

COMMUNITY MULTIMEDIA CENTRES IN
MOZAMBIQUE: EXPLORING AND EXPERIMENTING
CO-DESIGN

A dissertation presented by

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Abstract

The overall aim of this doctoral thesis was to elucidate the premises and conditions in which a co-design approach can be used with rural communities in Mozambique and the usage of Information and communication technologies for development as a tool for supporting rural communities on daily activities.

The doctoral thesis includes five papers, a systematic literature review, and four case studies.

The literature review (I) provides an overview of 34 studies that describe the implementation of co-design with rural communities. In the review, papers published between 2002 and 2013 were clustered in three groups – information system, social design, and ICT4D. The analysis provided insightful information about the knowledge and taxonomies required to understand how actually co-design can be used to support communities. While the conventional development paradigm asserted that developing countries could be propelled to growth path by knowledge emanating from developed nations, new approaches give priority to design partnerships and participation by the local civil society as the best method to achieve sustainable development.

Paper (II) describes a case study implemented in the Morrumbene district (Mozambique), which emphasizes the need to explore design spaces and meaningful dialogs to share past experiences and contextual knowledge. Data were collected via focus group sessions, which had as participant's people from the local community, the CMC staff, and two researchers. Findings from the Morrumbene case show that an equalitarian approach where all participants' ideas and perceptions are taken into consideration provides an artefact that unifies ideas and perceptions. It also creates conditions for individuals with social and political differences to work together, share ideas and competencies. Paper (III) brings a case study implemented in the Quelimane municipality. The case outlines a design perspective that brings up proactivity and trust as additional condiments to be taken into consideration while co-designing.

Papers (IV) e (V) provides understanding on how co-design can be used to produce sustainable services for the community. The cases analyse aspects that hinder – or even stop – intended positive ICT4D benefits to becoming a reality.

The case studies here presented were performed in the three regions of Mozambique (south, central and north), with social groups with different education level, language, and social status working towards the same objective.

The findings of this thesis could be used to develop a plan to support CMC and to further improve rural community's usage and adoption of ICT. CMC services are an important endeavour with significant payoff in communities' daily lives and activities. This thesis also contributes to a more complete, balanced, and grounded image of how CMCs and local communities can work together to create socially and financially sustainable services.

Keywords

Co-design, Community Multimedia Centre, Mozambique, ICT4D, Information and Communication Technologies for Development, rural communities, Telecenter.

List of publications that form part of this Thesis

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2. David, S., & Cantoni, L. (2015). Exploring and Experimenting Cooperative Design. In *Design, User Experience, and Usability: Design Discourse*. Springer International Publishing.
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List of Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
CAICC	Centros de Atenção Integral à Criança e ao Adolescente
CDM	Correios de Moçambique
CIA	United States Central Intelligence Agency
CMCs	Community Multimedia Centers
CIUEM	Centro de Informática da Universidade Eduardo Mondlane
EASSy	Eastern Africa Submarine Cable System
FAO	Food and Agriculture Organization
FRELIMO	Frente de Libertação de Moçambique
FDI	Foreign Direct Investment
FM	Frequency Modulation
FORCOM	Nacional das Rádios Fórum Comunitárias
FSAU	Fundo de Serviço ao Acesso Universal
GABINFO	Gabinete de Bureau de Informação
HCI	Human Computer Interaction
HIPC	Heavily Indebted Poor Countries
ICT4D/ICTD	Information and Communication Technologies for Development
ICT	Information and Communication Technologies
IDA	Associação Internacional de Desenvolvimento.
INCM	Instituto Nacional das Comunicações de Moçambique
INTIC	Instituto Nacional de Tecnologias de Informação e Comunicação
INE	Instituto Nacional de Estatística
IMF	International Monetary Foundation
IRDC	International Development Research Centre
IS	Information System
ITU	International Communication Union
MCC	Millennium Challenge Corporation
MCT	Ministry of Science and Technology

MTC	Ministry of Transports and Communication
Mcel	Moçambique Celular
MDGs	Millennium Development Goals
MNEs	Multinational Enterprises
RE-ACT	Social Representations of Community Multimedia Centres in Mozambique and Action's for Improvement
RENAMO	Resistência Nacional de Moçambique
RM	Rádio Moçambique
RTP	Radio Televisão Portuguesa em Africa
SEACOM	African Cable System
SSA	Sub-Saharan Africa
STV	Televisão de Moçambique Soico televisão
TDM	Telecommunications of Mozambique
TIM	Televisão Independente de Moçambique
TVE	Televisão Experimental de Moçambique
TVM	Televisão de Moçambique
UNESCO	United Nation Educational Scientific and Cultural Organization
UNICTTF	The United Nations Information and Communication Technologies Task Force
UN	United Nations
UTICT	Policy Implementation Technical Unit
VSAT	Very Small Aperture Terminal

Chapter 1 Introduction

Information and communication technologies (ICT) are largely assumed by academic practitioners, government entities and researchers from both the so-called developed and developing countries as tools with the potential to foster economic development (Bertot et al., 2010; Heeks, 2002; Macome, 2004).

Although adoption of computers, tablets, mobile phones and the Internet continues to advance rapidly in the developed context, the developing nations especially those in the African continent are lagging behind on technology adoption. Most of the communities in the African continent cannot afford computers, tablet devices or the Internet, as a single computer or tablet can outlay a year salary (Simmons, 2005).

Mobile phones adoption has grown phenomenally in Africa; the initial forecast has been extremely exceeded (Brown et al., 2003). Mobile phones are spreading universally across the planet; they are considered a common manifestation of the latest phase of globalization. With more than three billion subscribers around the world, mobile phones merit attention as a case in global technology diffusion (Kalba, 2008). In some regions of Africa, mobile phones represent the first modern telecommunication infrastructure; Mobile phones adoption have out-diffused virtually every prior technology, whether TV sets, radios, wireline phones or bicycles and have done so in the past 25 years (ITU, 2015). The most frequently cited explanatory factor for the diffusion is income, particularly at the per capital level and the reverse proportion to the existence of legacy “fixed line” connectivity (Castells et al., 2009). The world, as a whole, is rapidly adopting mobile phones and associated services, yet the pace of adoption varies significantly across countries.

Recent research (“Internet Usage Statistics for Africa,” 2014; ITU, 2015) suggests that Africa is home to approximately 900 million people; only 59 million Africans are Internet users. These represent an Internet penetration of 5.9%. Even with such growth, no African country made the top 20 Internet users list, relegating the continent to the lowest level of connectivity (“Internet Usage Statistics for Africa,” 2014). Seven billion people (95% of the global population) live in areas with mobile cellular network coverage. Mobile-broadband networks (3G or above) reach 84% of the global population but only 67% of the rural population (ITU 2015). The International

Telecommunications Union (ITU) estimates that 3.9 billion people (53% of the world's population) will still not be using the Internet by the end of 2016. Furthermore, the ITU estimates that in the Americas about one-third of the population is offline, in Europe only 21% of people remain offline, in the Asia Pacific and the Arab States the percentage of the population which is offline is 58.1 and 58.4% respectively. In Africa 75% of the population are non-users of the Internet (ITU, 2015).

Africa is on the margins of globalization; regarding trade the continent has dropped from 4% to 1.5% in the last 40 years (Artadi & Sala-i-Martin, 2003; Rodrik, 1998). The continent in the 70s and 80s was not taken as a serious investment destination; in the last five years, the continent was flooded with private capital and equities for mining and oil. In this globalized economy, many African countries are becoming emerging markets, allowing African citizens to actively participate and reap benefits from the global market (Kieh Jr, 2013).

In a globalized economy and society, access to information is a vital resource; there is no region that exemplifies the conflict of haves and have-nots than the sub-Saharan Africa (SSA). The SSA economy performance has been marked by slow growth, worse than any other region in the African continent (Rodrik, 1998). This slow growth can be partially explained by the human-made conflicts and natural disasters in the past half-century (Leibfritz & Flaig, 2013).

ICT provide new frontiers to exchange information and intellectual freedom in the developed world, boosting to the SSA enthusiasm and the benefits of the information revolution, to a context where information is known as limited.

Information is a resource with capabilities to mitigate the effects of economic, social, political problems and bridge the digital divide (Eubanks, 2011; Mosco & Wasko, 1988).

The digital divide is understood as a multidimensional phenomenon encompassing three distinct aspects:

1. The global divide;
2. Social divide; and
3. The Democratic divide.

The global divide is concerned with the divergence of Internet access between developed and developing societies. Lloid Morrisett from the Markle Foundation, defined this gap of access to electronic information technologies as a divide between the information haves and the information have-nots (Morrisett, 2001).

The social divide is concerned with the gap between the information rich and poor in a given geographical location, emphasizing the inequalities in access to Internet, extent of use, knowledge of search strategies, quality of technical connections and social support.

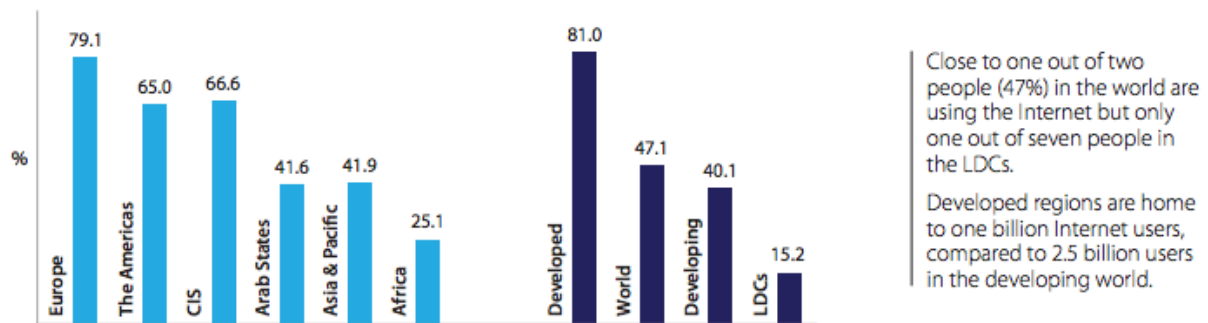
The democratic divide focuses on the so-called second level divide, which concerns the ICT” usage” divides. The democratic divide according to Norris (2001) analyses the concerns between those who actively use ICT and those who do not use it for political purposes (Norris, 2001). The democratic divide, if any, raises a critical social question since it suggests that there may be politically marginalized people in the digital world (Min, 2010).

Digital divide is also used as a broad and loosely term to express either the disparity between people in their access to ICT, or the disparity in people access to the Internet (Norris, 2001), hence we define digital divide “as both access and use of ICT“, a pressing concern for most African countries somehow excluded from the information society.

The figure 1:1 shows the percentage of individuals using the Internet; the developed regions are home to one billion Internet users compared to 2.5 billion users in the developing world. Europe and the Americas have the highest percentage of individuals using the Internet.

THE DIGITAL DIVIDE IN 2016

Percentage of individuals using the Internet



Percentage of households with Internet access

Figure 1:1 The Digital Divide 2016 (Source, The ITU)

The field of ICT is a multidisciplinary field, a heterogeneous collection of industries where several disciplines contribute to the field enrichment (Karanasios, 2014). The most known disciplines who contribute to the innovation and propagation of ICT are information system (IS) (Walsham et al., 2007), Communication Studies, Human Computer Interaction (HCI) and Development Studies (Dearden, 2008; Beckinsale & Ram, 2006). This perception is based on the premises that ICT can contribute to improving socio-economic conditions and wellbeing of communities in both developed and developing countries; this assumption was promoted and brought forward by the United Nations

Millennium Development Goals (MDGs) vision of eradicating poverty (Gilhooly, 2005, Kleine, 2009). In light of experiences in the SSA countries and elsewhere in the developing world, it appears evident that ICT can propel nations to development, when ICT are seen as:

“Set of activities that facilitate the capturing, storage, processing, transmission and display of information by electronic means” (Bellotti & Sellen, 1993, p. 22).

ICT are also seen by Dias and Toyama (2008) as:

“a connotation of modern electronic technology- primarily the PC, the mobile phone, and the Internet playing a central role in providing communication” (Dias & Toyama, 2008, p. 4).

Hence Commonwealth papers by Commosioug & Duggan (2008), define ICT as *“solution with potential to build social capital, contribute for bridging and linking resources that enhance economic and social development”* (Commosioug & Duggan, 2008, p. 3).

The African continent faces economic, social, and political challenges as policymakers and decision makers seek to improve material living standards and quality of life in a complex and uncertain environment (Jasanoff, 2003). As a direct consequence of the nature of ICT, policy-making in this sector is very diffuse; normally policymakers tend to be regulatory bodies, overseen by decision makers (government ministries). Both policymakers and decision makers see ICT as a shortcut for development, having observed the impact of ICT in the developed world (Ya’u, 2005; Munene et al., 2000;).

Unfortunately, ICT does not offer a panacea for social and economic development. There are risks of unemployment, social and economic dislocation, and these may lead policy makers to give lower priority to the need to create effective national ICT strategies (Unwin, 2015; Gyberg, 2014; Funtowicz et al., 1998; UNCSD, 1997;).

There are fundamental empirical and methodological challenges, such as irreversibility, uncertainty, perceptions, technological, environmental risks, which must be methodically analysed and understood in the context where ICT are implemented. These methodical analyses create conditions for ICT to harness its potential and link to resources to enhance economic and social development. Attention to social capital is important when aiming to develop community interventions; the on-going ICT initiative cannot deliberately be designed elsewhere (Sutinen & Vesisenaho, 2006). Decision makers in SSA must be encouraged to look at how the use of ICT applications and services can enhance opportunities to improve access to markets, health, education, empower communities and remove social barriers (Narayan-Parker, 2002).

Such awareness has been out of decision makers reach in the developing context, due to lack of sound knowledge and scientific information about development strategies and research disciplines

such as Information and Communication Technologies for Development (ICT4D) (Baskerville & Wood-Harper, 1996; Fry, 2006).

Information and Communication Technologies for Development is a research discipline defined as an *“initiative to bridge the digital divide (disparity between technological have and have-not geographic locations or demographic groups) and aiding economic development by ensuring equitable access to up-to-date communications technologies having researchers and practitioners, technologists and social scientist- all striving to work toward a better life for the least privileged”* (Toyama & Dias, 2008, p. 22-25).

