for women can be exemplified as lack of money to access the ICTs and not being able to buy a mobile phone (Cummings and O'Neil, 2015; Hafkin, 2002; Hafkin and Huyer, 2007). Since information services usually cost money they much likely to not have enough income to cover information services spendings (Primo, 2002).

Women and girls may have less opportunities to access and use digital ICTs due to socio-cultural barriers. Hafkin highlight 'collateral cultural factors', that is 'cultural attitudes based in gender bias, and not the immediate gendered identification of technology use' (Hafkin, 2002). As an example, women are more probable to have less time than man to browse the Internet due to the domestic responsibilities. or use of ICTs might be restricted by male members (Cummings and O'Neil, 2015). Also, a lot of girls and women are occupied with family and domestic routines instead of attending the school or would otherwise get married and not get any education at all. In many African countries there are social preference for boys and there is more investment into boy's education as well. Traditions and social rules might also affect women's mobility: for example they might be allowed to move away from rural or urban areas, or even just simply not allowed to travel unaccompanied. However, ICT can work as a solution for this issue due to the possibility of work done from home.

Despite material and social-cultural barriers, there are also psychological barriers which affect only women access to ICT and their participation in IT and STEM related jobs. Scholars highlight "technophobia," or fear of technology, as one of the most common one. Psychologically, gender stereotypes may lead women and girls to think that ICTs is strictly male-oriented domain. Consciously or unconsciously, by parents' or teachers', but this belief has been implemented in girl's and women's minds from early childhood. Sophia Huyer called the phenomena, when girls are being attrit in the ICT and STEM system, research and development in all the levels, a "leaky pipeline" (2002). This might affect girl's desire to learn new skills and have a significant self-doubt effect on their confidence of use of technologies (Cummings and O'Neil, 2015).

Limited institutional opportunities to access digital ICTs are considered under the category of political and institutional barriers. Antonio and Tuffley (2014) name informal social norms as one possible reason for this, but, according to Cummings and O’Neil (2015) formal political institutions may also influence women ability to use ICTs. Also, governmental ownership of media and technology “may also establish and increase existing gender stereotypes and limit women’s ability to use digital ICTs” (Antonio and Tuffley, 2014).

Unfortunately, despite there are human rights instruments, which guarantee the rights of all human beings, there are some traditional practices in Africa, which discriminate against women status and threaten their lives. Usually aggravated by the existence of poverty and illiteracy, Harmful Traditional Practices (HTPs) still take place and have an extraordinary influence on well-being of girls and women. HTPs, defined as “all behaviour, attitudes and/or practices which negatively affect the fundamental rights of women and girls, such as their right to life, health, dignity, education and physical integrity” in Article 1 in the Protocol to the African Charter on Human and Peoples’ Rights on the Rights of Women in Africa (Maputo Protocol) exist in many different forms. Some of the major HTPs practiced in Africa include female genital mutilation (FGM), early/child marriage, marriage by abduction and son preference (Wadesango, 2011; Gómez et al, 2017).

“While it is not clear if child marriage causes school dropout or vice versa, it is clear that child marriage often means the end to a girl’s formal education”²². Early marriage and teen pregnancy keep girls out of school (King and Winthrop, 2015).

Many families choose to educate sons rather than daughters. Son preference is usually characterized by a lack of attention to daughters, which, in exceptional cases it can lead to selective abortions or the killing of newborn girls. (Basu and Jong, 2006). This practice deprived girls of the rights which are stated in Art. 2, 6, 12, 19, 24, 27 and 28 of the Convention on the Rights of the Child, 1989, such as right of a good healthcare, education, recreation and economic perspectives. Parents may see educating boys as investing in future wage earners.

However, to address this issue later in this paper, Senegalese female initiative, which aims to tackle gender inequality, Jiggen Tech Hub will be discussed. In my opinion it is on

²² <https://www.girlsnotbrides.org/themes/education/>

the contrary the positive example of engaged women, who are changing the traditional attitude and stereotypes, despite of any difficulties listed in this chapter.

Gender inequality considering tech. Gender and education in STEM.

STEM-based careers provides employment opportunities, which have a positive effect on the unemployment rates in the Africa, since it is the the most in demand skill, which has an advantage of remote working (Khalifa, 2017). Besides, digital capabilities have a huge impact on the overall economic growth; “estimates that the digital economy, involving some form of digital skills and digital capital, represents 22.5 percent of the world economy” according to the studies done by Accenture (2017). It provides equal opportunities, diverse creativity, eliminating prejudice, new knowledge and solutions. STEM education and programming in particular helps to develop critical and computational thinking, which helps to develop problem-solving skills, which can be used to develop solutions for Africa’s unique regional challenges. For instance, the case study subject of this thesis is a coding and tech community Jiggen Ci TIC for young women, who partners with UNESCO and provide the trainings and competitions, where girls are presenting mobile apps to tackle local issues, for example, there is the project allows pregnant women to keep medical records for themselves and their children on a mobile device, mobile phone application Weccio that allow teachers, parents and students to exchange books and supplies. Or, women developers have created the app, which allows people to find out if the piece of land is free or already owned to address the frequent land rights problems in Senegal (Al Jazeera, 2016).

However, even though presence of women in the STEM education is important for the sustainable development, women's involvement in the field of STEM is very low all over the world, but in Africa the numbers are outstandingly low. Talking about coding and science, technology, engineering and mathematics education in general, we can observe a wider gender gap than in any other education sphere. According to the United Nations report, there are interrelated factors which contribute to the girl’s involvement in the computer science, STEM-related subjects and education in general, which can be divided by four levels, such as individual, family, institutional and societal. Among those factors there are parental beliefs and expectations, teachers’ profile and experience, access to learning materials and resources, gender stereotypes and biological factors that may influence girl’s abilities and motivation (UNESCO, *Cracking the Code*, 2017: 40). Of course, there are physical differences between

men and women, but there is no proof of difference in neural mechanism of learning, no evidence of genetic differences in cognitive ability between the sexes. Some little differences can be differently interpreted, but mostly the biological differences bias result from the stereotyped ideas and the social construction of gender. Also, the psychological factors are very important in the girl's participation in STEM, and they are being influenced by a number of contributors. Enormous role is being played by parental position and involvement, which is being influenced by the society's cultural norms, since the perception of the girl's future life and career is often based on patriarchal attitudes and related social norms regarding the gender roles.

Parents and teachers have a direct impact on student motivation, intellect, and social, and development. These traits encompass a student's sense of personal aptitude and ability for learning. Students with a high level of self-efficacy believe they can perform well in school (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996). Mastery orientation, a perception that one has control over their school outcomes is another characteristic attributed to parental involvement (Gonzalez, Holbein, & Quilter, 2002).

Gender, Development and Tech in International Development. Positive influence of ICTs. Women empowerment.

Interest in ICTs on the part of Francophone African countries are aligned with the ability of ICTs to promote the development objectives of Millennium Development Goals, especially gender equality, empowerment of women and the eradication of extreme poverty (Mottin-Sylla M., 2005). However, ICTs, online tools and information it provides cannot be empowering in case women do not, or cannot, use this data to make informed decisions or push the changes. (Cummings and O'Neil, 2015).

O'Neil and authors (2014) refer to empowerment as 'a process of personal and social change through which women (or men) gain power, meaningful choices and control over their lives'. Empowerment is a multidimensional concept, for women it can occur in different dimensions of their life. To understand what impact ICTs can have advancing gender equality and reducing poverty, it is important to analyze the dimensions where the gender inequality is taking place. In his research, Ogato (2013) highlights six major dimensions of impact of ICTs on women's empowerment in least developed countries: economic, social, political, legal, technological and psychological.

In economic dimension ICTs is being used as knowledge and networking tools for targeting initiatives to enlarge women's economic opportunity; reinforce their rights; and ensure their participation in economic decision-making (Van and Montagnier, 2007; UNDP, 2008). In the book "Access, Empowerment & Governance: Creating a World of Equal Opportunities with ICT" Abdul Rahim (2005) stated, that ICTs provide new opportunities for women's economic empowerment by "creating business opportunities for women as owners and managers of ICT-accessed projects, offering economic opportunities in employment and entrepreneurship, literacy programmes, business planning courses, ICT training, developing ICT- based tools that address women's specific needs and that are run by women". Cummings and O'Neil stated that economic power may have direct and indirect influence on women's voice and influence (2015). Also, regarding the use of ICTs, authors stated that it helps women entrepreneurs have better supervision over their enterprise or marketplace (Ibid, 2015). Digital ICTs lower information barriers between women entrepreneurs and their competitors and help in improving communication with their clients, as well, as it gives them an easier access to the banking and other business services, which has proven effect on savings control, financial security and some business costs reduction (Ibid, 2015).

According to Ogato (2013), social empowerment challenges social and cultural structures. In the research, author suggests that the impact of ICTs on women's multiple roles depends on how they are using ICTs in the context of gender roles (Grunfeld and Hak, 2009). ICT provide opportunities in health, education and other socio-economic areas (Rahim, 2005). It increases time flexibility for women, help with health care delivery, provide distance education, give an access to useful applications like market information and access to finance, improving service delivery by governments, improving functional literacy (Huyer and Mitter, 2002; Rahim, 2005).

In their research "Do digital information and communications technologies increase the voice and influence of women and girls?" Clare Cummings and Tam O'Neil highlight several points which can be advantages for women to use digital technologies. According to their findings, knowledge of ICTs can improve and straighten women and girls' self-confidence and enable them to review and react differently on traditional gender roles and their role in a global society in general, as well as "change women's personal aspirations" by changing the way society represent women (Cummings and O'Neil, 2015). This psychological empowerment can be used as a key for improving other aspects of women's

life or, make positive changes in sustainable development in general (Gigler, 2004; Buskens, 2009).

Access to social media and social networking also help women to understand themselves as individuals and help them to express themselves and their ideas more freely despite of social norms (Antonio and Tuffley, 2014). Due to the access to diverse information ICT can be seen as an effective tool for increasing women's voice, influence and political consciousness online, regardless of their physical location (Cummings and O'Neil, 2015).