ICT4D encompasses radio, television, cellular phones, computer networks, and other types of hardware, and software. Two expressions, one from the North and one from the South have claimed the emergence of ICT4D as a research discipline:

“Heads I win, tails you lose.”

The North reasons with the hypothesis of ICT4D introduced in the 90s by the Millennium Development Goals (MDGs) and the Internet. The United Nations ICT Task Force (UNICTTF) states, *“the intersection of ICT and the MDGs forms a critical nexus for the future of sustainable human development and poverty eradication”* (Badimo, 2005).

The South, the other face of the coin, is aligned with the idea of ICT4D being produced by moral arguments, immigration concerns, and self-interest. The moral arguments hinge on moral interest and consciousness to support communities who live on the front-line of poverty, conflict, disease, lack of resources, and terror (Gomez et al., 2012; Heeks, 2008). The self-interest is aligned with the weak financial capabilities of the world’s developing nations, combined with industrialized nations producing on a larger scale and with the emergent need of new markets to dump obsolete goods. Hence, it is important to alleviate the poverty to create capacities to acquire such goods (Ebel, 1991; Osibanjo & Nnorom, 2007). Migration from the South, mostly motivated by terror, epidemics, war, and poverty, is a concern for the global North (Baldwin-Edwards, 2006).

The early stages of ICTD were dominated by concerns of addressing the needs of the poor, where inclusive e-government activities were performed to increase the delivery of public services to address poverty, health, education and gender equality through Internet support. Most of the resources reserved for projects sought to deliver the promises of the MDGs in the world’s poor rural communities (Reilly & Gómez, 2001). The literature typically acknowledges that it is difficult to measure and quantify the influences of ICT4D because few data exist in the developing context before the conducted research. Moreover, there is no *“magic bullet“* or *hypodermic needle,*” ICT4D will not provide food, clean water, affordable health care, civil rights, or peace, instead, the

technologies that encompass the field of ICT4D can increase the ability to communicate, learn and interact (Raiti, 2006).

Heeks (2008) took things further in his analyses of the ICT4D discipline's early stages, presenting a mismatch, a disconnection between ICT4D research and implementation. Heeks provided distinctions and types of concerns tackled during ICT4D research and implementation. He proposed the idea of ICT4D seasons, distinguishing between ICT4D 1.0, or research, and ICT4D 2.0, which focus on implementation.

Heeks presents ICT4D 1.0 as the early stages of the discipline, which addressed the marginalization of the poor and the North's "self-interests." An era defined in the SSA as *e-waste or ICT4\$* (Odedra et al., 1997) was received with mixed blessings and brought many negative consequences to the region. Foreign currency became scarce due to large spending on equipment never used. Furthermore, the region was dependent on multinational corporations and expatriate personnel, a season marked with the deployment of telecentres, the dumping of boxes without the necessary know-how, and several sociocultural conflicts (Raiti, 2006; Odedra et al., 1997).

"Telecentres can be defined as strategically located facilities providing public access to ICT services and applications in remote rural areas, they were equipped with a combination of computers, telecommunication services such as telephone, fax, e-mail and Internet" (Reilly & Gomez, 2001, p.4).

Telecentres in the early stages of ICT4D were hailed around the world as "the solution to development problems" due to their ability to provide desperately needed access to ICT and narrow the digital divide. Such assumptions created conditions for the deployment of a significant number of such centres by various governmental and development agencies across the globe (Heeks, 2002a; Oestmann & Dymond, 2001). However, several studies (Gomez & Baron-Porras, 2011; Kuriyan et al., 2010; Heeks, 2008; Oestmann & Dymond, 2001) present this initiative in developing nations as less encouraging, as an anecdote, failure, and point of exclusion. These hypotheses and evaluations came to light not only by the telecentres' undeniable incapability of achieving financial sustainability or providing services, but also by their inappropriate ownership models, social exclusion, gender insensitiveness, and scarce community participation.

The digital divide soon after the telecentres' implementation was acknowledged as not the only problem; the "pro-poor innovation" was also emerging. The pro-poor innovation is defined as solutions designed outside poor communities but on behalf of the poor, often escalating to a "design-reality gap" whose outcome results in a mismatch between the innovation assumption and requirements of poor communities (Heeks, 2008).

Pro-poor innovations such as telecentres were seen as an underlying failure, particularly because the initiative had a Western concept and design with origins significantly different from African realities. As years of telecentre deployment advanced, the telecentres model did indeed fall into the design-reality gap, hence the widespread lack of success and sustainability reported for telecentre projects (Heeks, 2002; Sey & Fellows, 2009).

The ICTD 2.0 presented by Heeks is a new paradigm that focuses on reframing the poor by working with and for poor communities, centering on pro-poor participatory research. This new facet of ICTD brings opportunities and challenges, and it emphasizes the need for new methods, expertise, and worldviews.

This thesis presents a developing context where several approaches to using ICT to alleviate the digital divide in rural communities have fallen into the design-reality gap. The design-reality gap involves several facets that are often taken for granted, or they are particular assumptions and requirements built into the design of any service or product that may match or mismatch the real situation found in the context of implementation. Hence, this thesis presents the implementation of small budget projects in which Community Multimedia Centres (CMCs) support and provide services with inherent value to the communities within the CMCs vicinity.

This research links the following issues:

1. Co-design as an approach that can be used in ICT4D due to the approach capability to generate knowledge, proactivity, social learning and trust, favourable condiments for social and financial sustainability of pro-poor interventions.
2. CMCs need to be financially supported through small budget projects to create inherent services for communities.

This study is empirically based on a participatory action research initiative undertaken in Mozambique within the research and development project RE-ACT (Social Representations of Community Multimedia Centres in Mozambique and Actions for Improvement). RE-ACT was a joint research collaboration project run by the Università della Svizzera Italiana, (Lugano, Switzerland), in collaboration with the Centre for African Studies and the Department of Mathematics and Informatics of the University Eduardo Mondlane, (Maputo, Mozambique).

The RE-ACT project was divided into two broad phases: The first phase examined the perception, understanding, and awareness that different stakeholders have of CMCs. In the second phase, nine CMCs, a representative sample of the current CMCs in Mozambique, were involved in the co-design of improvement actions. These improvement actions were co-designed through the cooperation of the CMCs' directors and staff, representatives of the affiliated communities, and the RE-ACT team.

This thesis reports on the second part of the RE-ACT project, in the processes adopted to co-design improvement actions. To introduce co-design, one has to understand design, the different flavours and metamorphosis that the discipline has gone through.

The design is defined as “*a plan or scheme devised by a person for something that is to be implemented*” (Bernhard and Bürdek, 2005, pp. 32). It became a highly specialized subject with little space for the involvement of end-users in the object conception. The primary intent of the design is to create objects for sale that obtain customer satisfaction (Margolin & Margolin, 2002). More recently, higher standards and increasing competition at the level of quality determined a greater attention to the needs and views of users. This stimulated the inclusion of users in the design process as a mean of ensuring better quality and higher relevance of products and services (Wheelwright, 1992; Karma & Hasaballah, 2014). Over time, design faced an evolution toward a more social model, where designers and design researchers worked towards providing products based on customers’ requirements and supported by quantitative and data analysis.

In the 1970s, US design firms initiated an approach that came to be known as user-centred design, characterised by the reproduction or translation of user knowledge into principles and prescriptions that designers could work with (Santos, 2000).

This is a conventional approach undertaken once the technology is already developed and released to the market, an approach that mainly provides to designers the possibility to assess end-user goals within the users’ context. The user-centred design has been typically associated with designers producing a service that ensures that users’ needs are met by assessing users’ goals and designing within the context of the assessment. The user-centred design is linked to all forms of design in which users are included; the methods employed are commonly observation, qualitative surveys, or interviews to determine likes and dislikes, merged with quantitative analysis to collect statistics (Bevan & Curson, 1999; Gulliksen et al., 2003).

On the other hand, Participatory design involves users in all phases of design to build systems that fit user needs while simultaneously helping users understand complex systems (Muller, 2003; Schuler & Namioka, 1993). It originated within Scandinavian software development connected to cultural and social democracy traditions. Participatory design blends ethnographic methods with frequent user involvement; it integrates at all stages community members into research projects as co-investigators, fostering a reduction of the distance between research activities and real world activities. This design approach encourages participants to share and produce authentic and relevant objects, conceived from mutual understanding and practices between researchers and researched (Muller, 2003). In participatory design, users are engaged in the design process from a very early

stage of object conception, taking control of the process by directing what should be done (Brandt, 2006). Designers are like artists; fuse learned skills with intuition formed over their past experiences to unfold their creativity, constant interaction with the creations provides space for alignment and harmonization (Rodil et al., 2012).

Co-design follows a similar path to participatory design, although it is seen as an evolutionary approach to technology design for socioeconomic development. The approaches to technology design in developing contexts evolved about considerations and beliefs about the nature of development and the effective means to pursue development. The poles of this evolution can be associated with two approaches: a transfer and diffusion approach, characteristic of the first years of ICT4D initiatives, and a social embeddedness approach that gained increased attention in the most mature years of ICT4D research and practice (Avgerou, 2008).

The definition of co-design is traced to Thomke and Von Hippel (2002) and Sanders and Stappers (2008).

Thomke and von Hippel (2002) did not define co-design; they proposed the idea of using toolkits for user innovation. Toolkits shift development and design tasks from the locus of the manufacturer to the user, originating co-design (Thomke & von Hippel, 2002).

Sanders and Stappers (2008) defined co-design as a “*collective creativity as it is applied across the whole life cycle of design*” (Sanders & Stappers, 2008).

Co-design can be approached as a direct interaction between designers and users. Hence we see co-design as a plausible methodology for ICTD 2.0 presented by Heeks, where the focus is placed on reframing the poor by working with and for poor communities. This approach allows voiceless communities to provide their input on co-designing services that can serve their needs.

The field of ICTD has several challenges when it comes to addressing needs of specific social groups. Hence the adoption of co-design aims to produce solutions for the community with the community.

To illustrate the outcomes of this research, the contextual information is explained in detail with in-depth analyses of the ICT scenario, demographics and economy. This study presents the deployment of ICT as part of the social portfolio to mitigate the digital divide and create social ties between the community and CMC. The approach here adopted focuses on exploring the resources, community inputs of a particular context. The design of a technical intervention is based on the available resources in the context of deployment (Sutinen & Tedre, 2010). It means to realise the emancipatory interests of the community, and the understanding of meaning from within the life-world and realities of the local people to collaborate with community entrepreneurs, teachers, housewives and

treat local people in such a way that their traditional social structure, cultural practices values and dignity are observed and respected (Krauss & Turpin, 2010).

1.1 Research Questions

The motivation for this study is the evident inability of CMCs to address community needs. RE-ACT researchers witnessed the inability here described during the first phase of the project. The CMCs should attempt to become active participants in the community daily activities instead, municipalities and cities, in particular, show a low commitment to support these facilities, thereby not allowing CMCs to contribute to the endogenous growth of the location.

An approach was required to reconnect communities with CMCs; such approach should act as a tool to allow different actors of the community to actively contribute on the re-structure of CMC services. The approach should be capable of providing ground to accept different perspectives about the same problem, allowing communities to take the decision regarding the best way forward. Furthermore, the approach should be able to fit a rural environment and regard all participants as equal during design phase and implementation.

The following questions have been used as guiding principles in formulating the research design:

1. Can small budget projects create conditions for social and financial sustainability of CMCs?
2. How can co-design be applied with small communities to develop sustainable solutions in an emerging economy?
3. How can rural communities with lower knowledge of design practices become designers of services on their domain?
4. What is the impact of ICT4D solutions co-designed by local communities?

1.2 Structure of the Thesis

The present thesis is organized into six Chapters to provide an understanding of how different elements affect the co-design process in rural and urban communities. Each chapter of the thesis presents a specific aspect of the research conducted in Mozambique.

This chapter 1 presents the thesis introduction, research questions, and structure. Chapter 2 is devoted to the context explanation. The chapter 3 demonstrates the research design, results of the data collection and analyses. The Chapter 4 draws up a map of the existing community multimedia centres (CMCs), presenting three dimensions that structure the CMCs in Mozambique (people, technological infrastructure, and services) and the improvement actions.

As this thesis is a cumulative dissertation, Chapter 5 presents four articles: a literature review on co-design and three case studies, where co-design implementation in ICTD aiming to provide services with inherent value to communities is presented.

Chapter 6 provides a summarizing discussion, conclusion, limitations, implications and orientation for future and further research on co-design in rural settings.

Chapter Summary

This study is empirically based on a participatory action research initiative undertaken in Mozambique within the research and development project RE-ACT (Social Representations of Community Multimedia Centres in Mozambique and Actions for Improvement).

The RE-ACT project was divided into two broad phases: The first phase examined the perception, understanding, and awareness that different stakeholders have of CMCs. In the second phase, nine CMCs, a representative sample of the existing CMCs in Mozambique, were involved in the co-design of improvement actions.

The approach adopted in this study focuses on exploring the resources, community inputs of a particular context the design of a technical intervention is based on the available resources in the context of deployment. It means to realise the emancipatory interests of the community, and realities of the local people to collaborate with community entrepreneurs, teachers, housewives and treat local people in such a way that their traditional social structure, cultural practices values and dignity are observed and respected.

This study is a cumulative dissertation, which addresses four research questions:

1. Can small budget projects create conditions for social and financial sustainability of CMCs?
2. How can co-design be applied with small communities to develop sustainable solutions in an emerging economy?
3. How can rural communities with lower knowledge of design practices become designers of services on their domain?
4. What is the impact of ICT4D solutions co-designed by local communities?

To answer the questions mentioned above, co-design was used as an approach to re-connect communities with CMCs; such approach should act as a tool to allow different actors of the community to actively contribute on the re-structure of CMC services.

Chapter 2

Research Context: Mozambique

In this chapter, contextual information about Mozambique is presented in two sections. The first section provides an overview of Mozambique geographical location and a brief review of the political situation. The second section describes demographic conditions including geography, climate, population, language, religion and economy.