Another advantage of Information and Communication Technologies, which was noted by scholars is an increase of the independence of women and girls, greater sense of freedom and power (Ibid, 2015). Studies show that women felt empowered by the opportunities which ICTs offer, like purchasing activities and choosing education programs they wanted (Ibid, 2015).

Ownership of mobile device seems to have a positive effect on way women manage their time and also on the feeling of safety, which already have been discussed in the part 1.1 (p.16) of this thesis.

ICTs have a proven effect on women's social status. Studies show, that knowledge of using ICTs as well as paid employment in this sphere, or even just ownership of mobile devices lead to increasing women's social status and/or increase of status and influence within their families (Ibid, 2015).

The important role provided by ICTs is facilitation of political participation for public and provides more open and transparent service delivery system (Hafkin and Taggart, 2001; Thas et al., 2007). Gurumurthy pays a lot of attention to the benefits which ICTs provide to women in the context of politics (2012). His studies show that ICTs can influence women's public and political participation by providing an opportunity of expressing their opinion digitally, in case if they were limited in freedom of speech (Gurumurthy, 2012). Global network also ease up networking processes, which contributes to facilitate the creation and growth of women's movements (Cummings and O'Neil, 2015; Ogato, 2013).

Studies show that digital technologies help women "to make better-informed decisions", which "help to increase their control over their finances, their safety and their health" (Cummings and O'Neil, 2015).

Gender and Projects of International Organization

The existence of conferences, accelerators and training programs designed exclusively for women is sometimes perceived as another type of discrimination, since it allegedly underlines their inability to compete with men, including in the field of programming (NCWGE, 2008). But in reality it is not. The gender imbalance in IT has historically been so great that total equality cannot arise in it by itself. Therefore, the already emerging trend towards diversification needs to be maintained. Several organizations have recognized that women are at a greater risk of being left behind and out of the economic and social opportunities that technology can offer. Largest IT companies conduct special programs to increase the share of women among their employees and fix it annually in reports.

International non-profit organizations like, Girls Who Code, aim to support and increase the number of women in computer science. This foundation is working on narrowing and eliminating the gender gap in technology by establishing free trainings and intensive summer programmes. With the support of IBM, Girls Who Code want to teach coding to more than a million girls programming around the world. The target audience of this organization is girls from 13 to 17 years old (including from low-income families). IBM's goal is to foster the emergence of a new generation of women cloud programmers. A similar project - Women Who Code - is supported by Facebook and Twitter.

“Supportive sisterhood” and friendly environment empowering positively affects girl’s self-confidence and self-efficacy, which results in their interest and performance in computer science. Alike to Girls Who Code, there are many other organizations targeting the gender gap in STEM by working on the girls empowerment and development. Black Girls Code is aiming to increase the number of women of color in the digital space. As well, African Women in Science and Engineering (AWSE) is determined to do this through various programs, spanning from high schools through to the career scientist and engineer.

Despite not being gender specific, but still not less useful are projects like CodeAcademy and Code School, which are a good way to start coding for beginners. The Udacity platform, which partners with leading tech-employers, promotes the life-long learning and aiming to close the digital skills gap by organizing the scholarships for those participating in paid online courses. Also, there are startups, like Andela, which partners with companies including Microsoft and Facebook and offer an intense six-month training at one of two schools, in Lagos, Nigeria, and Nairobi, Kenya with after remote employment in the

for companies in the United States, Europe, and Africa. The project was created by a 26 year old Kenyan student who couldn't afford university education and became a self-taught developer.

There are several platforms for like-minded people for women in tech. Women and Tech²³ is a community of tech-savvy women who share experience, resources and knowledge. At Webgrrls International²⁴ women discuss the latest technology trends, support each other in business and develop new business contacts.

Following noncredit courses teach professionals valuable skills to enhance their career in IT, make them more employable, get the information about how to get an education in IT: Girls in Tech²⁵ is a global non-profit organization covering the involvement, education and empowerment of girls and women who are passionate about technology. The community for women, where you can find the support of experts who seek to level the playing field for women entrepreneurs, is called Astia²⁶. Women in Technology International²⁷ is another organization, whose mission is to empower women around the world, they are aiming to help women advance by providing access to and support from other professional women working in all sectors of technology.

One of the most talented modern programmers, 28-year-old Linda Liukas from Helsinki, who stood at the roots of the Codecademy, talk about programming at TED²⁸ and participate in the global programs to attract women to the technology profession. Liukas shares how to learn coding and how to create web applications with non-profit organization Rails Girls²⁹.

To help with building a career, there are a lot of events, which are open to connect women in IT sector, “learn and act on gender diversity by sharing the experiences of industry leaders and developing women’s skills, both soft and technical”³⁰. In Europe, such events are held by the European Women in Technology and Women Startup Challenge³¹. Women Who

²³ <http://womenandtech.com/>

²⁴ <http://webgrrls.com/>

²⁵ <http://girlsintech.org/>

²⁶ <http://astia.org/>

²⁷ <https://www.witi.com/>

²⁸ https://www.ted.com/talks/linda_liukas_a_delightful_way_to_teach_kids_about_computers?language=en

²⁹ <http://railsgirls.com/>

³⁰ <https://www.europeanwomenintech.com/>

³¹ <https://www.womenwhotech.com/women-startup-challenge>

Code³² hold meetings for women programmers around the world. A Google initiative - Women techmakers³³, which empower women in their careers by providing access to resources and events, as well as information and tools from Google, organize meetings, where they always welcome ambitious women, who are willing to study IT.

For women, who want to have the ideas for the projects and want to create a startup, there are special accelerators, which also help with understanding modern technologies, learning how to program, assemble robots and start, develop online business. As an example, there is an Aviatra Accelerators³⁴, which allow women to start a business by providing them with all the necessary resources. For ready projects, which just need a funding, there are special women's investment funds - for example, HeraFund³⁵ and Golden Seeds³⁶.

Besides online scholarships for studying, there are bootcamps and technology workshops targeted at girls, which are being organized by large and small organizations. Annual Scientific Camps of Excellence for Mentoring Girls in STEM are being organized by the UNESCO in Kenya and STEM clinics are being organized in selected districts in Ghana. In these events, girls can interact with role models and learn about the advantages and opportunities in STEM through mentorship talks and laboratory demonstrations.

Concisely, as we can see through these examples within this discourse field, there is already considerable activity in Africa trying to advance women in tech sector.

³² <https://www.womenwhocode.com/>

³³ <https://www.womentechmakers.com/>

³⁴ <https://aviatraaccelerators.org/>

³⁵ <https://www.heraangels.com/>

³⁶ <https://goldenseeds.com/>

3. CASE STUDY: SENEGAL - JIGGEN TECH

In Senegal there are a lot of examples of young innovators developing apps to meet local demands and trying to find solutions for problems in the country. Apart from examples stated in this paper earlier, there are programs created by female and male developers, which allows doctors to prioritize patients in hospitals, helps to make housing and rental contracts transparent or online neighborhood lost and found hub (Al Jazeera, 2016). There are a lot of great ideas, but the biggest challenge is to find the funding for this kind of projects. And this is something what Senegal is trying to address: government is allocating 100 million dollars to develop the IT sector and building so called Silicon Valley of West Africa near Dakar. According to the government 10% of this budget is dedicated to getting more women to get involved into ICT and enterprise sector.

3.1 Diamniadio Project

In order to accelerate their development plan towards emergence Senegal created a new strategy called Plan for an Emerging Senegal (PES): the mid- and long-term framework for the country's economic and social policy³⁷. This framework is based on three main priorities: promotion of human capital through a significant improvement of people's living conditions and illuminating social inequalities; provision of good governance to strengthen security and stability, protect human rights and structural transformation of the economy by strengthening current drivers of growth and developing new sectors that can create wealth, jobs, and social inclusion with a strong power of attraction for export and investments³⁸. Transformation of economy sector include a construction of the large economic hub to boost Senegal's development potential: Diamniadio Industrial Park, the most modern urban center.

The futuristic city of Diamniadio is planned to be ready in 2035, right next to "old, worn-out Diamniadio township"(Sala, 2018). It is located 40 kilometers from Dakar and it's priority objectives will be to contribute to the decongestion of overcrowded capital and trigger national economic growth. The connection between Diamniadio and Dakar is already facilitated by the motorway, which is run as a concession by the French Eiffage Group. This will be reinforced with the extension of the VDN and set up of Dakar - AIBD (Blaise Diagne

³⁷ Presidency of Senegal website, <http://www.presidence.sn/en/pse/emerging-senegal>

³⁸ Ibid.

International Airport) railway line³⁹. Reducing the movement flow from the Dakar-suburbs will help to solve the problem with the shortage of land reserves and the high cost of renting Dakar. Such implementation will favor the relocation of activities to this area as well which will bring the flow of population.

The project is co-financed by the African Development Bank, involves companies from several countries: Senegal (Générale de travaux publics et de négoce, Getran), India (Swaminarayan Vijay Carry Trade and Gorasiya Farm), Morocco (Alliances and Médina Invest), and United Arab Emirates (Doozy Gulf Group)⁴⁰. The total cost of the project is estimated 46.314 billion CFAF, from which the contribution of African Development Bank is 39.984 billion CFAF and contribution of the State of Senegal is 6.329 billion FCFA (Senegal Emergent Report, 2016)⁴¹.

The project will be build on a 25-ha closed site located on the urban pole of Diamniadio, and it promises to be the first regional platform for promoting innovation and digital development with a world-class infrastructure, that will make Senegal an attractive hub for investment in the ICT sector and provide 35000 direct and 105000 indirect jobs.

A very large area is going to be divided into 4 sectors. Diamniadio will host residential buildings for 300,000 inhabitants with luxury, middle-class, and economic buildings options, industrial structures, conference centers, a new university and, above all, the new “digital park”.

Abdoulaye Wade, the former President of Senegal had an idea about building a new urban capital, since it is quite common in the African continent when entirely new cities are built from scratch. However, alike to Macky Sall, he changed his mind regarding this plan. Critics call it a vanity project of president Sall and think that the project is not going to constitute to the development and fear for the debt-trap. In their research, “Africa’s new cities: The contested future of urbanization”, Femke van Noorloos and Marjan Kloosterboer stated that even though “the effects of new cities in Africa will depend on the exact governance arrangement”, it’s been proven that “Africa’s very necessary urban innovations will not come from new cities” and instead of providing needed development, it “may rather lead to a race to the bottom to attract investment” (Noorloos, 2018).