Mozambique is a country bordered on the north by Tanzania, on the west by Malawi, Zambia and Zimbabwe, and on the south by South Africa and Swaziland. Mozambican land area is 799,380 squarekilometers, including 13,000 square kilometers of inland water. Mozambique is endowed with rich and extensive natural resources; the capital and largest city is Maputo previously called Lourenço Marques.

2.1 Mozambique from birth to independence

Mozambique was a land inhabited by the Khoisan, a tribe of hunters, were replaced in the IV century by the Bantu, mostly farmers. During the IX and XIII, commercial posts were created, and people from the Gulf started living at the coast of Mozambique. During this period, several tribes have been set up with the biggest empire being the Gaza Empire of Shaka Zulu.

Mozambique as a nation came into existence as result of an Anglo-Portuguese treaty signed in May 1891, and according to documents and historical facts it was not a colony, it was instead a province of Portugal (Newitt, 1995; Coelho, 1990). Due to Mozambique location, in the early 20th century the Portuguese royalty entrusted the administration of Mozambique to three private companies financed by Great Britain. The private companies aimed to establish railroads connecting Mozambique coast to British colonies (South Africa and Rhodesia).

In 1962, Mozambicans opponents to the colonial regime, living in Tanzania formed a nationalist movement to liberate the country from colonial rule (Chaulia, 2003; M. Hall, 1990). Following uncountable ambassadorial struggles to attain non-violent independence a military rebellion began in 1964. The military struggle lasted for ten years with several fronts fighting for liberation (Machel, 1975), the peace agreement was signed in Portugal, the former colonial power, and the Front for the Liberation of Mozambique (FRELIMO) representing all Mozambicans (Cabrita & Cabrita, 2000). With the signing of the Lusaka agreement, a provisional government was formed, Mozambicans and Portuguese comprised this government (Newitt, 1995), only later in 25th of June 1975, Mozambique was declared by Samora Machel an independent nation (MacQueen, 1985).

The Lusaka agreement represented the end of colonial rule; unfortunately, the end of the colonial rule did not bring lasting peace. One year after independence a devastating civil war was begun, between the Mozambican National Resistance (RENAMO) a front for liberation created outside the country, and the government of Mozambique. RENAMO progressively became a military instrument for undermining the Socialist government of Mozambique (O'Meara, 1991). RENAMO acted mainly in regions close to the borders (Zambia and Zimbabwe), and in a couple of years, RENAMO gained strength, and the conflict was transformed into an armed confrontation in all parts of the national territory.

In 1984, as a result of the Nkomati Accord, a change of direction from the socialist model adopted in 1975 was initiated. This was a structural adjustment program, which provided several political reforms and ground for the revision of the constitution introduced in 1990. The new constitution postulated conditions for economic liberalization, political pluralism, and segregation of powers and freedom of speech. This environment became constructive for the appearance of western missionaries and NGOs. FRELIMO in 1988 realized that the armed conflict could not be settled by military means, so certain individuals within the Government and civil society, the Catholic Church and other religious groups made attempts to establish a ground for peace talks.

In October 1992, a cease-fire and peace agreement was endorsed in Rome between the Government of Mozambique represented by FRELIMO and RENAMO through the mediation of the Catholic Church and the Italian Government (Simler, 2004). The 1992 peace agreement (Roma agreement), which established a competitive democratic system, was overseen by the United Nations (UN) and the first general elections were held in 1994 and led to the current multiparty parliament and a legitimately elected government.

2.2 Demographics

The population of Mozambique is approximately 25 million, and the majority of the population is young (47% below 15 years old) with a life expectancy of 50 years (INE, 2013; World Bank, 2015). This estimation takes into account the effects of excess mortality due to AIDS, which results in lower life expectancy, higher infant mortality, higher death rates, lower population growth rates (2.44% in 2013) (INE, 2014), and changes in the distribution of population by age and sex than would otherwise be expected. The Figure 2:1 shows the growth of population since 2005 comparing with the growth of the Sub-Saharan Africa and Central Europe and the Baltics.

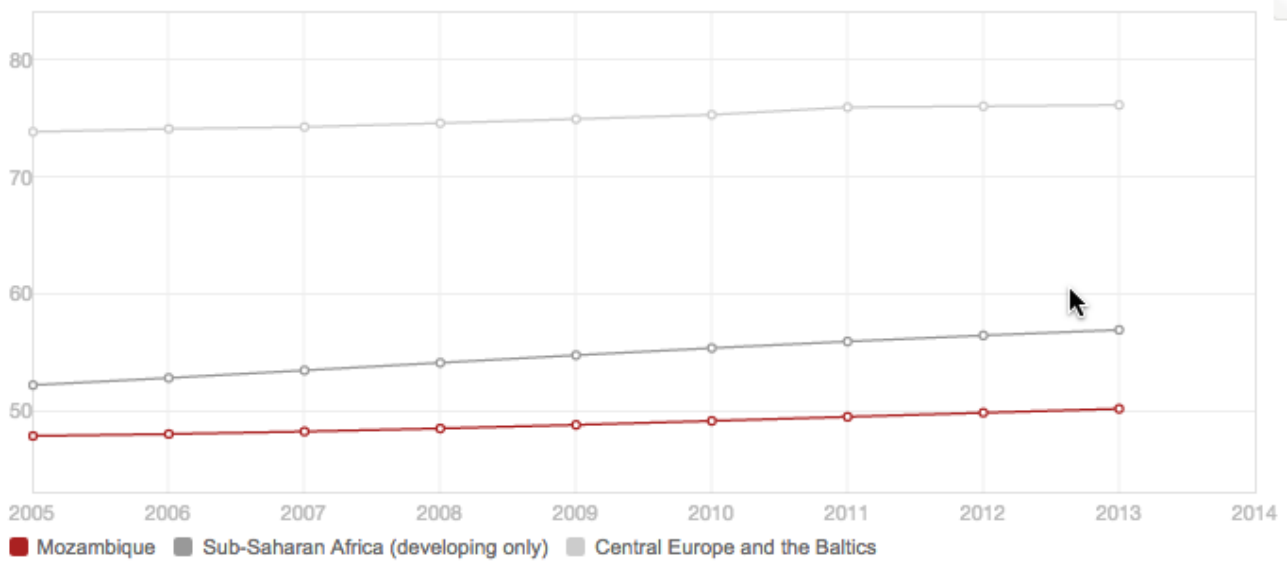


Figure 2:1 Life expectancy in Mozambique, Sub-Saharan Africa and Central Europe (Source, World Bank, data.worldbank.org/Mozambique)

Young communities living in various forms of deprivation see ICT as a hope for economic and social development (Pal, 2010). There are indeed transcendent contextual constraints to deliver access to ICT effectively; often-neglected aspects such as heterogeneity of communities, composition, and distribution tend to hinder deployment of technologies (Zhang & Chib, 2014).

Mozambique is geographically and politically divided into eleven (11) provinces and the capital is Cidade de Maputo; these 11 provinces fall into three groups: South, Centre, and North (Figure 2.3). The Mozambican population is divided into ethnic, social groups, subdivided into small subgroups with diverse and different dialects and cultures. The population contains twenty ethnic groups mainly of Bantu origin, distributed throughout the territories of neighboring countries. There are similar groups of Europeans and Asians living in the country. The largest ethnic, social group is called Makua, with a population of 4 million, living in the northern part of Mozambique, followed by Sena and Shona prominent in the centre alongside the Zambezi Valley, and last the Shangana dominant in the southern part of Mozambique. There exist other smaller groups like the Makonde, Swahili, and Tsonga, which are dispersed due to the civil war, recurrent drought in the hinterlands, desertification, pollution of surface and coastal waters (Tauacale, 2002). The Europeans and Asians most are based in the capital city Maputo, and they are less than 1 million inhabitants (INE, 2013).

2.2.1 Social groups

Different ethnic groups exist in Mozambique; the official language is Portuguese, and Mozambique neighboring nations have English as the main language. Portuguese is the country mother tongue for

3% of the population and spoken by approximately 50% of the population (Lopes, 1998). As most of the population remains in rural areas, the most used languages in these regions are the regional dialects. The most widely spoken dialect is Emakuwa spoken by 24% of the population living in the northern provinces. The Xichangana is the second most spoken dialect by 13% of the population inhabiting the southern part of Mozambique. Other dialects like Elomwe spoken by 14%, Cindau 11%, and Xitsonga 11% are dispersed within the country; other 40 smaller linguistic groups share the remaining 24%, these languages are spoken at a district level.

Figure 2:2 Language distributions in Mozambique (Source, Instituto Nacional de Estatísticas)

The different social groups and languages are not a factor of segregation between individuals or group of people in Mozambique. The 2007 census reveals an increase of social groups migration from the north to south and vice versa. Communities have become more integrated with lower constraints to accept individuals from different social groups. Networks of communities are created allowing people to act collectively as it pertains economic development by building synergies at the community and institutional level. In contemporary rural Mozambican communities' emphasis is placed on the process of knowledge sharing and learning, with information passing from generations using supportive culture, context learning, and knowledge as a crucial sharing platform. This is attained in fields such as health, education, agriculture, pasture, and fishing.

The figure 2:3 shows the geographical limits, neighbouring nations, the provinces, and the language distribution.

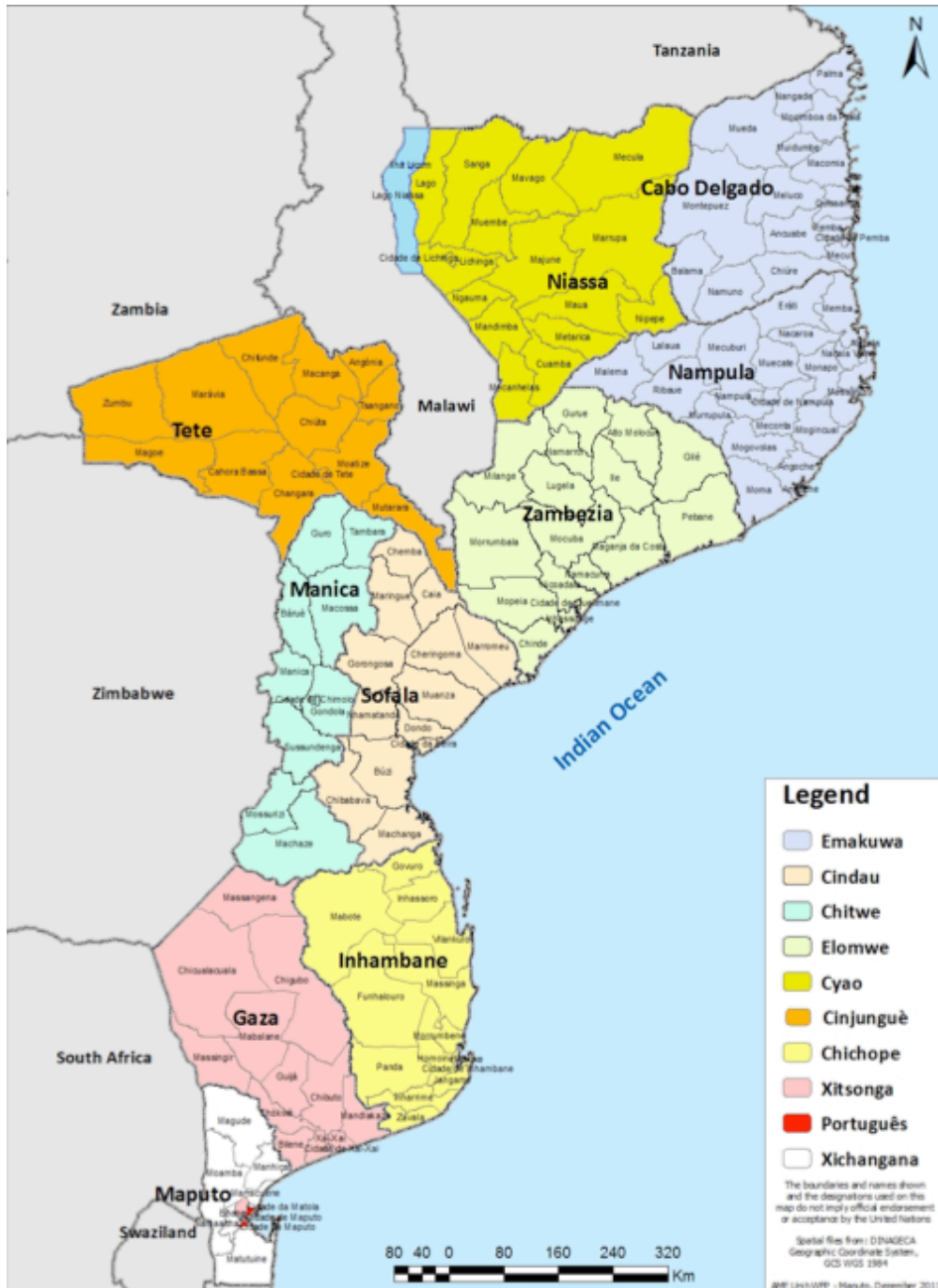


Figure 2:3 Language Distributions (Source: Fiji press 2000 <http://www.mcescher.com/>)

2.2.2 The Climate

The climate through the country is covered in a mixture of subtropical scrub where the south tends to be cooler and drier than the north (Herrick et al., 1969). This climate originates flooding in the south where the valleys of Zambezi and Limpopo rivers tend to burst their banks after the combined effects of weeks of torrential rain and winds. The post-floods originate several diseases like malaria,

respiratory infections and diarrheic infections (Kondo et al., 2002), this phenomenon affects millions of Mozambicans, forcing migrations of approximately 4.5 million people in 2000 (Arnold, n.d.; Kondo et al., 2002).

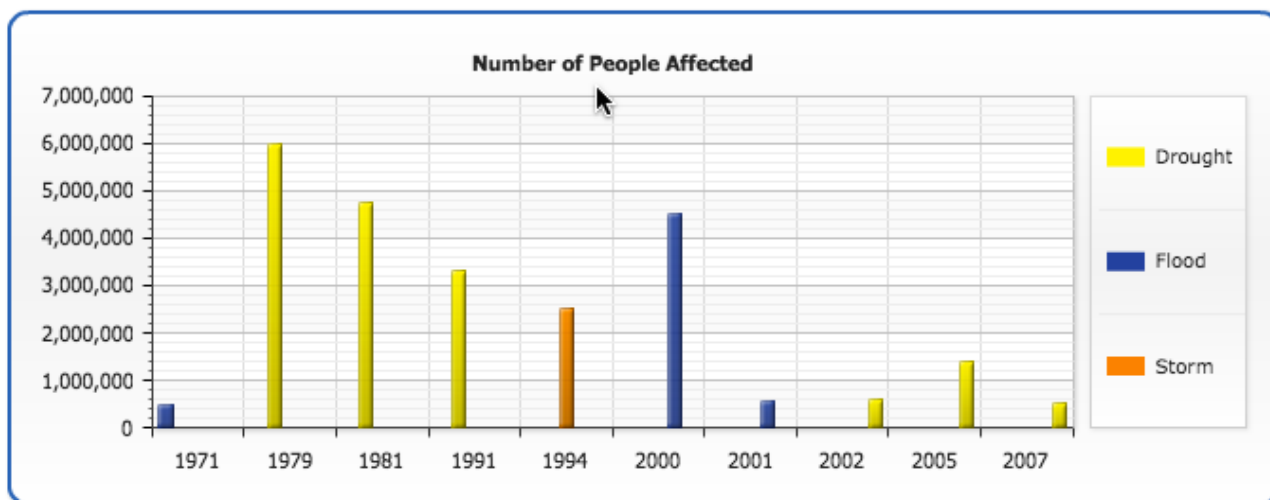


Figure 2:4 People affected by natural disasters in Mozambique (Source: Climate portal <http://sdwebx.worldbank.org/climateportalb>)

2.2.3 Religion

Religion has a strong growing significance as a key source of identity for millions of people, especially in the developing world (Castells, 2011). The Muslims have been the first community to enter Mozambique through the northern provinces of Cabo Delgado and Nampula during the XII century; the Islamic religion propagated through the coast only to cover commercial areas (Levtzion, 2012). With colonization that lasted for almost 400 years and the Portuguese reaching and establishing first at the southern provinces of Inhambane and Maputo, several specific Portuguese cultural practices were transferred. Cultural aspect contained habits, ideas, kinship formation, language and especially the religion (H. S. Klein, 2010). Nowadays more than 50% of the Mozambicans are Christians, Muslims are 28% of the population, and the remaining 22% of the populations adheres to traditional beliefs or have dualistic faith that integrates Christian/Islamic beliefs with traditional animism or pantheism (Haynes, 2007).

Christianity is more common in urban areas, and in the south and centre provinces, Islam is more predominant in the northern part of the country, and the traditional beliefs are predominant mainly in the rural areas of the country. Furthermore, a fraction of Indian immigrants prophesies Hinduism (ED, 1996).

2.3 The economy

For many years, war, drought, and economic crisis made Mozambique the world's poorest and most foreign aid-dependent country (Lubkemann, 2005), even if the country has high agricultural potential and it is rich in coal and natural gas (Macamo & Neubert, 2004). Mozambique's aid dependence is highlighted by the fact that there aren't financial resources domestically to extract the existing mineral resources.

The Mozambican economy is dependent on foreign aid, and the government since the end of the civil war is trying to improve conditions to attract foreign money (Briggs, 2011). A proof of this is the significant amount of money donated by agencies such as the World Bank, IDA, IBRDA, DANIDA and other development actors that have programs in Mozambique. This is mainly due to the 20 years of unbroken relations with international financial institutions and 40 years of close links with Nordic countries (Norway, Finland, Sweden and Denmark). Market-oriented reforms, which included privatization of several important industrial sectors along with debt relief programs, prophesied economic improvement for the country. The amount of foreign investment in the recent years have shown a substantial increase due to the discovery of mineral resources in the central and northern provinces of Mozambique. The figure 2:5 illustrates the growth in foreign investment per each fiscal year.

Operations by Fiscal Year

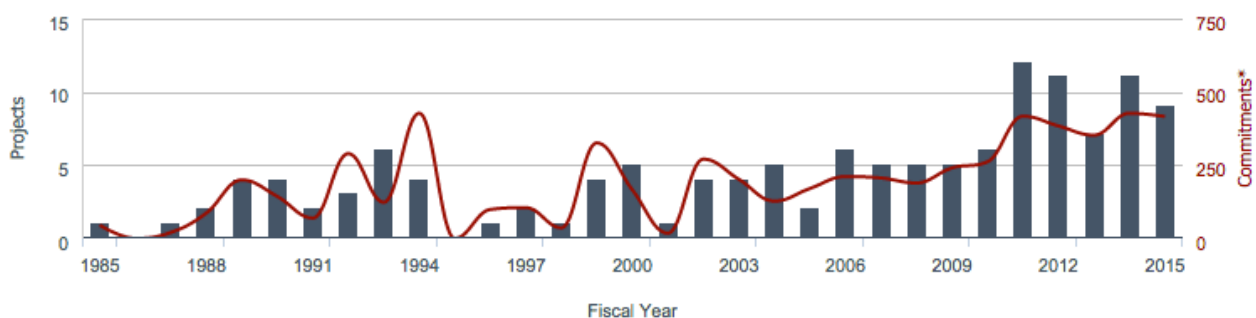


Figure 2:5 Foreign Investment for Projects in Mozambique (Source: World Bank portal

<http://www.worldbank.org/projects>)

This economic improvement provided the commerce and services to lead the income generation by 46%; the industry provides 30.5% and agriculture 23% (World Bank, 2014; FAO, 2014).

The agriculture sector is the least productive sector through the highest number of Mozambicans works in it. INE estimates that 80% of Mozambicans rely on the subsistence farming and fishing to

survive. The agriculture sector provides the highest exportation, where products like shrimp, prawns, cotton, cashew nuts, sugarcane, copra and crops (cassava, corn, and wet rice) are sent abroad (Ndege, 2007; McCann, 2001).

During the decade of the '90s, Mozambique turned into one of the rare cases of success in SSA, rewarded with an extensive international assistance of donors and the subsequent installation of foreign direct investment (FDI) coming from a number of countries like South Africa, United Kingdom and Portugal (Martins & António, 2010). This great assistance was a result of the low cost of work as well as the integration of the Southern African Development Community (SADC). The Portuguese companies selected Mozambique to be the source of their investment not only because of the low cost of work but also due to the common language and the possibility of acquisition of existing installations and joint ventures with Mozambican citizens. Throughout this period several cooperation agreements were established with multinational enterprises (MNEs) for the transference of knowledge aiming at increasing competencies of the local counterpart (Klein & Wöcke, 2009).

Mozambique's once substantial foreign debt has been reduced through forgiveness and rescheduling under the International Monetary Fund (IMF) and the Heavily Indebted Poor Countries (HIPC) and enhanced HIPC initiatives, and it was at a manageable level (Easterly, 2002). Mozambique grew at an average annual rate of 6%-8% in 2013, one of Africa's strongest performances according to the US Central Intelligence Agency (CIA). Mozambique's ability to attract large investment projects in natural resources was expected to fuel continued high growth until the discovery of hidden debts in May 2016.

Mozambique concealed debts amounting to US\$ 2.4 billion in recent years leading international creditors to demand an external audit to launch talks on the resumption of financial aid. The Mozambican economy suffered the spill over of its hidden debt crisis, causing to fall short of the requirements of most international aid programs. The country is experiencing the lowest growth rate in more than a decade. In 2016 the metical lost nearly half of its value due to international investors lack confidence and sharply rising inflation in constraining household consumption. In the third quarter of 2016 Fitch Ratings downgrade the country's rating from CC to RD (Restricted Default).

2.3.1 The industry

In the past five years, higher investments have been done in the mining and heavy industry; there has been a decentralization of projects, namely:

- Mozal - the aluminum smelter project in Matola;
- The heavy sands extraction project in Moma; and

-
- The coal mines in Tete.

The investment for this projects came from South Africa (Castel-Branco, 2003). Electricity is universally recognized as a requirement for social and economic development and also a source of income for Mozambique (Ferguson et al., 2000). In the 1970s, the Portuguese colonial authorities, engineers, and hydrologists built Cahora Bassa. The dam covers 2600 square kilometers; it has 510-foot walls and five electric turbines that produce 2,500 MW of clean and ecologically sound energy. It is estimated that Mozambique uses only 20% of the annual production of electricity; the remaining is exported to South Africa, Swaziland, Zimbabwe, Zambia, Botswana, and Malawi. The electricity problems in Mozambique are largely connected to the distribution grid. This problem hinders education, agro-business, commerce and the public sector.

2.3.2 Tourism

Tourism is also an industry that contributes to the Mozambican economy. In 2009 tourism industry represented about 8.3% of the GDP (Gross Domestic Product) and kept around 15,000 inhabitants of the coastal area employed. The Government of Mozambique considering tourism as a key sector, has combined construction of infrastructure and roads to provide access to the vast forests, national parks, beautiful landscapes and beaches” (Maiela & Canastra, 2013). To remain competitive, Tourism has promoted the coastal area as the main tourism attraction. This policy is at the origin of different initiatives: set-up of well-known luxury hotels in the coastal zone, the creation of nightclubs and casinos in the coastal region, airports in the coastal provinces of Inhambane and Nampula, training of local people in languages such as English, French, and Spanish.

2.3.3 The Agriculture

Agriculture including livestock and forestry accounts for a quarter of GDP (crops 20.5%, livestock 2.5%, forestry and wildlife 2.5%). Mozambique has 36 million hectares of arable land; from it 3.6 million hectares are used for permanent crops, the remaining area is used for pasture and forest. Most of the fertile arable land is located in the central and northern provinces, while recurrent floods affect the southern provinces forcing southern communities to use the land mostly for pasture. Agriculture in Mozambique is often farmed by families or head of households, having multiple farms with sizes not higher than 1.2 ha. Food production is the sector that accounts for approximately 80% of the cultivated area, where maize and cassava are the major staples followed by millet, rice, beans, sweet potatoes and a wide variety of vegetables (Pretty et al., 2011).

The use of modern technologies and irrigation facilities are limited to a small number of commercial farms growing vegetables, cotton, and tobacco (Gouse et al., 2003).

In the last ten years, the areas under cultivation have increased at a rate of 2.4% over year due to favorable macroeconomic stability, sector liberation and the return of 3.2 million displaced citizens to rural areas. In the central provinces, production remains very low compared to 1970's, but in some regions in the northern provinces, the subsistence farming has shifted partially to production-for-market.

The low use of improved farming technics reduces the productivity not allowing crops together with cattle, which have higher growth rate to be produced in higher quantities. The fisheries sub-sector is of commercial importance; three largest companies add up to 35 to 40% of the country total fish exports.

2.4 Potentials of ICT

ICT are assumed by the Mozambican players, and government entities as a field with the possibility and ability to foster development (David et al., 2014; Rega et al., 2011; Chemane et al., 2005; Macome, 2004). ICT are seen as a support and crosscutting means, capable of providing solutions for education, health, and governance. ICT can enable Mozambicans to acquire the knowledge necessary to raise efficiency and effectiveness on the provision of services (Mario, 2003), and actively contribute to improving socio-economic conditions and well-being of rural communities. ICT have the capability to involve people, promote relations and socioeconomic change through local and external technology engagement. The deployment of ICT around the world has a fairly long history (Hudson 1984; Butcher 1998; Warschauer 2003; Castells et al. 2004; Wilson 2004), there is still no definitive word on the microeconomic contribution of the field in the developing context. Several approaches to using ICT to leverage developing communities on the micro level felt in design-reality gap or creating a differentiation between those who have and those who haven't. For socio-economic development, it is still hard to measure how big or perhaps how critically is the contribution of the field of ICT for development (ICTD) (Sey & Fellows, 2009).

As an emerging field, ICT4D tends to be associated with the use and adoption of equipment such as computers, radio, television, the Internet and mobile phones. This equipment is denominated as ICT resources to provide socioeconomic development, access to education, health, and governance. The International Communication Union (ITU) estimates that approximately 49% of African families own radios and televisions, mobile phones have a higher level of penetrability in the urban and rural context in the last decade. The lack of both landline telephone and Internet density has been

documented (Britz et al., 2006).

2.4.1 Education and ICT

The Mozambican education sector in the last five years has undergone several changes; the primary school is compulsory at the age of six. Primary schools operate two or three shifts per day depending on the region where they are established. The education takes place in both private and public institutions. The education sector is divided into three levels, namely:

- The primary school from the 1st to 7th grade;
- The secondary school from the 8th grade to 12th; and
- The higher or University which can take 3,4 or 5 years;

Child poverty is one of the reasons why primary school children drop out from school; poverty hinders the effective delivery of education with about 58% of children living below the poverty line (infoDev, 2007).

The country introduced ICT in the school curriculum in 1997 for students of the secondary and university level. The ICT education project is known as SchoolNet which was established as a pilot project, aimed to introduce computer literacy to school, explore the integration of ICTs in the teaching process, encourage schools to become centres of information sharing and communication and promote the usage of internet and e-mail.

The availability of ICT in public secondary schools vary according to school conditions; some schools prioritize the provision of ICT training courses to teachers, others to students. Computers are available to students only during the ICT classes, which occur once a week, the number of computers is far from meeting the number of students. In the public schools one computer is for 394 students. The Internet is not used in the schools located in the rural areas, mainly because the price for connectivity is very high. The schools located in the urban areas have connectivity provided by mobile companies such as Movitel and Vodacom, who invested aggressively on providing connectivity to schools for free.

The students from private secondary Schools effectively use ICT for education purposes, teachers have reported that students participate effectively in the class because they had the opportunity to explore the topic before the lesson and combine/compare contents found in books. The ratio computer student is one computer for ten students. Most if not all private schools have access to the Internet.

In conclusion, the use of ICTs in Mozambique for education is still not yet effective because of lack

of equipment and trained professionals. The Ministry of Education estimates that for the effective integration of ICT in education it will be required to improve teaching-learning processes, equip schools, train teachers and school managers.

2.5 ICT players in Mozambique

The field of ICT is inherently multidisciplinary, comprising Information System (IS) (Walsham et al. 2007), Communication Studies, Human Computer Interaction (HCI) and political science studies (Dearden 2008; Beckinsale & Ram, 2006).

In the Mozambican context, the main contributors for the emergence of ICT are entities associated or with business in the education sector, information system, communication studies and political science.