³⁹ <https://www.railjournal.com/africa/first-train-for-dakar-ter-on-test/>

⁴⁰ <https://journals.openedition.org/geocarrefour/10174>

⁴¹ http://www.cc.lu/uploads/media/APIX_Fiche-CITE_DU_SAVOIR.PDF

The new urban pole of Diamniadio is expected to serve as Senegal's urban model for a sustainable, carefully planned and managed city. The project will support clean industrial production and emissions reduction, as well as hazardous waste management and low carbon energy technologies through the following activities: firstly, development of an approach for efficient natural resources use and cleaner production for industries located in Diamniadio; secondly, pilot methods for the reduction of dioxin, furan emissions and industrial hazardous waste; and thirdly, low carbon energy technologies⁴².

As for accommodation, Diamniadio Lake City (DLC) promise to be a high-end showcase, a utopian city, which harmoniously mix all the functions. It is divided into three zones: financial district will place a stock market and ample office spaces, residential district will mix homes with shops and cafes and entertainment district with mall, national library, the Fashion Walk, 5-star hotel around the beautiful natural lake. The buildings would be at the highest environmental standards and the city will have a particularly efficient transport service with ultra modern train station⁴³. However, Diamniadio inhabitants complain, that it was built without actually thinking about the inhabitants, since even the economic and social accommodation seems to be affordable only for wealthy people (Konaté, Touré E, 2015). Even though, the Agency for the Promotion of Investments and Major Works (APIX) is reassuring about the capacity from the urban center of Diamniadio to offer all amenities of an urban mix, the locals still question the concept of "social housing", because of the skeptical estimate price range by some specialists of the sector who find that they "will be everything, except social" (Ibid, 2015).

With the total cost of €388 million and €65 million contribution from the African Development Bank, the 45-kilometre Dakar-Diamniadio Highway has cut the drive between the city and suburb from 90 to 30 minutes. According to the African Development Bank report, the new highway has a greatest impact on the development of the region. From the creation of hundreds of job places (with the special attention to women's employment), construction and refurbishment of a public markets, health centers and schools, building sports facilities, social and cultural centres and mosques to reduced travel time for working parents to spend more time with their kids. They also claim to compensate all the families,

⁴² <https://www.thegpsc.org/city/diamniadio>

⁴³ <http://diamniadiolakecity.com/en/home/>

who were relocated to sites for the building purposes⁴⁴. However, the highway's toll, which is the first in the country, is considered quite high at 2500 CFA (around €3.77), which is expensive for the average Senegalese. For now, only some of the many projects were functioning: a hotel, one ministry, conference center, and a sports complex(Sala, 2018). As well, apparently there are delays with the \$900 million costing express train that will link Dakar to Diamniadio (Ibid, 2018). Most residential buildings construction is behind the schedule, as well as the Amadou-Mahtar-Mbow (UAM) University's campus (Ibid, 2018).

Residents of old Diamniadio, where still lacking some basic facilities, are complaining of an inadequate compensation for the lands demanded for the new city (Ibid, 2018). Young people from Diamniadio, who have failed to find a job on one of the construction sites of the conference center, blame authorities for not turning their speeches into realities, they believe that "if the mayor was not able to get hired local youth for construction of this center, he will not be able to do it for other projects " (Konaté, Touré E, 2015).

Training, research and innovation activities will occupy a prominent place in the Diamniadio project. The scientific and technological pole will include a major university campus and the "City of knowledge", which will also have a function of incubators and a scientific parks. One of them will host the UAM University, dedicated to science, which will host 30,000 students⁴⁵. Another, placed on 14-ha territory will host several institutes dedicated to education, research and innovation. It is expected that other higher education institutes of the country will place branches in the cluster⁴⁶. City of knowledge will host the seats of the Ministry of Higher Education, Research and Innovation, it is going to be the place for the National Center for Scientific Research (CNRS), several shared laboratories specialized in life sciences, like biology, biotechnology, in the basic sciences and mathematical modeling, computer science, robotics, as well as nuclear medicine and physics. Finally, an area devoted to the promotion of scientific culture will have a house of Science,

⁴⁴"Dakar-Diamniadio: Senegal's Highway of Hope", African Development Bank Group, 2018, <https://www.afdb.org/en/projects-and-operations/selected-projects/dakar-diamniadio-senegals-highway-of-hope-164/>

⁴⁵ <http://uam.sn/nvsite/>

⁴⁶<https://www.clustercollaboration.eu/news/senegal-west-africas-future-scientific-and-technological-pole-under>

which includes a planetarium, an aquarium, an astronomical observatory and a scientific demonstration area⁴⁷.

Digital Technology Park

From all the constructions in Diamniadio, the most promising is the digital hub, the new “Silicon Valley”, named "Diamniadio Technology Park," which is being designed to attract foreign capital, local businesses and e-government services.

According to the African Development Bank Group Report (2015), the project focuses “on job creation that will have direct impact on women and young people and the improvement of the business climate for private investment and economic diversification”. They promise, that the Digital Technology Park “will improve the contribution of the ICT sector to the economy and foster youth employment, gender equality and foreign direct investment” (2015). The project is aiming to create the “enabling environment for investment and universal access to ICTs by all people” (Senegal Digital Technology Park Appraisal Report, 2015).

The main objectives of the Digital Technology Park are very ambitious. They aim to place a world-class infrastructure to attract international companies in ICTs, research and innovation sector, create a platform for innovative solutions for e-government that will improve efficiency of all development sectors such as health, education, agriculture, etc; improve research and local development and entrepreneurship in the ICT field; encourage the relocation of foreign ICT companies that increase innovation; facilitate business creation and human resource training in the above sectors, promote the incubation of new businesses, create jobs in Digital Economy Services and in all sectors of the economy (APIX report, 2015)⁴⁸. The construction of the Park is projected to the contribution of ICT to the economy from 6% to 15% by 2022.

Apart from constructing and equipping public buildings and facilities with commercial center, the project is going to have three enterprise towers, Data Center with cloud computing services, a BPO center and construction of a training center, a research

⁴⁷“Sénégal : à Diamniadio, un campus pour servir le beau savoir”, 2018, Amadou Oury Diallo, <https://www.jeuneafrique.com/mag/560978/economie/senegal-a-diamniadio-un-campus-le-beau-savoir/>

⁴⁸ LE PARC DES TECHNOLOGIES NUMERIQUES DE LA REPUBLIQUE DU SENEGAL, 2015, http://www.cc.lu/uploads/media/APIX_Fiche-CITE_DU_SAVOIR.PDF

center and an incubation center along with an audio visual and content production building that will be used for multimedia production (Senegal Digital Technology Park Appraisal Report, 2015).

The main beneficial influence of the project correlates with the main research of this thesis, since Tech Hub is expected to influence gender related development issues. The digital city is also expected to create 30000 direct jobs and 105000 indirect jobs, of “which over half will be for women” and integration of gender within the activities of the park as much as possible. The gender gap in IT sphere and STEM education in Senegal is very sharp, even though there are some promising statistics on growing participation of women in the IT field. According to statistics, only 18.2% of Senegalese women own their own computer to 39.6% of men; 19.2% of men have an access to Internet comparing to 10.6% of women (Senegal Digital Technology Park Appraisal Report, 2015). The amount of women graduates in STEM in Ecole Supérieure Multinationale des Télécommunications from 2011 to 2012 years from Master level is only 17.07%. Also, the entrepreneurial sector is showing it’s gap: business incubation center (CETIC) is hosting only 1 female entrepreneur compared to 8 males (Ibid, 2015). However, the examples of incubators like CTIC Dakar, shows positive changes in the amount of women in IT, what makes it evident, that women will be the major beneficiaries from the Digital Technology Park project. The new incubation of Diamniadio centre will allow young graduates to create their own IT startups in various areas including mobile applications, web solutions. “With a Senegalese Silicon Valley in the works, the timing for Senegalese women to enter the tech sector couldn't be better” (Rowley, 2016)⁴⁹.

The project seems to have a considerable impact on job creation and fostering Senegal towards an information society, which will have an overall impact on the quality of life of its population. The technology park is going to work as a platform for software and IT solutions that will directly impact on sectors like education, agriculture, entrepreneurship, as well as services like finance that will lead to improved development and provide more collaborations opportunities among all tech companies in the same area.

Overall, the whole is truly greater than the sum of its parts. Cluster is intended to facilitate the emergence of smaller initiatives and strengthen their positions in the respective

⁴⁹https://newsroom.cisco.com/feature-content?type=webcontent&articleId=1796391&fbclid=IwAR0VFOKm2G3UXFkAkKpakJIP6KIAjjiMJwg3xsepT3A6f_UN9a2DUVdjttg

industries. The detailed analyses of one of the female-led organizations, which is going to be the part of this huge technology center will be addressed in the following chapter.

3.2. Case Study: Jiggen Tech

Jiggen Tech (JTH) is the first hub of its kind in Senegal specifically dedicated to women and young people in STEM encouraging more girls to take STEM subjects in school and university. It has been named Jjiguene Tech Hub (old naming) - Jjiguene meaning "woman" in Wolof, the most widely spoken language in Senegal. JTH was officially launched in December 2012 by women champions competing in ICT, entrepreneurs, engineers & entrepreneurs. Most of the young women from JTH are in their early 20s. Currently JTH has more than 40 male and female volunteers who have a common goal to boost girls and women use of ICTs and careers in this sphere. Their objective is to encourage, inspire and introduce more women to integrate the technological ecosystem in Senegal through networking, training, coaching, mentoring and sharing, knowledge. Jiggen Tech is helping to increase the number of women in STEM, entrepreneurs and girls who take science courses at university to reduce the gender gap and compete with men for jobs and improve the living conditions of women in Senegal.

Today, the hub gives visibility to female entrepreneurs and help them get funding for their projects, giving them access to opportunities for participation in different startups competitions and projects. They have worked in a collaboration with International Organization of Francophonie (OIF), Orange Senegal, Planet Finance, The US Embassy in Dakar and Microsoft and gained new experience in logistics, field deployment and partnership establishment.