The appearance of ICT in Mozambique is concomitant with the emergence and proliferation of NGOs after the end of the civil war. During this period the Minister of Science and Technology (MCT) understood that the NGOs are an active and neutral aid channel that aimed at reaching the most deprived communities in all corners of Mozambique. The proliferation of NGOs provided ground for the appearance of the first computers in the urban and rural areas of Mozambique. The NGOs aiming at providing training and decentralizing the use and proliferation of computers in Mozambique provided capacity building to the University Eduardo Mondlane, which later created the *Centro de Informatica da Universidade Eduardo Mondlane* (CIUEM). The CIUEM is an educational entity specialized in the study, training, research of ICT services and solutions with inherent value for Mozambique (Moiana et al., 2005). The CIUEM in 1993 introduced the Internet in Mozambique; at that time the main service was e-mail provided with a very small aperture terminal (VSAT) satellite link to the United States of America. During this period ICT were acknowledged by all actors as a dynamic and efficient solution for communication with inherent value to the acquisition and transference of information from Maputo to the outside world (Nhampossa, 2005; Spielman et al., 2008; Macueve, 2008; Shvaiko et al., 2009). During this period NGOs sidelined the Government of Mozambique, and worked particularly with the CIUEM, mainly because the CIUEM is an academic body (Lubkemann, 2005).

In 1992 the large public institution that held the monopoly of the Mozambican telecommunication sector was separated into three new institutions, namely the *Instituto Nacional das Comunicações de Moçambique* (INCM), the Telecommunications of Mozambique E.P (TDM), and the *Correios de Moçambique* (CDM). The TDM and CDM could only operate on the Telecommunication and Postal sectors respectively while INCM had the mandate to regulate the Telecommunication and Postal

sector. It also had the responsibility to draft regulations and policies to allow fair use of the radio-electric spectrum. Within the same period, the Government Information Bureau (GABINFO) was created, a regulatory body that has the mandate to regulate and supervise the media in Mozambique. GABINFO is overseen by the Prime Minister's office and likewise, fulfils the role of an information ministry while the Minister of Transport and Communication (MTC) oversees the INCM. The GABINFO supervises the main state media, licenses private newspapers, radio stations and television channels, provides accreditation to foreign journalists wishing to work in Mozambique, and monitors all the information that is published and broadcasted in the country.

In 2002 with the revealed potentiality of ICT and growth of the telecommunication industry and ICT Policy Implementation, the Ministry of Science and Technology (MCT) created Technical Unit (UTICT) with the mandate to oversee the implementation of ICT in Mozambique.

The Ministry of Science and Technology oversaw this special unit, which later converted into the *Instituto Nacional de Tecnologias de Informação e Comunicação* (INTIC). INTIC has the mandate to oversee the use of Internet (cybersecurity), the implementation and use of ICT in the public sector and management of the government data.

2.5.1 The Telecommunication sector

In this section the state of the Telecommunication sector in Mozambique is presented, an analysis is presented about the situation of the fixed line, mobile, radio, television, and Internet.

The telecommunication industry in Mozambique was transformed from an exclusive service to a market commodity in 2000. In the early 2000s, four events contributed to the growth of the ICT sector: the creation of the INCM and the *Fundo de Serviço do Acesso Universal* (FSAU) at the national level and the completion of the SEACOM and EASSy submarine backbone cables in the international arena. Together, these made bandwidth more affordable, thus transforming ICT related services - especially the Internet - from an exclusive service available to few institutions into a market commodity accessible to a much wider public. The FSAU is an institution within the regulator of telecommunications that has the mandate to provide universal access to the telecommunications in Mozambique. The FSAU acquires resources to implement its mandate from the 1% annual profit contribution from every registered telecommunication company operating in the country except from the cyber cafes (*Decreto* n. ° 69/2006).

The Mozambican telecommunication market is liberalized and segmented in fixed and mobile; there are four main players, one fixed TDM, and three mobile players: *Moçambique Cellular* (MCEL), Vodacom, and Movitel.

The TDM was transformed into a shareholding company and received an operating license from INCM with a guaranteed monopoly until December 2007 (*Decretos 22/92, 23/92*). The TDM has not benefited from the growth of teledensity. While overall access to telecommunication increased more than thirty times in a single decade, TDM saw its number of clients decrease from about 89,500 in 2001 to 67,000 in 2006 as the landline technology became increasingly less attractive in comparison with the mobile technology. The fixed segment is the most affected by the lack of proper telecommunication infrastructures. The fixed network coverage is very limited, being concentrated in Maputo and the other main cities and its services are perceived as unreliable and expensive. Hence this created a very favourable environment for the mobile segment (Guido, 2014). TDM's role became more and more the provision of the infrastructure (optical fiber and the so-called backbone) connecting Maputo City to the provincial capitals and the exterior for digital data transmission (Brouwer & Brito, 2012).



Figure 2:6 TDM Existing and planned fiber links (Source: TDM and Accenture study <http://www.oafrica.com>)

Mozambique with a weak economy, low literacy rate, and challenging terrain and with few working telephone lines outside the capital, the TDM sought to offer and expand Internet services to rural communities. Although the infrastructure for such provision exists, TDM failed to circumvent barriers to providing the Internet to rural communities. The Telecommunications Act of 1999 began a process of deregulating and privatising TDM. While the process is ongoing, the government still

owns a significant share of TDM, which remains a para-statal company with limited financial autonomy.

The less capacity to provide services to communities and the changing field of telecommunication provided ground for the creation within TDM of a mobile company, *Moçambique Celular* (Mcel), which in January 2003 was separated from TDM to allow an open and more competitive market.

In 2003, Mcel was officially split from TDM and is now an autonomous company, with TDM owning 74% and the Mozambican government the remaining 26%. While the initial number of users was unimpressive, the introduction of a prepaid service in 2000 boosted a phenomenal growth, with an annual increase of 67% in 2009 (Greenberg, 2006).

With the split of Mcel and TDM, the playing field changed to allow the appearance of a second operator in the market. In June 2003, Mcel lost its monopoly, when a second 2G license was issued to Vodacom, a daughter of the multinational Vodafone and South Africa's Telkom. Vodacom's network became operational in December 2003; Vodacom became the company that democratized the mobile sector in Mozambique, not only through the mobile (core business) but also in service, by building infrastructure capable of supporting broadband growth, increase international capacity through investment in satellite and undersea cables, the introduction of low-cost handsets and bundled laptop packages. With an eye to having one of African largest telecommunication infrastructure, and provide coverage to administrative posts in Mozambique, INCM created conditions for the appearance of the third mobile operator. On October 6th 2011, Movitel a joint venture between Viettel international and SPI & Investpar Corporation officially started operation with just nine base transceiver stations (BTS) in Mozambique.

In May 2012, the network infrastructure of Movitel rapidly reached 18,000 transmission stations supported by 12,500 Km of fiber optic cable, which represented 40% of the Mozambican telecommunication network infrastructure. The deployment of such infrastructure being in administrative posts of rural Mozambique, Movitel acquired in its first 90 days of operation an average of 30,000 new subscribers supported by the new mobile handsets with a cost of 10\$ USD.

The fixed line segment fuelled the mobile market to expand its coverage and deploy new services. In the last decade, this market recorded.

The table below illustrates the evolution of mobile penetration between 2009 and 2013 and the estimation for 2014 until 2017 in Mozambique; it presents the growth of the industry with the three main players of the country mobile industry. The mobile market is the most successful segment in Mozambique, but it has one of the lowest mobile penetration rates amongst its peers, which can be partially explained by the country's low GDP per capita (Guido, 2014; Ramos, 2014).

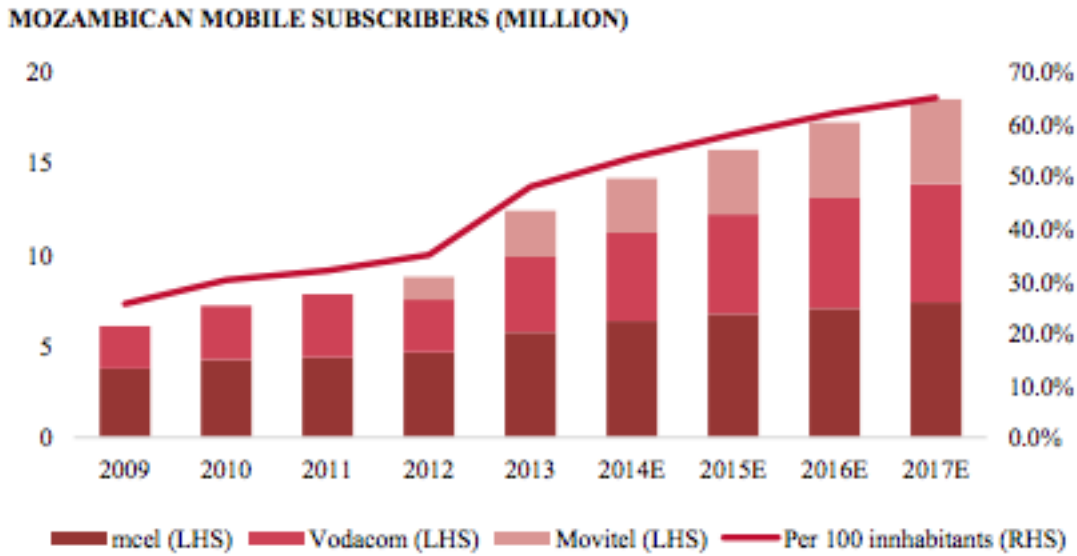


Figure 2:7 Evolution of Mobile Industry (Source Department of Telecommunication of INCM, 2014, June info@incm.gov.mz)

2.5.2 The Internet

In February 1993, the top-level domain .mz, “co.mz,” “org.mz,”” gov.mz” and “edu.mz” were entrusted the management to CIUEM. The Internet deployment in Mozambique was also a pilot study done by the CIUEM.

According to the INCM, there are 32 data service and Internet Service Providers (ISPs) licensed in Mozambique. Most of the licensed ISPs are based in Maputo, with branches located in Maputo, Beira and Nampula. The ISPs offer services mostly directed towards the corporate segment. As stated before, the weak fixed infrastructure created favourable conditions for the deployment of wireless technologies not only for the mobile segment, but also to the technologies such as WiMax, VSAT, CDMA, and TV-White Spaces (David et al., 2015). With the success of over-the-top applications, data providers have the chance to be almost perfect substitutes of fixed operators by offering the same services (voice over IP).

In Mozambique, four data operators stand out: Teledata, Internet Solutions, SatCom and Ologa. TDM owns Teledata, the company provides Internet through dial-up, ISDN, and WiMax. Internet Solutions is one of the first wireless ISPs in Mozambique; the company expanded its coverage beyond Maputo to connect to the Seacom Africa cable system. Internet Solutions is the only company in Mozambique that ventured to partner in research and development of new communications media and technologies such as TV-White Spaces.

Ologa is one of the youngest ISPs in the Mozambican market; the company mainly uses VSAT to provide access to the internet. Ologa is the first company that provided access to the Internet to CMCs in Mozambique.

2.5.3 The radio and television

In Mozambique, rural communities know the radio as the most efficient method for disseminating information among rural groups. This phenomenon is driven by the lower citizens' literacy, lower access to newspapers and television.

Radio Moçambique (RM) is a State-run radio station that covers the entire country on Medium Wave and Frequency Modulation (FM). The RM has a broader reach within each province this capacity is reachable because the stations have 11 radio stations affiliated with it in each province. The RM affiliated radios are responsible for acquiring news and information from their respective provinces so that the complete information is compiled and broadcasted to all the remaining provinces.

The *Televisão Experimental de Moçambique* (TVE) was the national television broadcaster, started as an experimental channel working only on weekdays. In 1991, with the technological innovation, the experimental channel started broadcasting using satellite and with it the name changed to *Televisão de Moçambique* (TVM). In the year 2012, with the changes in television viewing behaviour, the state channel created a subsidiary channel denominated TVM 2.

Presently Mozambique has 10-television channels: TVM, TVM 2, *Record Moçambique*, *Soico televisão* (STV), *Stv Noticias* (STV News), *Televisão Independente de Moçambique* (TIM), Miramar, C channel, RTP Africa, and Gungu Tv.

The RM and TVM get funding from the government. With the introduction of pre-paid electricity, each house and the car have to pay on a yearly basis a tax for radio diffusion.

The provincial difference in culture, language and development, allow populations across the country to look for different types and sources of information suited for each social group needs. GABINFO directly supervises the main state media organizations including RM, TVM, *Agência de Informação de Moçambique* (AIM) and radios under *Instituto de Comunicação Social* (ICS).

From 2010 until the year 2014, the GABINFO report presents that 126 information agencies were registered in Mozambique, among them 10 radio, 8 television stations, 56 magazines, 25 newspapers (both daily and weekly), and 23 other publications, including newsletters, advertising publications, and promotional magazines (GABINFO, 2014). GABINFO also registered five new newspapers circulating since September 2010. Since then, 49 new community radio stations, eight religious radio

stations, four commercial or private television channels, 15 radio stations and community television channels have hit the airwaves.

This growth of information agencies at the rural level allows RM to broadcast news at the rural level and also to acquire information from all the country to be broadcasted.

Unlike RM, the community radios extensively disseminate information in local languages as well as Portuguese. There are in Mozambique about 40 independent community radio stations, including several run by Christian churches, technically and financially supported by the *Forum Nacional das Rádios Comunitárias* (FORCOM). FORCOM was founded in 2004, helps its affiliated stations with training, maintenance, repair of equipment, and fundraising.

As RM could not keep up with the social differences and needs of communication, the government of Mozambique created the ICS, an institution that manages local community radio owned by the government. ICS administers a network of 38 radio stations, controlled by the local administration officials over their programming; it is perhaps more accurate to call them as government local radio stations. Besides broadcasting their radio programs, the ICS stations relay the national news from *Radio Moçambique* (RM), three times a day.

Figure 3 shows the number of radio stations that exist in Mozambique divided by provinces. From the data presented we can see that the southern province of Maputo has a higher number of radio stations owned by private entities. Except the Manica province, where most of the existing radios are private.

Figure 2:8 Radios Distribution in Mozambique (Source: Department of Radio Communication and Technologies of INCM, 2014, June: info@incm.gov.mz)

The government of Mozambique owns two television channels (TVM, TVM 2) and 8 other channels are the property of the private sector. There are also in the country two digital satellite television providers (Multichoice and Zap) and two analog television providers (DSTV Go and Startimes Moçambique).

The Pay-TV market is disputed by four players: (1) Digital Satellite television (DSTV); (2) Tv Cabo Moçambique; (3) Zap and (4) StarTimes.

These providers sell their packages from a range of 10 USD\$ to 200 USD\$, while the 11 analog channels are free, but due to the high cost of network maintenance, the free channels can only be seen in the capital city Maputo and some urban cities. Most of rural Mozambique has access to 2 TV channels, Television of Mozambique (TVM) and Soico Television (STV), the last being a private channel. Social groups based in urban areas like Maputo and Beira, have access to 6 television channels mainly TVM, Miramar, C channel, RTP Africa, and Gungu TV.

Chapter Summary

Mozambique is a country bordered on the north by Tanzania, on the west by Malawi, Zambia and Zimbabwe, and on the south by South Africa and Swaziland. The population of Mozambique is approximately 25 million; the majority of the population is young (47% below 15 years old) with a life expectancy of 50 years. The country is geographically and politically divided into eleven (11) provinces and the capital city Maputo. The official language is Portuguese, and Mozambique neighboring nations have English as the main language, the economy is dependent on foreign aid, and the country is struggling to improve conditions to attract foreign money.

Mozambique like most of its African peers; a strong mobile segment and an increasing popularity of broadband characterize the telecommunication sector. On the other hand, wireline accesses have been recording a negative performance in the last couple of years. Nowadays one fixed operator, three mobile operators, and four pay-tv operators compose the telecommunication sector in Mozambique.

According to the INCM, there are 32 data service and Internet Service Providers (ISPs) licensed in Mozambique. Most of the licensed ISPs are based in Maputo, with branches located in Maputo, Beira, and Nampula. The ISPs offer services mostly directed towards the corporate segment.

Radio Moçambique (RM) is a State-run radio station that covers the entire country on Medium Wave and Frequency Modulation (FM). The RM has a broader reach within each province. This capacity is reachable because the stations has 11 radio stations affiliated with it in each province

The Pay-TV market is disputed by four players: (1) Digital Satellite television (DSTV); (2) Tv Cabo Moçambique; (3) Zap and (4) StarTimes.

These providers sell their packages from a range of 10 USD\$ to 200 USD\$, while the 11 analog channels are free, but due to the high cost of network maintenance, the free channels can only be seen in the capital city Maputo.

Chapter 3 Research Design

In this chapter, the data presented was collected during the first RE-ACT (Social Representations of community multimedia Centres and ACTions for improvement – www.react-project.ch) field trip conducted in the north, centre and south of Mozambique. This data was used in the 2011 white paper Rega et al., "Community Multimedia Centres in Mozambique: a Map and in the 2015 journal article Baia et al., "Social Representations of Multimedia Community Centres (CMC) in Mozambique."

This chapter presents the results of the RE-ACT first phase and the research design adopted in the second phase.

This chapter is presented in six main sections: Section 3.1 discusses the first phase of the RE-ACT Project and the data collection; Section 3.2 discusses the overall study research design; Section 3.3 demonstrates the data clustering and collection; Section 3.4 provides demographics of the targeted population; Section 3.5 shows the data analyses; Section 3.6 lists the motivations for usage and non-usage of the CMC and the Section 3.7 shows the co-design approach adopted in the study.

Two broad phases divide the RE-ACT project:

1. The first step of the project comprised using social representation theory supported by photo elicitation technic to examine the services offered by 10 CMCs in Mozambique and their relevance for local communities.
2. In the second phase co-design was used, aiming to create improvement actions with intrinsic value for communities;

In our context improvement actions are defined as small budget projects aiming at providing the CMCs capabilities to address emerging community needs. The aim of the co-designed improvement actions are also to be financial and social sustainable.

Sustainability in this study is defined as "*the ability of a project or intervention to continue in existence after the implementing agency has departed*" (Harris et al., 2003, p.2).

The CMCs operations assert on four main pillars that serve as bases for their services. Two of the pillars are people (users and managers) and the other two regarded as objects (content/services and infrastructure). Hence, several scholars have been arguing that there will be no value for excess in technology for a CMC if there is no public demand for the services they are providing (Vannini et al., 2015).

Since, the deployment of telecentres and later escalation to CMCs in Mozambique, no evaluation study was conducted to understand the conditions CMCs survive. The study motivation is

intrinsically related to the fairly long history of public access venues deployment in Mozambique; the CMC is expected to provide access to ICT to all social groups within rural communities, but there is a sustainability problem, technological and literacy gap between the elders and young generation which have not yet be carefully addressed.

This study, aims to answer to four main research questions:

1. Can small budget projects create conditions for social and financial sustainability of CMCs?
2. How can co-design be applied with small communities to develop sustainable solutions in an emerging economy?
3. How can rural communities with lower knowledge of design practices become designers of services on their domain?
4. What is the impact of ICT4D solutions co-designed by local communities?

To evaluate the CMCs, we focus on understanding how and why the intended beneficiaries make use of the CMCs and benefit from the services provided. If there exists any impact on development, it needs to be assessed from the perspective of beneficiaries instead of routine monitoring operations carried out by the CMCs. The need for monitoring and evaluate CMCs efforts has been raised in multiple ICT4D conferences. Evaluation can serve several purposes such as formative evaluation to provide feedback on individual CMCs (identify strength and weakness), or to multiple sites. Evaluation can also be used for pointing out how well, what changes and improvements should be made.

3.1 Research Design

To answer the four main research questions presented in the section above, this interpretative study, will be characterized by a concern for the individual and will seek to understand the subjective world of co-design with communities (Cohen et al., 2007). The researcher will be focussing on co-design and intentional behavior to explore favorable conditions for community-based participatory action research and how participants (actors) share their experiences.

The research design of the first and second phase adopted was multiple cases study (Yin, 2002), covering 10 CMCs, one per each province of Mozambique.

On the first phase, semi-structured Interviews (230), questionnaires (328), observations, pictures (194), and focus groups sessions with community stakeholders have been used to get insights about stakeholders' representations and perceptions about CMCs. On the second phase (co-design of improvement actions) observation, focus group sessions (14), Google analytics (4) and questionnaires (168) data was used to understand the outcomes of co-design. The co-design phase is

longitudinal (Sahay & Walsham, 1995), and runs within sixteen months, after a period of incubation (two months). The RE-ACT team worked as observers and the implementation, management was solemnly the responsibility of the community.

While Social Representations theory is commonly used in social sciences, only a few scholars so far have applied it to explain ICT phenomena, e.g. the relationship between gender and ICT (Gloria Bonder, 2007); gender in the teaching of mathematics with multimedia devices media and communication (Birgiita, 2011); information systems (Gal & Berente, 2008); ICT meanings and practices (Sarrica, 2011), but, except Rega's study (Rega, 2010) and Vannini (Vannini, 2014), not many publications have been found applying this approach in ICT4D.

Photo-elicitation can be performed by using different approaches, depending on whether photos are taken (or chosen) by the researcher and showed to the interviewees, or the interviewees themselves take them. In both cases, photo-elicitation is believed to prompt reflection, carry information, stimulate affective reactions by people (Collier, 1967; Rose, 2007), and to constitute a useful tool to triangulate between different information sources (Bignante, 2010). In the RE-ACT case, participants were asked to take two photos, then to explain what they portrayed and why. The first photo had to portray what they liked on the venue ("Take a picture of what you like about this place"), while the second one had to capture what they did not like or could be improved ("We are also interested in shortcomings and downsides of this place. Take a photo of what you don't like this place, or about something that can be improved here").

Participants were given a digital compact camera and told they would have to come back after each photo and explain what they wanted to capture and why. When they came back, they were asked to show their photo to the interviewer (through the camera screen), who asked both what the photo represented and the reasons why the interviewee had portrayed that particular subject.

Each interviewee was given approximately 2 to 3 minutes to take each photo, which had the following methodological implications: first, interviewees had to make a quick decision on the subject they wanted to portray; second, they could not choose exactly in which moment of the day/week take their photo (e.g.: they could not choose whether to portray the radio production studio with a particular journalist, or the telecentre while there was a computer course happening). Interviewees' explanations of their photos were digitally recorded and subsequently transcribed and coded. Photos were collected and named according, on the one hand, to the name and number of the interview they refer to, which itself indicates place, interviewee typology and number of the interview (i.e., "Cua_Staff02" stands for Cuamba CMC, Staff member number 2), and, on the other

hand, with a code indicating if the photo referred to what a person liked (01) or to what she did not like (02).

In total, 194 photos have been collected from 102 interviewees, 95 of which were taken by Staff members and 99 by Users. 48 Staff members and 54 Users participated in the photo-elicitation part of the interviews, taking a total of 101 photos about what they liked of the venue (hereafter, “photo 01”), and 93 photos about what they did not like (hereafter, “photo 02”).

The second phase of RE-ACT captures a detailed picture of the ingredients, experiences, attitudes and perceptions in using co-design for community-based research development initiatives.

The epistemological viewpoint of the interpretivism paradigm is that knowledge of reality is a social construction by human actors. Interpretivism is based on a life-world ontology that argues all observation is both theories value-laden and investigation of the social world is not, and cannot be, the pursuit of a detached, objective truth (Leitch et al., 2010). Epistemologically, the viewpoint of the interpretive paradigm is that our knowledge of reality is a social construction by human actors (Burrell & Morgan, 1979). The interpretive research paradigm is characterised by a need to understand the world as it is from a subjective point of view and seeks an explanation within the frame of reference of the participant rather than the objective observer of the action. At an axiological level, the interpretivism paradigm is more concerned with relevance than rigour (Ponelis, 2015).

The criteria used to evaluate the findings in this study were a comparison of quantitative data generated by the co-design studies and the interpretive paradigm information acquired on the focus group sessions and observations. Results were not generalised, as the cases, participants, context and conditions were different.

3.2 Data cluster and collection

Qualitative research is designed to address questions of meaning, interpretation and socially constructed realities (Newman, Ridenour, Newman, & DeMarco Jr., 2003). Qualitative data are a source of “well-rounded, rich descriptions and explanations of processes in identifiable local contexts” from which the researcher can “preserve chronological flow, see precisely which events led to which consequences, and drive fruitful explanations” (Miles & Huberman, 1994, p. 1)

For the research sample 10 CMCs were selected, one per each province of Mozambique, to have a representative sample of the CMCs, they were chosen based on (1) Location (rural/urban); (2) ownership model (private, public); (3) year of installation;

Based on these criteria were selected the CMCs of Ilha de Moçambique (Nampula), Cuamba (Niassa), Chiúre (Cabo Delgado), Quelimane (Zambezia), Chitima (Tete), Dondo (Sofala), Sussundenga (Manica), Morrumbene (Inhambane), Chókwe (Gaza), and Xinavane (Maputo).

In qualitative research, sampling can be based on probability, that is, a random sample, or on non-probability, that is a purposive sample. Non-probability sampling requires the RE-ACT team to purposely select a section of the wider population to include or exclude from the sample because they illustrate some feature or process in which the researcher is interested, with the aim being for the sample to represent itself rather than to seek generalizability (Cohen et al., 2007; Silverman, 2005). In a purposively selected sample the chances of members of the wider population being chosen for the sample are unknown whereas in a probability sample the possibilities of members of, the broader population being selected for the sample are known, that is, every member of the wider population has an equal chance of being included in the sample. This interpretive study will utilize non-probability sampling. Participants purposively chosen will exhibit common characteristics when it comes to their relation with the CMC such as: they are educators (staff), they are government employees, they use the CMC regularly, or they don't use the CMC regularly, they are housewives, they are students or contribute to activities in the CMC, or the CMC contributes to their professional learning. These groups of individuals have been clustered into three groups: (1) Staff members; (2) CMC full users; (3) Radio only users; and (4) Non-users.

- CMC staff members are individuals from the community who work as employees or volunteers at the CMC.
- CMC full users are people who use both the components of the CMC (Telecentre and Community Radio).
- Radio only users are people within the community who only use the radio services.
- Non-users are individuals who do not use the radio or telecentre services.

During March and April 2011, the RE-ACT research team undertook three different field trips: one to the Southern provinces of the country (Inhambane, Gaza, and Maputo), one to the Central provinces (Tete, Manica, Sofala and Zambezia), and one to the Northern provinces (Cabo Delgado, Nampula, and Niassa). The first field trip was undertaken by four members of the team: two senior researchers and two Ph.D. students, the aim of this first field trip were to assure that all the team members would conduct the interviews in a harmonized way and to tune the interview protocol. The other two were undertaken by couples of researchers: one senior and one Ph.D. student.

During the fieldwork, 230 semi-structured interviews have been collected, divided as follow:

- 57 Staff members of the CMCs: individuals from the community who were working (as employees or volunteers) at the CMC.
- 93 CMC full users (hereafter, U-CMC): people using both components of the CMC (Telecentre and Community Radio).
- 72 Radio-only users (hereafter, U-RC): individuals who listened and interacted with the radio, but never used the Telecentre component.
- 8 Non-users: people in the community who never listened to the radio nor accessed the Telecentre.

It is important to notice that – even if in theory possible – the category of people using only the Telecentre component of CMC does not exist: those using this component do always use also the Radio.

Different interview protocols, corresponding to various interviewees’ categories, have been prepared and validated by the research team, by following a semi-structured interview approach (Thallmaier, 2014). The interview protocols were intended to investigate values, ideas, and practices (Moscovici, 1976) that interviewees attribute to CMCs.

The interview is the most common method of data gathering in qualitative research and the goal of any qualitative research interview is to “see the research topic from the perspective of the interviewee and to understand how and why they have come to this particular perspective” (King, 2004, p. 11). Kvale & Flick (2007) describe the interview as a conversation that has a structure and a purpose determined by the interviewer and in which the researcher asks about, and listens to, what people relate, in their words, about their lived world. However, it is a professional interaction beyond everyday conversation, one that involves careful questioning and listening.