JTH offer different training programs and support after, provide personalized training programs for application development and business development in order to increase the number of female entrepreneurs in IT and reducing the unemployment rate among young people organizing caravans in cities Dakar, Thiès and Saint Louis to raise awareness raising among girls and women. Aside from supportive trainings for children, who don't have access to computers and STEM courses in schools, women of Jiggen Tech provide reintegration programs for ICT illiteracy and entrepreneurship of young people between 13-25 years old and those who dropped out of school.

From my conversation with the training lead of JTH Coumba, it was clear that Jiggen Tech put a lot of effort not just in trainings, but also to other activities like distributing information opportunities in the ICT field to enable young people to seize them, doing networking and exchanges on various topics with a variety of presenters and experts, working a lot on awareness programs in schools and universities that support and encourage young women to take an interest in technology and related careers. Sharing experience and knowledge, enhancing skills and implementing new behaviors are the intended targets of a their mentoring program. And, of course, they pay a lot of attention to women's empowerment by providing support of project idea, helping to bring it to life and follow up later.

How and why did they start?

"We want to be a role model for girls and girl women in tech," Awa Caba

"We have created the Tech Hub to help women and girls to be able to work with the information technology. Some of them aren't literate, some are students, some are business professionals. All around the world and in particularly in Senegal you can see that women have a great potential but it's not being used. You find women working in agriculture and commerce, but information technology seem not accessible for them." Coudy Binta Dé

Coudy Binta Dé was excited about computers and technology since her early childhood. As she told to Naveena Kottoor, BBC journalist, when she went to visit her mother in work at one of the Senegalese government's first computer departments, she was just amazed by "seeing those big computers, with their black screens and green text"⁵⁰. It inspired her to become an engineer. In 2012 Dé with two other future co-founders, students from the IT University, were selected as the only all-female team for the international tech contest in IT organised by Microsoft in New York. "We knew that in Senegal we were the only women's tech team, but being the only all-women's team in that competition was surprising. American people were very happy to see that there were black girls competing, so everybody wanted to talk to us. It was very interesting to us, but also very insulting, because we knew there were other women in the tech field, but nobody knew about them."⁵¹

⁵⁰ <https://www.bbc.com/news/business-28363783>

⁵¹ Equal Times, 2018, <https://www.equaltimes.org/the-women-in-senegal-pushing#.W9CIVGIzZE6>

The hub was created in 2012 by four young women, including the Anglo-Senegalese entrepreneur Marième Jamme, named in 2012 by Forbes magazine as one of the most influential women in Africa. They decided, that the best way for the information to reach women is to create a group of women, who has the same interests, same vision and who love technology. Since then, Awa Caba, but also Ndeye Awa Gueye and Binta Coudy Dé have been running the company, and now include about thirty volunteers, men and women, students of IT universities, under the slogan 'Share-build-inspire'. Dé says, that people were quite sceptical about the idea of creating a hub totally run by women at first, but they "knew that it was the best way to reach women, to teach them how to be confident and to think about how to really achieve their professional goals"⁵². Between 2012 and 2014 thirty women have joined Jiggen Tech, whose "lives changed, in terms of ability to express themselves, self-confidence and accomplishment"⁵³.

Co-founder Awa Caba, a young entrepreneur, a Mandela Washington Fellow at the University of Iowa, is aiming to connect business women in Senegal with the internet in order to grow their influence. She has her own business called Sooretul and work with another organization which help to promote young Senegalese people in agriculture, called Yeestal AgriHub⁵⁴. In JTH Caba's role includes scheduling training for girls and women. According to Awa Caba, young girls often don't have internet access or proper computer during their studies and can not practice at home. Once at university, they become discouraged and avoid STEM field, which they consider be reserved for men." Using playful methods, trainers strive to make concepts accessible to everybody.

They started going from one school to another, giving small workshops about how computers work and explaining basic tools for networking, so students can learn from each other. At first, they had to make sure that school has an equipped computer class. Spread the information about the training throughout the social media or director of the school, or they would come to the class and explain what they want to do and take names of those, who are interested, so later they gather a class.

At present the hub offers all its services for free. It is able to do so thanks to sponsorships, both from local businesses and US giant Microsoft. In 2016 Jiggen Tech have

⁵² Ibid, 2018.

⁵³ <http://www.universityworldnews.com/article.php?story=20140618100823929>

⁵⁴ <https://www.iowajpec.org/news/meet-entrepreneur-changing-tech-scene-senegal-1>

signed a partnership agreement with the International Organization of Francophonie (OIF⁵⁵), which meant a beginning of a big change for them. Until then, the hub was running on individual donations and technical, financial and material contributions from the founders and volunteers. Some partners sponsored some specific hub programs, but not the needed computer hardware and not the needs necessary for the operation and expansion. Support of the OIF helped them to rent a workspace for a period one year, get training materials and make some team members to become permanent employees. However, the most significant contribution is that they were able to reach 387 entrepreneurial women and girls, who started learning how to use ICTs, and helped them to reach the effective implementation of their projects and/ or straighten their capacities in the companies they are working and promoted social and economic empowerment. According to the statistics of applications from women's organizations on social networks and through the network of Jjiguène Tech, there is a database of more than 1000 Senegalese women, who want to take part in their computer and personal development trainings. In addition, they have established partnerships with organizations that wish to benefit from their expertise in helping women to entrepreneurial capabilities and/or become female ICT project leads. For now, Jiggen Tech's new goal is to reach 500 female trainees for by the end of 2018.

One of these high school girls has even become a volunteer in the association and trains young people in her school during breaks, when she does not review for her baccalaureate.

Trainings

After spending five years of traveling around Senegal and training groups all of all ages, Jiggen Tech members realized a strong need for training both for girls and women in the formal and informal sector. The social context in Senegal and the limited access to ICTs have caused a wide gender gap between men and women trainings, since most schools don't have a properly equipped computer class and even less schools have any informatic classes. During the interviews with former trainees of Jiggen Tech's programs they found out the main barriers which are on the way to women in businesses in Senegal, which are the lack of finances, lack of practical training and family context. Moreover, after doing a deeper research, Jiggen Tech realizes these barriers create a lack of self-knowledge, self-confidence and method. This made them to create their training model, which includes three main

⁵⁵ <https://www.francophonie.org/>

components: the training in leadership and personal development itself, teaching how to self study effectively and showing the importance and impact of knowledge sharing.

The kind of women, Jiggen Tech is targeting is very diverse. Some of the women are there to learn, while others are working on their own entrepreneurial ideas. The kind of courses are depended on the need. The typical training schedule can be found in the Annexes (Table 1, Annex B).

Firstly, they do trainings for kids. There is a program called a Jiggen Camp aimed for for young girls from 6 to 18 years old. The aim is to teach them how to code in different programming languages, like HTML and CSS, using different tools and just simply also to show them how computer works, since the majority of the kids have never seen a computer before. These are short weekend courses, which runs from 9am until 5pm. They start with the presentation about the hub, then run HTML, WordPress or CSS course with lunch break on Saturday. On Sunday's they finish the day with the group picture and hand certificates of participation for the students.

In case, when trainings take place in the primary school, JTH's mentors go to school in the afternoon, meet students, explain them what they do and in a playful form explain how technology works. Usually, they are using a special online puzzle - giving them a logic of coding through the game⁵⁶. This "fun" way increases the chance, that kids will develop their interest in technology and will choose IT field in the university.

Second program is aimed on young women and girls, who have the project or idea of a project related to technology or development. This course is aimed to help girls to bring their idea to the market and explain how to use digital tools in order to improve their business. Women are very present in the field of agribusiness, specifically in the processing of local products, even though the entrepreneurial environment in Senegal is not very favorable. A lot of women in Senegal are working on processing food, but there are no big marketplaces to sell their products. The advertisement events, where they can demonstrate their products very rarely, once or twice a year, which it's not enough. Since this business sector quite often operates in informal way, basic knowledge of ICTs allows female agribusiness entrepreneurs to regularly register their activities and to move towards professionalisation of their business, as well as finding local solutions for local problems and

⁵⁶<https://studio.code.org/s/course1/stage/13/puzzle/1><https://studio.code.org/s/course1/stage/13/puzzle/1>

using ICTs as tools of action. Jiggen Tech also created an e-commerce platform with advertisement tools to give these women an opportunity to sell those products online. They also help with advices and contacts how to get more funds and increase their visibility online.

Another category of female entrepreneurs are from all the other possible fields, like communication, journalism, trade, human resources, local development, politics, fashion, sport, agronomy, biology, etc. Quite often, they are business managers and employees at the same time. Digital training from Jiggen Tech teaches them how present a project in record time, with a use of low-cost visual aids, how to use digital marketing, how to build websites on e-commerce platforms and how to sell products online by placing them in the Internet through social networks. Diversity of kinds of female entrepreneurs or project leaders profiles made Jiggen Tech to create long term courses with individualized support. After the course, best students usually benefit with the additional program or guidance aiming on further development and implementations of their projects.

Of course, sometimes women are not interested in coding, or simply don't have the basic computer skills. For these cases they run courses about Microsoft Word, Excel, Powerpoint or teach women how to sell their products on Facebook. Every course starts with the application through the website and after they see the demand, JTH organise the needed course.

Outcomes

"Our greatest pride is when our students send us text messages to thank us filled with tags that we have taught them." Awa Caba

In 2017 Jiggen Tech have trained 387 women, which makes 77,4% completed out of their goal in 500 female trainees. Training program is established based on students needs and according to their existing skills. The instructional design process includes the development of methods and materials, delivery of the program, and finally the evaluation of the training's effectiveness.

Programs differ in terms of the context and purposes, but all of them involve the leadership and personal development variable. The training they offer ranges from a basic introduction to IT, such as using programmes like Microsoft Word and Outlook, to more

complex like “Lean Canvas & Pitch”, “Building website with Wordpress”, “Social Media Positioning” and “E-commerce Digital Marketing”.