3.3 Demographics of the sample

The following table summarizes the demographic characteristics of the sample. In general, the sample presents more males than females in all interviewees’ categories, with a stronger difference within the staff. Regarding age, all categories present a majority of interviewees 20-29 years old; U-CMC is younger than all other categories, with 38.7% of people between 10 and 19 years old. Finally, Staff members are the most educated category, while U-RC has the lower instruction levels.

	Sex		Age				Education				
	Male	Female	10-19	20-29	30-39	40 +	No school	1-5 grade	6-10 grade	11-12 grade	University
Staff	72.2%	27.8%	11.1%	46.3%	22.2%	20.4%	0%	1.9%	35.2%	51.8%	11.1%

members											
Users whole CMC	60.6%	39.4%	38.7%	39.8%	14.0%	7.5%	0%	4.3%	56.4%	31.9%	7.4%
Users Radio only	63.4%	36.6%	42.8%	28.6%	14.3%	14.3%	2.9%	15.7%	45.7%	27.1%	8.6%

Figure 3:1 Demographics of data collected (March-April 2011 RE-ACT)

3.4 Data analyses

To analyse the interviews, a qualitative content analysis approach has been chosen, with a first bottom-up phase leading to a preliminary explorative analysis done using paper and pencil on a small number of interviews. This explorative analysis aimed to identify thematic areas and recurrent topics. At this point, a first formalization of the interpretative model was drawn.

To manage such large body of data, and to perform further analyses, a qualitative content analysis software (NVivo, version 9.2) was used. The second phase of analysis included a top-down approach, moving from the first formalization of the interpretative model built. During the coding process, the interpretative model has been continuously refined, in a constant shift between a top-down and a bottom-up approach meant to let the data “talk.”

The final result of this coding process is an interpretative model structured in eighteen different macro-themes, each of which divided into sub-themes. While two of the macro-themes refer to people, the remaining sixteen ones inform the complex social representation system attached to CMCs in Mozambique, by depicting interviewees’ values, ideas, and practices regarding them.

For the aim of this study, the following macro-themes have been taken into consideration:

- Motivation to use the Telecentre;
- Reasons not to use the Telecentre;
- Services of the Telecentre;
- Services of the Community Radio; and
- Community involvement/support to the CMC.

These macro-themes provide clear understanding regarding the motivations to use and not use the telecentre services and the community involvement in the CMC activities.

As regards the part related to photo-elicitation, a content analysis was performed on both the photos as well as on the transcribed interviews about them. The analysis was twofold. On the one hand, a

triple top-down categorization (Community Radio, Telecentre, and Community Multimedia Centre) was used on the photos themselves, based only on what images portrayed. Thanks to this analysis, researchers wanted to shed light on which component of CMCs was mostly represented for each question and by each interviewee typology. Photos, which represented radio locations, tools, or signs were categorized as “Community Radio”; photos representing telecentre locations, technologies or signs as “Telecentre.” All the photos that were taken outside the CMC building or in joint spaces between the radio and the telecentre and the ones that showed technologies that belong, potentially, to both components (e.g.: the TV) were classified as “CMC.”

On the other hand, interviews’ transcriptions (related to photos) were coded and analyzed according to an Interpretational framework that derives from Cantoni & Tardini (2006). The framework called WCM (Website Communication Model) is mainly used in the field of web design, and was adapted by Rega (2010) to interpret telecentres.

3.5 Outcomes of the analyses

In this section is presented the motivations for use and not use the telecentre services, the elements to be improved, and services.

3.5.1.1 Motivations to use or not to use the telecentre component

Considering the reasons why to use telecentres, both Staff members and Users of the whole CMC agree on the fact that it is because of their *services*. Some interviewees mentioned that telecentres are the only place in the community where a given service, such as the possibility of digitizing documents or attending a digital literacy course, can be accessed:

"I was nervous because I never had access and I would like to write poems, stories, but I do not have access, I have no sponsorship from anyone, [...]"(Chiure, User3)

"First of all, I decided to take the computer course; it was the only site that had a computer course." (Island, User5)

Others mentioned the quality of services, which is higher if compared with other places offering the same products and services:

"This is the only place I trust to take a photocopy. [...] Other places, they do not work well." (Island, User4)

"The centre struggles to be a centre of quality. There is a good provision of services." (Xinavane, Staff3)

"There are only four packages there, not here. Here are five packages. So I came to do here because there are five packages." (Chokwe, User3)

"Example in my school I have computer classes, yes but there we have more theory from time to time we practice but not always. Here we practice to be more used to the computer one has to take the course in the CMC." (Morrumbene, Non-user2)

Finally, Staff members also considered that the population had valued the promotion strategy of CMCs:

"They come here because it is a public place known to the community, to which people have become accustomed, to make copies, to make use of the telecentre, to print documents." (Sussundenga, Staff2)

"At the same time that we render a service we want that person to return, and to be able to return we have to inform of the other services that are also available here and finally also inform the person that also these services belong to him." (Chokwe, Staff5)

However, *services*, together with *economic reasons*, are also one of the two main declared reasons for not to use them. In fact, interviewees mentioned the fact that services are not working properly, or that services, which could satisfy information and communication needs of the community, are not present in the telecentres:

"Now it is difficult because we have reprographic problems, it is not working [...] and maybe two, three or four people appear to type and put on the flash drive, but there are not many people anymore because the person who types and prints without the reprography things get complicated." (Morrumbene, Staff3)

"That is a multimedia centre, that could also have fax service; the Internet is part and fax as well. When we want to receive a fax here, we are obliged to go and ask the solidarity shop to say that we want to receive fax, but we have a multimedia centre, so it is essential that they put internet services and fax services" (Chiure, User 4)

"My goal I did not reach there because my goal was to do some research on the internet more. When I arrived there they told me that the system was broken so I could do nothing else." (Morrumbene, Non-user3)

Furthermore, some interviewees do not use the telecentre because they have access to the same services offered by the telecentre somewhere else:

"Because I have facilities in my office, I have a netmóvel, I have the Internet like that of TDM, so it is difficult for people who are in need, or there is nowhere to go so they can go to the radio." (Cuamba, Non-user3)

"Because my office also has a copy machine." (Island, Non-user2)

Finally, some people stressed that the services offered by the telecentres are not for them since they consider their level of education too low to be able to profit from such services and technologies:

"The problem does not study, so what I am going to do there?" (Chiure, Non-user5)

"I would like if I could talk Portuguese, but I do not speak Portuguese because I did not study." (Ilha, Non-user7)

3.5.1.2 Telecentre and Radio Services

Regarding telecentres, *digital literacy courses* are the only shared reference to services among Staff members and Users of the whole CMC. *Photocopies* are the most mentioned service by Staff members, the second most cited by U-CMC, and the third by U-RC. Staff members do also mention *access to the Internet*, *digitizing texts*, *access to computers*, and *printing services*, while U-RC mentions in the second position *access to computers*.

Regarding the Community Radio, the only shared service mentioned is *news*. Second and third services in the rank are *dedicatorias (dedicatory)*, *anuncios (announcements)*, and *programas sobre educacao (education programs)*, however, these two last services are not shared among the groups. Staff members also mention *publicidades (publicity)*, and *programas de agricultura (programs about agriculture)*.

3.5.1.3 Elements to be improved

The two most frequently mentioned elements to be enhanced in the telecentres is related to their *services* and *technologies*. When referring to services, people mentioned things that are not functioning properly, such as the Internet connection, or an out-dated digital library, or services that should be improve or added, such as the need for more digital literacy courses, courses non-only related to digital skills (e.g. language courses), newspapers, online market, or fax services. Also, when referring to technologies, interviewees differentiated between things that do not work properly, usually computers, and the need to increase the number or the palette of technologies, such as having more computers or further devices, for example, printers or photo cameras.

The same goes for the Community Radio. As regards services, people mentioned the need of enlarging the program choice, increasing programs for children and youth, broadcasting more hours in local languages, or involving local musicians or local institutions in the creation of radio programs. Among others, they also stated the need of bettering the accuracy and objectivity of transmitted information, the need of broadcasting for free social announcement, and to notify the audience in case of changes in the radio program schedule. Taking into consideration technologies, interviewees stated the desire of having more equipment, such as an antenna able to broadcast further, audio and video recorders to enhance the programs of the radio, a better Internet connection, and faster computers. When considering technologies not working properly, interviewees mentioned the computer and the antenna of the radio, and audio recorders.

However, in the case of the Community Radio, only Staff members are concerned with technology, while U-CMC and U-RC only focus on services.

3.6 The Co-design as an approach

In order to explore the nature of co-design and to understand its use in the field of ICT4D, we argue that solutions for the design research (DR) problems encountered in the first phase of the RE-ACT project require the usage of a design approach in which the communities express their needs, requirements and carry out the realization process of the desired artefact. In the process of design, thoughts are shared among participants in a collectively and equalitarian manner. Co-design is a design approach seen as the step forward from user-centred design, and closely related to participatory action research. Co-design aims at building innovative artifacts in an organizational context and learning from intervention while addressing problematic situations. In co-design, the notion of *design* refers to specification, which contains the fundamental information to construct and execute an artefact. The term “Co” is frequently interpreted as collective, cooperative and collaborative. However, it branches from Latin prefix ‘Co’, which exhibits the meaning of together, mutually or jointly (Thallmaier, 2014).

While the exact definition of an artefact is a much-debated issue in IS and ICTD, we define artefact “as organizational features that are socially recognized as bundles of hardware and software.” Our definition reflects on technology as structure, where structures of the organizational domain are inscribed into the artefact during its development and use.

We recognize that for DR problems can be addressed in Information System (IS) using action research (AR). The AR approach accommodates designers building and organizational stakeholders

shaping the designed artefact in a single definition, thereby softening the sharp distinction between development and use assumed dominant in co-design.

The AR approach in community-based research prevails the approach captured in DR of “building and *then* evaluate” in a cycle proposed by March and Smith (1995) and advocated by Nunamaker et al. (1991) and Hevner et al. (2004). In this study, the artefacts should be analysed beyond the technological part because they must result from the interaction of design efforts and contextual factors throughout the design process. The notion of design in this study refers to a specification, which contains fundamental

We look at co-design as a step forward in participatory design research in the sense that explicitly the approach recognizes artefacts as ensembles emerging from design, use and on-going refinement in the context deployed. We look at critical elements such as securing a long-term commitment from the stakeholders as an item in defining the problem as an instance of a class of challenges. Although this approach may be tentative, it lays the groundwork to address the tension between the CMC and the community and deals with a broader class of problems.

In similar, Lee (2007) places AR as a step towards DR method that accommodates the interaction of design efforts and contextual factors throughout the design process. This cross-fertilization attempts that combine DR and AR by either sequencing or interleaving self-contained steps they do not allow AR to capture the emergent nature of the artefact, and, in effect, disregard design outcomes.

Co-design was adopted as the basis for mutual understanding on the scope, focus, and mode of inquiry. It also sets up the roles and responsibilities of the research team that includes researchers and community as a group.

This principle emphasizes the viewing field problems as knowledge creation opportunity and a place where technology and community knowledge are merged to create a sustainable and required artefact.

The intent of the research team should not be to solve the problem per se as a software engineer or intervene within the organizational context of the problem. Instead, he should gather knowledge that can support the community to solve the class of challenges that the specific question exemplifies.

In this research study Co-design has been applied with an approach that provides access to people, groups or individuals, to all stages of the design process, including idea formulation, implementation, and review providing, effective participation has positive implications for efficiency, resource allocation and governance (David et al., 2013)..

To implement co-design with the Mozambican CMCs, in the first instance of the study a qualitative research study was conducted as demonstrated in the section 3.2. The Qualitative research involved

collecting data and trying to understand it in a particular context (Smith, 1987). As this study seeks to understand local behaviour and construction of needs, the primary data was collected using the social representations theory and photo elicitation, that is, research carried out with an insider perspective (Patton, 2002; Tashakkori & Teddlie, 2003). On a second instance an approach to co-design adapted from the Heeks (2002) and Tikkanen (2008) is used to identify:

- 1- Social needs,
- 2- Changes;
- 3- Formulate the improvement action;
- 4- Implement actions and;
- 5- Review and measure.

We explore the concept of co-design from the viewpoint of the community, reframing the idea by allowing the community to act as designers and the researchers working as facilitators to avoid differentiation on values and conceptualizations (Winschiers-Theophilus et al., 2012).

3.6.1.1 Social needs

Communities have needs the approach used to identify the needs deals with real dilemmas aiming at solutions to solve social concerns. It is intrinsically important to consider user needs, to produce an artefact required by the social group who participate in the co-design process. To harness user needs, researchers need to evaluate and understand the social groups within a community. The process of formulating social needs allows the researcher to be immersed within the community and identify and conceptualize research opportunities (Ramachandran et al., 2007). This first phase of co-design acknowledges the use of structuring the problem, to identify solutions and possibilities. This stage is enriched by dialogue at all levels with complete disregard for the power structure existent in the social group.

3.6.1.2 Changes

The Changes phase is where the reflection regarding what we are to conceive occurs, is one of the points during the process where each member of the activity has an opportunity to learn about different aspect our perceptions people within the community see a specific issue. This step allows comprehensive intervention that involves evaluating the feasibility of what we are to conceive by casting and formulating questions regarding the idea of the artifact we are to conceive. During the changes, the phase, provides conditions to evaluated the cost and benefit of the artefact, the group of people who are to benefit from it need to be capable of evaluate and perceive the cost and benefits of the artifact.

3.6.1.3 Formulation

The formulation process in co-design allows the community and researchers to refine the theory but also look at the social group needs and hold them on higher consideration. During the formulation phase, several hypotheses can be raised regarding the conditions of usage and the technologies that are best suited to the community. Evaluation cycles for the beta version are formative, contributing to the refinement of the artefact and surfacing anticipated as well-unexpected consequences. The formulation stage provides conditions for the summative, assessing value and utility outcomes of the artefact.

3.6.1.4 The Implementation

The implementation stage emphasizes the principle that the team should be sensitive to signals that indicate refinement. The artefact should reflect or represent a solution that addresses a problem both generalized or conceptualized. Competence management and skills development through training are crucial for keeping the implementation running to reach desired objectives.