Key points of their achievements from the past years include providing better visibility to female beneficiaries of their courses, the volunteering team and the Tech hub itself; access to decision-making parties, particularly regarding the digital strategy of Senegal by 2025; participation in the 34th session of the Ministerial Conference of the Francophonie (CMF) in Paris. Their initiative is among the leading ones in Senegal’s ICT and entrepreneurship field, which helps with facilitation of the organization process and access to local networks and venues through partnerships, strengthen the network of female entrepreneurs, while implementing ICTs into everyday activities.

Student’s statistics

Young females seems to be very motivated and interested in the Jiggen Tech activity. Facebook page insight tool, which track the demographic data of people, according to their age and gender, show the overall statistics of 77% women in their interested audience (Figure 1, Annex A). Total percentage of females in the age group from 13-17 is equal 5% verses 0,323% male audience. Age group 18-24 has 32% and 5% of women and men interested accordingly. Interested viewers in the age from 25 to 34 differs from 28% of females to 12% of male. The gender demographic in the age group 35-44 is evenly split, with female viewership (5% to 3%) in the slight majority. Interest is spread almost evenly between men and women for the age group between 45-54 years old and 55 to 64 years old (0,711 % male and 1% women, and 1% women vs 0,496% male accordingly). Women continue to outnumber men in the group age over 65 years old. The numbers are equal 5% for women viewers and 2% of male.

According to the data of 1042 responses obtained after closing a call for application about the profession of beneficiaries, their activity and their geographical location, the 53,1% of them are students, 18,3% of trainees are unemployed and 11,9% are private employees. Approximately 5% are half-time contractors, 3% are full-time contractors, 5 % are civil servants, 3% of them are active members of associations and 1% are current employees of NGOs (Figure 2, Annex A).

From the almost 1000 women, who answered the survey, 52,9% of women, who want to take part in Jiggen Tech programs have their own project idea and 19,1% already has a

project. Usually those, who already have a project need a guidance and empowerment for the further development of their idea, as well as connections and financial support (Figure 3, Annex A).

Regarding the location of applicants, it is very diverse, however, the majority is located in Dakar (71,4%), Thies (9,7%) and Saint-Louis (7%). The rest of the picture looks like this: Diourbel 3%, Fatick 2,5%, Kaolack 2,5% and Louga 3,5% (Figure 4, Annex A).

For now JTH have a profiles database of female entrepreneurs with promising projects to follow in the long term perspective and to later measure their impact and refocus their trainings for better results. The association is creating a database to see the impact of the program within five years with a growing influx of female students in the technology sector.

Barriers

JTH's members highlighted several main obstacles, which are challenging the women's participation in their courses. They name the transportation problem as a main barrier. The training in Diourbel was suppose to have 200 beneficiaries, however, after receiving the request of additional transportation cost, which equals to the amount of 5000 FCFA per beneficiary ($5000 * 200 = 1.000.000$ FCFA (Approximately €1500)), they had to cancel the training, since they could not maintain the activity with such high cost.

The second obstacle is related to the gap between the number of those who requested and those who actually participated in the training. JTH was suppose to teach 695 women in 2017, however, the amount of participants was equal to 387 due to absence and cancellations from the requesters side. The main explanation given to JTH was mostly related to family context, female household responsibility or lack of time off work: "... I could not find someone to look after my children ... I did not get permission from my husband ... I had to cook, I was already late I did not want to come ...". Table 2 in the Annex C clearly illustrates the difference between the actually trained students and those, who register for the participation.

The last obstacle is linked to the availability of volunteers. Since every team member in JTH is working there just on volunteer basis, they have their main job or study routine. Consequently, when the volunteer program trainer, or his substitutor, are not available, the training have to be canceled.

Partnership

As part of the implementation of the program to promote employment through entrepreneurship among young people and women, the OIF has awarded Jiggen Tech Hub with a grant to support for the implementation of their program. The OIF is implementing a strategy with clear objectives and JTH contributes in an operational way to the implementation of this strategy which correspond with Senegal's 2025 economy goals and needs identified in the field.

The World Bank supported the incubation program of Thiès University, but the mobilization of women entrepreneurs has been a challenge during the last three years. In 2018, due to the visibility obtained by JTH through the OIF Jiggen Tech was able to train women from the university's incubation program in a provided by university workspace to hold the training.

Equipment

According to Coumba, students in Dakar are now well exposed to the tech tools, but those in suburbs don't have the chance to have even one laptop at home, or the ability to use computers in school. Since JTH is being runned only on volunteer basis and all the courses they offer are free of charge for their students, hub does not have sufficient resources for providing equipment, like computers. With the help of sponsorship of such organizations, like OIF, they were able to invest in a decent hardware necessary for trainings. JTH bought 25 personal computers with a two year warranty, which allows them to hold a minimum class of 25 people and 50 people in mass trainings. They also have two video projectors, which allow them to do simultaneous training classes. Good photographic and video equipment allows them to work on the visibility of Jjiguène Tech.

Network

Beyond hardware, JTH had worked a lot on their network to make it grow and gain credibility and visibility. During their participation in the conference of women of the Francophonie Africa in Bucharest, they had the opportunity to meet the Minister of Women, Children and the Family, as well as Minister of Social Development and National Solidarity Aminata Mbengue Ndiaye and Dr Danièle Bordeleau, Director of the Department of Administration and Management of Senghor Francophonie University of Alexandria and

discuss the opportunity for the establishment of contractor Communication Skills Training Course. Participation in the 34th session of the Ministerial Council of La Francophonie have also strengthened JTH's perspectives: Rector of Senghor University confirmed his commitment to support Jiggen Tech in their training projects next year.

JTH is strongly advocating to make more space for women in the technological ecosystem. In this question they acquired political support of Ministry of Communication and Digital Economy and collaborated in the project Jiggen CI TIC Caravan. This project aimed to integrate the ICT in different projects and programs, reduce the gender digital divide and to encourage girls to pursue their studies and careers in these STEM fields. The Jiggen CiTIC Caravans gather engineers, female developers, lawyers, sociologists with the objective to raise awareness and educate young girls about ICT (UNESCO, 2016).

In april 2014, Ministry launched the contest Djiguène CiTic organized with the financial support of Sonatel, the US Embassy in Dakar, Google and Microsoft. This competition, according to Ms Bitilokho Ndiaye, helps to identify and support young people with innovative ICT projects and help them with SMEs⁵⁷. This contest is open to girls and women from secondary school to until the age of 35. Girls, who wanted to participate had to form a group of three, which allowed to have a male in the team, but the idea the idea of the project had to be carried by a girl or a woman. The best idea receives funding from the Senegalese government, which is sponsoring the contest. Ms. Bitilokho Ndiaye, Djiguene CiTic project have an impact on the entire population because "when women have access to information and communication technologies, they can benefit their entire community, as well as their husbands, that their children."⁵⁸

Other successful initiatives of Jiggen Tech include USO Forum, composed of eight students from the University Assane Seck of Ziguinchor, which had created an online incubator to help women processors to set up companies to sell their products⁵⁹.

Students reviews

The most significant outcome success indicator from the programs are the reviews from trainees. After the basic computer formation bootcamp in Thiès, students, who took part

⁵⁷ Successful project management for small to medium enterprises

⁵⁸ <https://en.unesco.org/news/promoting-young-girls-technology-jiggen-ci-tic-caravans-senegal>

⁵⁹ <http://www.universityworldnews.com/article.php?story=20140618100823929>

in the training noted they learned an outstanding amount of new information during this short weekend course. One of the trainees shared, that they “had the screen, the keyboard and the central processing unit”, but didn’t know how to use it, since there have never been any class about it. She also stated, that she wish to extend such trainings into small villages and used an example of her mother, who lives and works in a village and said, that if her mother would know how to use computer, it would allow her to use advertisement in social networks.

Another trainee, Ms Fal, who is doing her Master Program in agribusiness development and entrepreneurship participated in the e-marketing training. She was very pleased with how friendly coaches were and noted that she gained a lot of new skills, which allow her to develop her future plans from now on. As an entrepreneur, she added that JTH’s initiative to bring more women insertion into information and technologic sphere is incredibly valuable for women like her: “When I saw this on your Facebook page, I told to myself it was made for me. This is great for women in Africa and Senegal. Women need to be trained on this kind of themes.”

In the interview with BBC News, Ms Sio, 18-years-old hub’s student, shared that JTH made her to change her mind from studying languages or communication, because they showed that “technology is very, very interesting, particularly for girls”. She stated, that before she thought that computers “are for men”, but thanks to Jiggen Tech initiative, she has an opportunity to meet more women interested in technology. Aminata Balde, who said, that she was afraid to express herself before, learned how to be confident due to the coaching lessons JTH team provided (Kotoor, 2014).

Interview highlights

Predominant motive for volunteering in JTH, according to the surveys taken in JTH, was simply to help and support women who are interested in the Information Technology in Senegal. Some of them have no IT background and I “just wanted to do something useful for their community”.

Inspiration source for JTHs volunteers is actually the hub itself, it’s values and people, who share similar aimed on changes. Every person from Jiggen Tech got a particular story how and why they got involved. They might come from different professional backgrounds, but they seems to be sharing share a common awareness and drive to improve their community. The main thing which unite all of them is the passion about what they do.

Some survey participants stated that they are very inspired with the team members and trying to use this project inspiration to their trainees.

Questionnaires showed that volunteers started developing interest in technologies as they joined JTH. As a 23-year-old event manager stated: “I had mostly literature and philosophy classes back in high school and I seriously wasn't interested in math, physics classes or just open to technology subjects. JTH has been a door for me to enter this new innovative world. I have learned that those issues are relevant and important for my own personal development and for other young ladies we were in charge of.”

Volunteers from JTH seem to be very active in terms of being involved in some other initiatives apart from their activity in the hub. Respondents noted that they currently are being involved in a number of projects from their university, in particularly language ones. They use their linguistic proficiency in foreign languages to help other students to improve their knowledge and skills in a comfortable and relaxed atmosphere while getting to know other people from the campus.

The most interesting part of the survey for me was to read the responses regarding the question about Women Empowerment in Tech. Participants seemed to be very engaged to and touched by this topic. Volunteer ladies from Jiggen Tech explained women empowerment as a “way to give girls/ladies/women useful tools to better know themselves first and then to use their strength to overcome all the issues they will possibly face making their way in the IT jungle”. According to them, empowerment in the ICT field will help women to improve their knowledge and get access to the information in the spheres they are most interested in. In case, if women are interested in coding, it will help them learn necessary skills and get into programming career path, discovering new technological tools helps women to develop their own projects. Participants of the research also stated, that women empowerment should “include a lot of soft skills and the ability to know how to use them efficiently in a daily life”.

As for the main gender-based obstacles, which women in Senegal face to entry and advancement in the ICT labor force, team members highlighted “the lack of knowledge and awareness of the opportunities” and the lack of motivation and, sometimes, fear caused by social influence, which pushes them to choose the same mainstream fields as their fellows.

Regarding the views and solutions for the gender digital divide, participants noted the need for equal encouragement for boys and girls to study subjects of their interest. “We

are luckily living in a time, when women stand up against this problem and share their experience in these fields. I am sure this will inspire a lot of girls to embrace the IT branch. I truly believe, that by empowering these young ladies and making them stand up for this issue will progressively change this gender divide problem.”

Future targets and plans

Due to the various limitations related to travel, JTH is planning to implement online training in partnership with youth networks (support for access to the internet and equipment) to provide support continues for ICT training in Senegal. Taking into account the obstacles for women entrepreneurs beyond the use of ICTs related to financial education, sales, leadership, they intend to integrate the "serious game", a space for collaborative work and individual coaching with competent partners. Future development, along with the full-time classes, will involve paid courses, so they will be able to start paying salaries for the employees. In the plan of Jiggen Tech there is also an establishment of a West African Female Tech-Training Center, the objective of which will provide a short-term and marketable trainings based on hard skills, such as website creation, word processing and so on. As for Diamniadio project, women from Jiggen Tech expect from the cluster to help them to expand their current activities: having a new local compartment away from Dakar is one of the targets. Furthermore, JTH team sees new opportunities in terms of networking and collaborations among all tech companies in the area. JTH see the Diamniadio center as a new site for their advancement, which will help them to be recognized as tech school in Senegal and set up a profit-oriented training centre.

4. CONCLUSION

The first chapter provided an overall perspective of this study through the review of the literature dedicated to the current state of technology focusing on the African continent. Thus, the opening chapter explores different kinds of ICT infrastructure, which have boomed in the last decade. There I argue, that the digital divide, expressed with the limited access to fixed broadband infrastructure, has blossomed into the rapid growth of the mobile market. Growing data usage is supported by international submarine and terrestrial fiber cables that lay along the continent's coast. Moreover, the analysis is spread out around the idea that an

easy and affordable access to the Internet, which mobile technology provides, connects individuals, information, markets and services.

Proceeding from examination of the general growth and omnipresent advancement of technology, I argue that the very process also has a notable socio-cultural influence on African society: mobile phones have a crucial role in individual expression and identification, increased feelings of safety and help to maintain kinship bonds. This argument comes in compliance with the proposition about ICT playing a crucial role by providing access to education, easier access to information, better market reach and facilitated access for medical personnel in rural and urban areas of developing countries. Relatively low-cost mobile technology are significantly important for existing businesses. Internet and mobile banking in African countries are increasingly developing and introducing new kinds of mobile payments and transfer services. There has also been an observed increase in the number of small local e-commerce services on the African market.

The technological development being described, I also touch upon the issue of the overall education situation and gender inequality that are still notably challenging for the African continent: many children remain absent from schools and don't acquire basic literacy skills. As for the gender inequality, being the main theme of the thesis, I argue that, even though gender balance and women's empowerment have improved over the decades in sub-Saharan Africa, girls and women still suffer from a range of gender-based obstacles and challenges to women's rights are still a concerning reality, also revealed in the field of technology. Digital technologies provide incredible potential for education and development by facilitating access to learning materials and offering new methods of teaching. However, the findings outlined through the thesis demonstrate a strong effect of the limited access to the Internet and computers as one of the main challenges for technological innovations in education.

In the second chapter, I specifically turn to the issue of gender inequality and place it in the center of analysis. Statistical data informing my analysis on gender parity in the aspects of human development, such as reproductive health, empowerment, and economic status, demonstrate the significant gender gap in Sub-Saharan Africa. Using the preceding analysis of the field data, I suggest that in the studied area, despite the democratization processes and a formal presence of the non-discriminatory policies, there is a common influence of the traditional stereotypes regarding social norms and roles that deepen the

mentioned gender gap and unequal opportunities. Traditional women responsibilities such as household chores and child-care, significantly limits their access to employment posing a serious risk of facing severe poverty.

Analyzed data regarding the barriers, which is influencing the digital divide enabled me to categorize material, psychological, socio-cultural and political factors as the most common and widespread constraints for women in SSA in the use of ICT. At the same time, some of them, such as technical infrastructure availability, connection costs, computer literacy and proficiency in languages are shown to be equally accessible for female and male settlements. However, women have to face some culturally determined conditions resulting from traditional gender stereotypes, gender hierarchy, social power relations outlined in normative social rules and general stereotypical representation of gender roles. All these additional factors, limit women's access to professional careers, align them with solely domestic responsibilities or pose restrictions to ICT usage. As for the resulting psychological mindset, these gender stereotypes may lead women and girls to internalize the gender prejudices and establish that ICTs is strictly male-oriented domain. Combination of these factors also affect women's ambitions and will to try to join IT and STEM related jobs. The research shows that major HTPs are still being practiced in Africa constituting a major constraint to a sustainable development and equal opportunities.

The qualitative analysis of the statistical data and of the socio-economic context enables to note that women's representation in STEM careers and education in the studies region is outstandingly low. However, STEM education and programming in particular helps to develop critical and computational thinking assisting to develop problem-solving skills, which on their side could be used to develop solutions for Africa's unique regional challenges. Addressing the issue of impact of ICTs on women's empowerment, the following six major dimensions such are highlighted: economic, social, political, legal, technological and psychological. ICTs is being used as a networking tools for targeting initiatives aiming to enlarge women's economic opportunities. In particular, ICT provides opportunities in health, education and other socio-economic areas, by increasing time flexibility for women, helping with health-care delivery, providing distance education and improving service delivery by governments. Furthermore, an access to social media and social networking also help women to understand themselves as individuals and emancipate within the society. In short, the research has demonstrated, that ICTs have a proven effect on women's social status by easing

up the networking opportunities.

The next part of the research is overviewing the existing programs of International Organizations which are aimed to tackle the gender imbalance in IT. There is already considerable activity in Africa trying to advance women in tech sector. Despite gender-specific, there are projects, which can be used as a good source to start coding good way to start coding for beginners. Some of the programs are organizing bootcamps and Large IT companies conduct special programs to increase the share of women among their employees. There are several platforms for like-minded people for women in tech, where they share experience, resources and knowledge, discuss the latest technology trends, support each other. Playing field for entrepreneurs, as well as non-profit organization covering the involvement, education and empowerment of girls women are also created. To help with building a career, there are a lot of events, which are open to connect women in IT sector. For women, who want to have the ideas for the projects and want to create a startup, there are special accelerators, which also help with understanding modern technologies.

As the case analysis, I have examined the future Senegalese tech cluster Diamniadio project near Dakar, which aims to provide a considerable funding for enterprise initiatives in the field of ICT. The government is devoting 10% of its budget to getting more women to involved into ICT and enterprise sector. Planned to be ready in 2035 and co-financed by the African Development Bank the Diamniadio will connect Dakar with the new the 45-kilometre Dakar-Diamniadio Highway. Analysing the reports have shown that, Diamniadio is planning to have several sectors: residential buildings, and economic buildings options, industrial structures, conference centers, a new university and the new “digital park”. The most promising part is named "Diamniadio Technology Park," which is being designed to attract foreign capital along with the local businesses and e-government services with very long-term objectives. The main beneficial influence of the project correlates with the main propositions of this dissertation, since Tech Hub is expected to influence gender related development issues. The digital city is also expected to create 30000 direct jobs and 105000 indirect jobs, improve research and local development and entrepreneurship in the ICT field; encourage the relocation of foreign ICT companies that increase innovation; facilitate entrepreneurship and human resource training in the above sectors, promote the incubation of new businesses. The new incubation of Diamniadio centre will allow young graduates to create their own IT startups in various areas including mobile applications, web solutions.

From the interviews conducted, it was observed that apart from trainings, Jiggen Tech put a lot of effort into other activities like distributing information opportunities in the ICT field to enable young people to seize them, doing networking and exchanges on various topics with a variety of presenters and experts, working a lot on awareness programs in schools and universities that support and encourage young women to take an interest in technology and related careers. Sharing experience and knowledge, enhancing skills and implementing new behaviors are the intended targets of a their mentoring program. And, of course, they pay a lot of attention to women's empowerment by providing support of project idea, helping to bring it to life and follow up later. At present the hub offers all its services for free.

They are targeting different kind of women: some of the women are there to learn, while others are working on their own entrepreneurial ideas. Another kind of trainings is aimed at young women and girls, who have the project or idea of a project related to technology or development. To another category of trainees, Jiggen Tech explain how present a project in record time, with a use of low-cost visual aids, how to use digital marketing, how to build websites on e-commerce platforms and how to sell products online by placing them in the Internet through social networks. According to the statistics analyzed and regarding outcomes, Jiggen Tech almost achieved their goal - they have trained 387 women out of 500 proposed.

Having the positive effects and prospects described, JTH's members highlighted several main obstacles, which are challenge women's participation in their courses, like: transportation expenses, gap between the number of those who requested and those who actually participated in the training and the availability of volunteers. Computer hardware used to be a problem, but OIF helped them to invest in a decent hardware necessary for trainings. The questionnaire had shown that volunteers from JTH seems to be very active in terms of being involved in some other initiatives apart from their activity in the hub.

The key points of their achievements from the past years include providing better visibility to female beneficiaries of their courses, the volunteering team and the Tech hub itself; access to decision-making parties, particularly regarding the digital strategy of Senegal by 2025. Their initiative is among the leading ones in Senegal's ICT and entrepreneurship field, which helps with facilitation of the organization process and access to local networks and venues through partnerships, strengthen the network of female entrepreneurs, while

implementing ICTs into everyday activities. As, for the future, JTH see the Diamniadio center as a new site for their advancement, which will help them to be recognized as tech school in Senegal and set up a profit-oriented training centre

Finally, I intended to provide a close analysis of the case and outline its main mechanisms and prospects in order to back up the main idea of the dissertation: the sub-Saharan region, although experiencing a major technological development and a massive impact of it on the everyday traditional lifestyle, constitutes as a prominent example of unequal distribution of opportunities along gender division and restricted access to labor for women in these advanced field. Thus, the affirmative measures taken in this context could improve a general distribution of benefits and emancipation of half of the work-force: the women.

BIBLIOGRAPHY

- Abdul Rahim, R., Waldburger, D., Siegenthaler Muinde, G. (2005), "Access, Empowerment & Governance: Creating a World of Equal Opportunities with ICT", Global Knowledge Partnership (GKP), Kuala Lumpur, Malaysia
- Accenture (2017), "Digital disruption: growth multiplier". Retrieved from: <https://www.accenture.com/us-en/insight-digital-disruption-growth-multiplier>
- African Development Bank (2015), "Senegal Digital Technology Park", Appraisal Report
- African Development Bank (2015), "Dakar-Diamniadio Highway Project", Appraisal Report
- Aker J. and Mbiti I. (2010), Mobile Phones and Economic Development in Africa, *Journal of Economic Perspectives*—Volume 24, Number 3—Summer 2010: 207–232
- Allais C. (2006), "An overview of human trafficking in sub-Saharan Africa", University of Illinois at Urbana-Champaign Join Area Centers Annual Symposium, Retrieved from: https://www.researchgate.net/publication/237769872_AN_OVERVIEW_OF_HUMAN_TRAFFICKING_IN_SUB-SAHARAN_AFRICA
- Alzouma, Gado. (2005), "Myths of digital technology in Africa: Leapfrogging development?", *Global Media and Communication*, 1, 339 DOI: 10.1177/1742766505058128
- Basu D., Jong R. (2006), "Son Preference and Gender Inequality", Department of Economics, Ohio State University
- Bayeh Endalkachew. (2013), "The role of empowering women and achieving gender equality to the, sustainable development of Ethiopia", *Pacific Science, Review B: Humanities and Social Sciences*, Volume 2, Issue 1, January 2016, Pages 37-42, Doi.org/10.1016/j.psr.2016.09.013
- Boateng Richard (2010), "Mobile phones and micro-trading activities: Conceptualizing the link", VOL. 13 NO. 5 2011, pp. 48-62, Q Emerald Group Publishing Limited, ISSN 1463-6697, DOI: 10.1108/14636691111160635
- Brinkman Inge, Mirjam de Bruijn & Hisham Bilal. (2009), "The mobile phone, 'Modernity' and change in Khartoum, Sudan"
- Bruijn Mirjam, Nyamnjoh Francis, Brinkman Inge (editors), (2009), "Mobile phones: The new talking drums of everyday Africa", Langaa & African Studies Centre.
- Burrell, Jenna (2009), "Could connectivity replace mobility? An analysis of Internet cafe use patterns in Accra, Ghana".

- Cleland J., (2002), “Education and Future Fertility Trends with Special Reference to Mid-Transitional Countries”, United Nations Department of Economic and Social Affairs, Population Division.
- Cummings, O’Neil (2015), “Do digital information and communications technologies increase the voice and influence of women and girls?”, A rapid review of the evidence, Overseas Development Institute
- Ericsson (2014), “Sub-Saharan Africa Mobility Report”
- Falcão, Ricardo. 2010. "O papel das TIC no Desenvolvimento: Migrações e Globalização senegalesas", Communication presented on the 7th Iberian Congress of Africa Studies, Lisbon, url: <https://repositorio.iscte-iul.pt/handle/10071/2306>
- Falcão, Ricardo (2014) "Senegalese Youth at the crossroads between Cossan (Tradition) and the appropriation of ICTs - Technology, Body and Autonomy" in Marti, Josep, ed., "African Realities: Body, Culture and Social Tensions", Cambridge Scholars Publishing
- Falcão, Ricardo (2016). “Apropriação de Tecnologias de Informação e Comunicação no Senegal : Sociabilidades Jovens e Valores Sociais em Crise”, Tese de Doutoramento em Estudos Africanos, ISCTE-IUL, Lisboa, url: <https://repositorio.iscte-iul.pt/handle/10071/11393>
- Gómez L.N. et al (2017), “Multisectoral Academic Training Guide on Female Genital Mutilation/Cutting”, ISBN 9788491481652, Publisher: Dykinson, Retrieved from: <https://mapfgm.eu/wp-content/uploads/2017/04/Guia-Ingles.pdf>
- GSMA (2017), “The Mobile Economy”, Retrieved from: <https://www.gsma.com/mobileeconomy/wp-content/uploads/2018/05/The-Mobile-Economy-2017.pdf>
- Hafkin, F. (2002), “Gender Issues in ICT Policy in Developing Countries: An Overview”, UNDAW Expert Group Meeting, Seoul, 11-14 November.
- Hagen I. and Lal R. (2005), “Scaling up development initiatives through ICT: potentials and challenges”
- Hausmann R., Laura D., Tyson S.Z. (2012), “The Global Gender Gap Report 2012”, World Economic Forum.
- Hootsuite (2017), “We Are Social”, Report, Digital in 2017.
- James J. (2015), “Mobile phones and safety in developing countries: Evidence from Sub-Saharan Africa”, *Geoforum* 2015, 62:47–50.
- Kayisire D. and Wei J. (2016), “ICT Adoption and Usage in Africa: Towards an Efficiency Assessment”, *Information Technology for Development*, 2016, Vol. 22, No. 4, 630–653, <http://dx.doi.org/10.1080/02681102.2015.1081862>

- Khalifa, Ghada (2017), “Why coding is still the ‘must-have’ skill for the future”, Microsoft on the Issues Africa; Available at: https://blogs.technet.microsoft.com/microsoft_on_the_issues_africa/2017/02/23/why-coding-is-still-the-must-have-skill-for-the-future/
- King E. and Winthrop R. (2015), “Today’s challenges for girls’ education, Global Economy and Development”, Working paper 90, June 2015
- Konaté A., Touré E. (2015), “Passage douloureux à un pôle urbain”, Apamag, Poles Urbains, February 2015, Available at: <http://apanews.net/storage/app/media/magazine/APAmag2.pdf>
- Kottoor N. (2014), “The Senegal tech hub run by women for women”, BBC News, Available at: <https://www.bbc.com/news/business-28363783>
- Lancaster, Henry (2017), “Fixed and Mobile Broadband in Africa: An Executive Summary”, *Africology: The Journal of Pan African Studies*, vol.10, no.10, November 2017.
- Lee, K.R. (2009), “Impacts of Information Technology on Society in the New Century”, Available at: <https://www.zurich.ibm.com/pdf/news/Konsbruck.pdf>
- Maguire C. and Zhang J. (2016), “Effective Blended Learning for Development”
- Mark, D. J. W., Mayer, R., & Minges, M. (2011), “Africa’s ICT infrastructure. Building on the mobile revolution”. Washington, DC: The International Bank for Reconstruction and Development (The World Bank).
- Master, Allison, Meltzoff, Cheryan, Sapna (2014), “Reducing adolescent girls’ concerns about STEM stereotypes: When do female teachers matter?”, *REVUE INTERNATIONALE DE PSYCHOLOGIE SOCIALE-INTERNATIONAL REVIEW OF SOCIAL PSYCHOLOGY*; 2014, 27 3-4, pp: 79-102.
- Minges, M., Briceno-Garmendia, C., Williams, M., Ampah, M., Camos, D., & Shkratan, M. (2008), “Information and communications technology in Sub-Saharan Africa: A sector review”, Background Paper, 10. Retrieved from <http://www.eu-africa-infrastructure-tf.net/attachments/library/aicd-background-paper-10-ict-sect-summary-en.pdf>
- Mottin-Sylla M. (2005), “The Gender Digital Divide in Francophone Africa: A Harsh Reality”, ENDA Third World, Dakar, 2005
- NCWGE, (2008), “Title IX at 35: Beyond the Headlines”, Report, <https://www.ncwge.org/PDF/TitleIXat35.pdf>
- Newman Wadesango, Symphorosa Rembe & Owence Chabaya (2011), Violation of Women’s Rights by Harmful Traditional Practices, *The Anthropologist*, 13:2, 121-129, DOI: 10.1080/09720073.2011.11891187

- Njoh, Ambe (2017), “The relationship between modern Information and Communications Technologies (ICTs) and development in Africa”, Environmental Science & Policy School of Geosciences, University of South Florida, USA. Available at: https://ac.els-cdn.com/S0957178717301157/1-s2.0-S0957178717301157-main.pdf?_tid=d801490c-fa54-42c7-b0d7-b57340c02f5d&acdnat=1529062522_5837bfd99aad95cfa49c7b5a67079c
- Noorloos F., Kloosterboer M. (2018), “Africa’s new cities: The contested future of urbanisation”, Urban Studies 2018, Vol. 55(6) 1223–1241, Urban Studies Journal Limited 2017
- Nyamnjoh, Francis. (1999), “Africa and the information superhighway: The need for mitigated euphoria”, *Ecquid Novi*, 20 (1): 31-49.
- Ogato G., (2013), “The quest for gender responsive Information Communication Technologies (ICTs) policy in least developed countries: policy and strategy implications for promoting gender equality and women’s empowerment in Ethiopia”, *International Journal of Information Technology and Business Management*, 29th July 2013. Vol.15 No.1
- Pelckmans, Lotte. (2009), “Phoning Anthropologists: The mobile phone’s (re-)shaping of anthropological research”.
- Petesch C. (2016), “In Senegal, young women challenge boundaries through coding”, (2017), Available at: <https://apnews.com/6ecef8a988b94532a03062fcc4b423b2/senegal-young-women-challenge-boundaries-through-coding>
- Pfaff, Julia. (2009), “The mobility of a mobile phone: Examining ‘Swahliness’ through object’s biography.
- Robins, Melinda. (2002), “Are African Women Online Just Ict Consumers?”, *Gazette: The International journal for communication studies*, Sage Publication.
- Sala I.M., (2018), “Senegal is building a futuristic city to deal with its congestion problems”, Dakar, Article, <https://qz.com/africa/1352926/will-senegals-diamniadio-city-solve-dakars-problems/>
- Stearns, Elizabeth, et al, (2016), “Demographic Characteristics of High School Math and Science Teachers and Girls’ Success in STEM”, *Social Problems*, Volume 63, Issue 1, 1 February 2016, Pages 87–110.
- Tousseau-Oulai, A., & Ura, S. (1991), Information technology transfer: Problems facing African developing nations. *International Journal of Human-Computer Interaction*, 3(1), 79–93.
- UNAIDS (2012), “Impact of the global economic crisis on women, girls and gender equality.”

UNESCO (2016), “School resources and learning environment in Africa”. Available at: <http://uis.unesco.org/sites/default/files/school-resources-and-learning-environment-in-africa-2016-en/school-resources-and-learning-environment-in-africa-2016-en.pdf>

UNESCO (2017), Cracking the code: Girls’ and women’s education in science, technology, engineering and mathematics (STEM), ISBN 978-92-3-100233-5, p.40

United Nations. (2015), “UNCTAD Technical Notes on ICT for Development”. Available at: http://unctad.org/en/PublicationsLibrary/tn_unctad_ict4d09_en.pdf

United Nations (2015), “Transforming our World: The 2030 Agenda for Sustainable Development”.

United Nations (2015), “UNCTAD Information Economy Report”. Available at: http://unctad.org/en/PublicationsLibrary/ier2015_en.pdf

United Nations (2017), “The Sustainable Development Goals Report”, Available at: <https://unstats.un.org/sdgs/files/report/2017/TheSustainableDevelopmentGoalsReport2017.pdf>

Wallsten, S. (2005), Regulation and internet use in developing countries. Economic Development and Cultural Change, 53(2), 501–523.

SOURCES

Internet source, African Undersea Cables, July 2017 (Version 47), Available at: <https://manypossibilities.net/african-undersea-cables/>

<https://www.theguardian.com/world/2014/jun/05/internet-use-mobile-phones-africa-predicted-increase-20-fold>

<http://www.jthsenegal.com/>

<http://risktakers.co.ke/2017/02/27/senegal-the-west-africas-quiet-high-tech-titan/>

<https://www.senboutique.com/h>

ANNEXES

ANNEX A

Fig. 1 - Facebook page insights on the demographic data

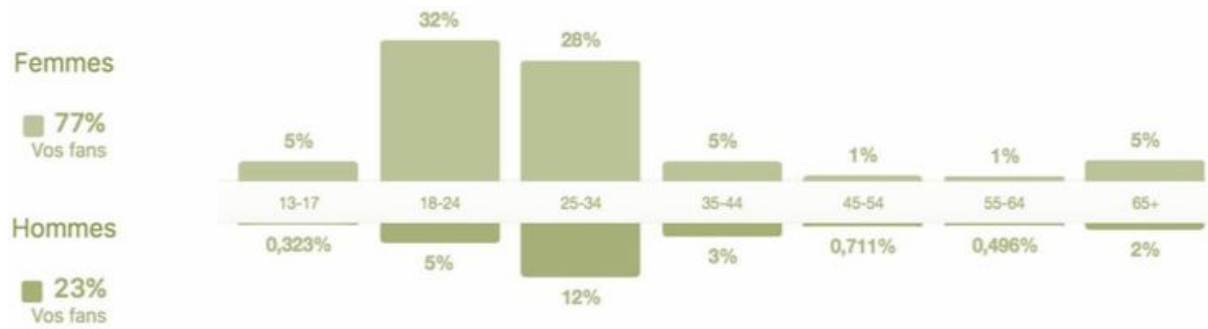


Fig. 2 - Profession of beneficiaries

Quelle est votre profession ou activité ?

1 042 réponses

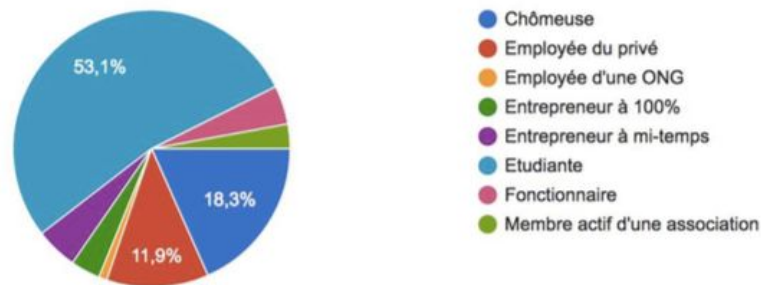


Fig. 3 - Project idea

Avez-vous un projet ou une idée de projet ?

1 042 réponses

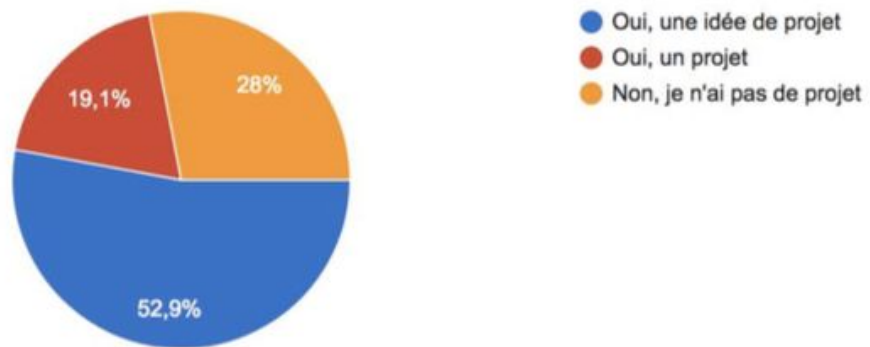
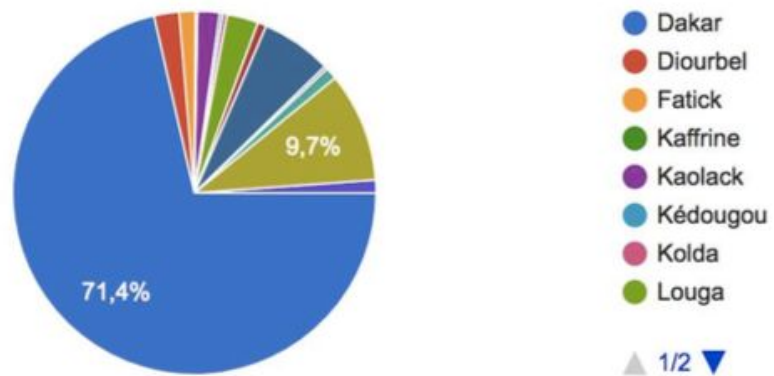
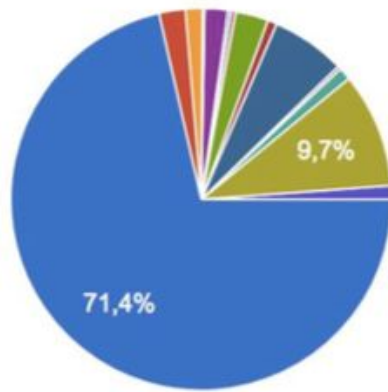


Fig. 4 - Location

Dans quel région du Sénégal êtes-vous ?

1 036 réponses





- Matam
- Saint-Louis
- Sédhiou
- Tambacounda
- Thiès
- Ziguinchor

▲ 2/2 ▼

Annex B

Table 1 - Example of a usual training schedule

Activité du Samedi 23 Septembre

Plan C Ré-adapté : 60 Personnes soit 10 personnes par salle

Lieu : Formation au QG

Salle 1	Salle 2	Horaires
<ul style="list-style-type: none"> • Accueil des participantes • Emargement, Remplissage des formulaires de pré-test • Présentation membres, jth, warm up, speed-meetup et restitution 		8h - 8h55 (à faire par chaque formateur)
Prise en main de l'ordinateur et création d'adresse email Formatrices Awa Cheikh Gueye, Astou Coulibaly	Lean Canvas, Elevator Pitch & PowerPoint pour un entrepreneur Formateurs Lean : Diambo, PP: Omar	9h00 - 11h30
<ul style="list-style-type: none"> • Accueil des participantes • Emargement, Remplissage des formulaires de pré-test • Présentation membres, jth, warm up, speed-meetup et restitution 		11h30 - 12h00 (à faire par chaque formateur)
E-marketing et Sécurité informatique Formatrices Fadieye, Adja Dia	E-marketing et Sécurité informatique Formatrices Aminata, Marième	12h00 - 14h30
<ul style="list-style-type: none"> • Accueil des participantes • Emargement, Remplissage des formulaires de pré-test • Présentation membres, jth, speed meetup et restitution 		14h30- 15h00 (à faire par chaque formateur)
Excel pour les entrepreneurs Formatrices Coumba, Caroline	Création d'applications mobiles Formateurs Ndongo, ?	15h-18h
DEBRIEFING, RANGEMENT & GESTION LOGISTIQUE		18h00-19h

Équipe complémentaire :

1. Gestion du temps (timekeeper) : **Scica**
2. Accueil des participantes / Émargements / Tee-shirts / Attestations / Porte clés : équipe logistique
3. Gestion des Prétest / Post-test de chaque cours et enregistrement sur google drive : Coudy
4. Gestion du rapport d'activité de la journée: ?

ANNEX C

Table 2 - Ratio between actually trained and registered applicants.

Zone	Date	Effectivement formés	Inscrites et confirmées	Ratio
Thiaroye	15-mars	38	50	12
Ziguinchor - Bignona	19 & 21-Mai	65	65	0
Kebemer	05-août	41	50	9
Thiès Ville	26-août	86	200	114
Dakar	16-sept	13	50	37
Dakar	07-oct	55	60	5
Dakar	14-oct	20	50	30
Dakar	28-oct	17	50	33
Dakar - Equipe	18-nov	20	20	0
Dakar	25-nov	21	50	29
Dakar	02-déc	8	25	17
Dakar	09-déc	3	25	22
Total		387	695	308