3.6.1.5 The Review and Measure

In the review stage, evaluation can be difficult to achieve, due to the nature of the artefact. Therefore, evaluation opportunities should be sought following native controls where possible. The core measurement of the improvement action asserts on the achievements. Example : education, income, and additionally at the dimensions of participation and empowerment. In the RE-ACT case this was done with a survey of research evidence seeking to evaluate whether or not ICTs have demonstrated positive outcomes for dimensions such as education, income, empowerment and community participation. This dimensions provide understanding on the levels of social and financial sustainability..

The figure bellow demonstrates the cycles that were taken during the implementation phase of the co-design initiative.

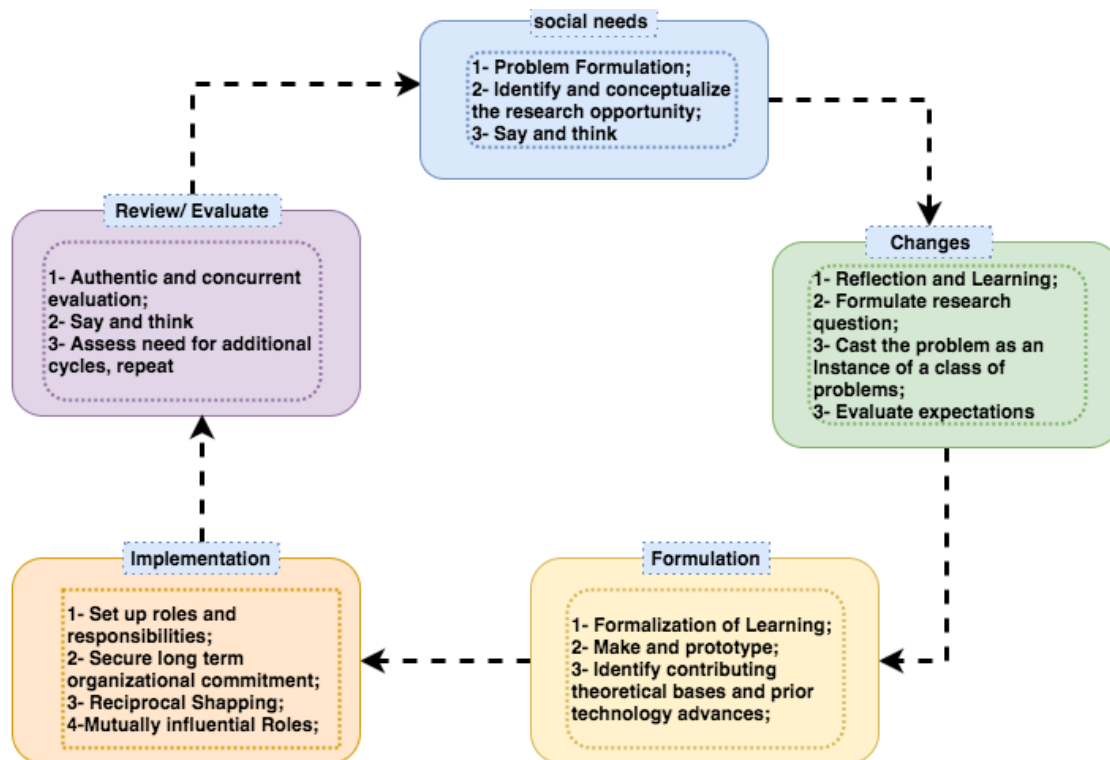


Figure 3:2 The Co-design approach adopted in RE-ACT

3.6.1.6 Case study approach

Before beginning, the researcher must be clear on the definition of case. Gillham (2000) defines the word ‘evidence’ as: “a unit of human activity embedded in the real world; which can only be studied or understood in context; that merges in with its context, so that precise boundary is difficult to draw.”.

Case studies have been viewed as a less desirable form of inquiry than experiments or surveys however Yin (2003) puts forward that case studies are generalizable to theoretical propositions and that the case study “does not represent a 'sample', and in doing a case study, our goal is to generalize theories (analytical generalization) and not to enumerate frequencies (statistical generalization)". The case studies seek a range of different kinds of evidence to answer specific research questions (Gillham, 2000), focuses on understanding the dynamics present within original settings (Eisenhardt, 1989) and can incorporate qualitative data only, quantitative data only, or both (R. K. Yin, 2003). Multiple methods of evidence collection are used and may include participant observation, direct observation, ethnography, interviews, focus groups, documentary analysis and questionnaires, with researchers remaining open to both opportunistic and planned data (Hartley, 2004).

During the implementation phase of the co-design was adopted as data gathering technique focus group, observation, and surveys. The RE-ACT team implemented the focus group and observation

during the first and fourth stage of the design process (social needs, changes, formulation and implementation). The community following guidelines provided by the RE-ACT team implemented the surveys; the data provided insights about the evaluation of the entire project.

Yin (2003a) identifies six kinds of case studies: single or multiple case studies either of which can be exploratory, descriptive or explanatory (causal). This study will employ a multiple case study approach, which is descriptive, that is, it presents a description of a phenomenon within its context.

A multiple case study approach can be used when the results attained from one case are wanted to be confirmed with other cases (R. K. Yin, 2003). Multiple case studies include two or more cases within the same survey; each being selected so that they replicate each other and either predicts similar results or different results for likely reasons. Multiple cases are a powerful means to create theory because they permit replication and extension among individual cases, that is, individual cases can be used for independent corroboration of specific propositions and corroboration helps the researcher to perceive patterns more easily and to eliminate chance associations allowing the researcher to draw a complete theoretical picture (Eisenhardt, 1991).

The method is said to suit a situation in which little is known about the subject area of the study, and this applies especially to rural communities in Mozambique which are a relatively new to research (Laine, 2006) It is expected that in this study, similar responses to the research questions will be given by a variety of participants. A multiple case study approach will confirm or contradict if there are commonalities in the use of co-design improvement action for community multimedia centres aiming to acquire social and financial sustainability.

Chapter Summary

This is an interpretative study characterised by a concern for the individual and will seek to understand the subjective world of co-design with communities. The researcher will be focussing on co-design and intentional behaviour to explore favourable conditions for community-based participatory action research and how participants (actors) share their experiences.

The following questions have been used as guiding principles in formulating the research design:

5. Can small budget projects create conditions for social and financial sustainability of CMCs?
6. How can co-design be applied with small communities to develop sustainable solutions in an emerging economy?
7. How can rural communities with lower knowledge of design practices become designers of services on their domain?
8. What is the impact of ICT4D solutions co-designed by local communities?

In the first instance of this study, a qualitative research study was conducted, the qualitative research involved collecting data and trying to understand each particular. As this study seeks to understand local behaviour and construction of needs, the primary data was collected using the social representations theory and photo elicitation, that is, research carried out with an insider perspective. On a second stage, co-design was applied as an approach to building innovative artefacts in an organizational context and learning from intervention while addressing problematic situations. The co-design approach adopted in this study is an adaptation of Heeks (2002), and Tikkanen (2008) used to identify social needs, changes, formulate the improvement action, implement actions and evaluate or measure improvement action.

Improvement Actions in Mozambique

In the year 2000, due to social and financial sustainability aggregating telecentre and community radios became the viable solution to expand the reach of telecentres and access to ICT (Rega et al., 2011). The CMCs in Mozambique were built with the premises that connectivity and direct access to information will lead to empowerment and capacity building and with it “development” (Roman & Colle, 2002). Most of the CMCs in Mozambique were established in the rural areas where the lack of broadband telecommunication infrastructure to connect to the Internet is the greatest challenge. Those CMC developed in the urban areas although broadband connectivity does not present a challenge; they face other problems such as operating cost, and capable staff to maintain the technological infrastructure. In this chapter, we present a representative sample of the CMCs in Mozambique. The present CMCs are part of the RE-ACT project, a description of the services provided, group of people managing the centre, and the technological infrastructure of the 9 CMC is presented.

The description of the 9 CMCs will be presented using a framework called the WCM (Website Communication Model), mainly used in the field of web design adapted by Rega (2010) to interpret public access venues. The WCM model is composed of four pillars, two regarding people, and two regarding objects and physical infrastructure. The framework is considered suitable to describe CMCs and is useful to respond to community needs. The model shows that the CMC depends not only on the technologies but on the services, facilities that are capable of offering and on the needs of the public that uses the services (Baia et al., 2014).

The four pillars included in the framework are:

1. Services: this pillar addresses the services offered by the CMC;
2. Facilities and tools: this pillar describes the services provided by the CMC and the technology used to provide the services;
3. People managing the CMC: this pillar looks at the group of people who works on the CMC and use the technological infrastructure to provide services for the general public;
4. People: this pillar is used to describe the person who uses the services provided in the CMC.

4.1 The southern provinces

The south of Mozambique has three provinces: Maputo, Gaza, and Inhambane. The provinces of the south are close to the Indian Ocean, offering favourable conditions for tourism activities (deep sea fishing, sea kayaking, windsurfing, water skiing, scuba diving, and parasailing). The interior region is covered by forests and pasture regions mostly located in the Gaza province. The culture in the southern provinces is influenced by the Portuguese presence either in architecture or tradition; the three provinces have several similarities in traditions and languages.

Maputo Province has six CMCs, while Gaza and Inhambane Provinces have three each. The CMCs selected within the RE-ACT study were the CMCs of Chockwe in Gaza Province, the CMC of Morrumbene in Inhambane Province, and the CMC of Xinavane in Maputo Province.

4.1.1 Chokwe CMC

Chokwe District is situated in Gaza Province, 150 km northeast of the capital city of Maputo; the district has a population of approximately 250,000 inhabitants. Chokwe is well connected to nearby towns (Maputo and Xai-Xai); it is located 90 km from the capital province Xai-Xai, and it has the N1 as the main access road to the South and central Mozambique. The district main economic activity is farming: 67% of the population living in the rural areas practice agriculture for family subsistence, as Chokwe lies in the farming zone of the Limpopo River.

In 2005, a CMC was established in the town, and the people entrusted to manage the CMC are from the Associação Rural de Ajuda Mutua (Association for mutual rural support), based approximately 40 minutes from the CMC.

The services provided by the telecentre are basic computer training (Word, Excel, PowerPoint), printing, photocopying, and faxing. The community radio covers the entire district and works 12 hours a day, seven days a week. The radio station provides services like necrology, advertisement, news, and Music Box.

The technological tools used to support the provision of such services are six computers, of which three are used for training, two by the radio station, and one by the secretary.

The people using the CMC services are mostly students and teenagers; adults visit on a random basis, mostly to have documents typed and to make photocopies.



Figure 4:1 The Chockwe CMC (RE-ACT Project 2011 Field Trip)

4.1.2 The Morrumbene CMC

The village of Morrumbene is a tropical estuary located on the Inhambane Bay, the district of Morrumbene has an area of 193 km (Day, 1974). This district has a population of approximately 150,000 inhabitants; the main economic activities are agriculture, fishing, and tourism.

In 2010, the MCT built this CMC and entrusted its management to the Associação Juvenil a Chama. The CMC was deployed in 2010, is part of the new model of CMCs, but like its predecessor, this new model of CMC provides services such as computer training in Word, Excel, PowerPoint, Access, and the Internet.

The technological tools used in the CMC are 16 computers. Of those, 12 are used for computer training, 3 for public access to the Internet, and 1 used by the radio station. The CMC has Internet broadband access through VSAT and fiber optics provided by Movitel. The Internet is not provided in the training room due to vulnerabilities of the Windows 2000 operating system. The CMC staff sees the Internet in the classrooms as a distraction to students.

The community radio covers the entire district and works 20 hours, seven days a week. Of the airing time, 60% is devoted to music, 30% to news and community-related programs, and the remaining 20% of commercials and publicity.

Users of the CMC are mostly students and government employees. Attention should be paid to this CMC, as it is a new model whose main distinction is the provision of high quality services and more reliable technological infrastructure.



Figure 4:2 The Morrumbene CMC (RE-ACT Project 2011 Field Trip)

4.1.3 Xinavane

Xinavane is a town on the Incomati River, located in the Manhiça district of Maputo Province, approximately 80 km north of the capital of Mozambique. The town has nearly 157,642 inhabitants, most of them working for the sugar mill managed by Tongaat Hulett Sugar. This district is known for the highest employment rate in all of Mozambique, with 82% of the population working in agriculture (sugar cane) and 12% in commerce and finance. The remaining 6% of the population is not employed or works outside of the district (Green et al., 1993). The town's main economic activity is farming sugarcane, either for the local association of Xinavane or Tongaat Hulett Sugar. In this city, the most common language is Xichangana, spoken by 63% of the people, followed by Portuguese, spoken by 27%. The remaining 10% of the population speaks Xitswa, Xhironga, or Cichopi (Lopes, 1998).

In 2005, UNESCO founded the CMC of Xinavane, and its management was entrusted to the Associação Juvenil para o Desenvolvimento da Comunidade (Youth Association for community development). The people who manage this CMC are local people from the community, most of them teachers at the local secondary school of Xinavane.

This CMC provides services such as computer training (Word, Excel, PowerPoint), photocopying, printing, and document typing. It has four computers in the training room and an additional three computers distributed in the coordinator room, the clerk, and the radio station.

The community radio provides news (in Xichangana and Portuguese), announcements, necrology, and lost and found information, and it promotes community debates.

The CMC users are young students and teachers who seek photocopy services and computer courses provided by the CMC.



Figure 4:3 The Xinavane CMC (RE-ACT Project 2011 Field Trip)

4.2 The central provinces

The Centre of Mozambique has four provinces, namely Tete, Sofala, Manica, and Zambezia, and it has nine CMCs. Sofala Province is the point of connection between the south and the rest of the country; it witnesses the movement of goods due to the existence of the second biggest port, the Port of Beira. Beira is the second largest city in Mozambique and the primary port in the country. Beira is the centre of the commercial fishing industry and also the main point for trade for Mozambique, Malawi and Zimbabwe.

The Cahora Bassa Dam is located in Tete Province; it is the biggest hydroelectric facility in southern Africa and the second largest in Africa. The dam is 250 km long and reaches 38 km.

About CMCs, Tete province has two, as Sofala, Manica, and Zambezia. The CMCs selected within the RE-ACT study were Chitima, Dondo, Quelimane, and Sussundenga.

4.2.1 Chitima

Chitima is located in Cahora Bassa District in Tete Province. The district has a population of approximately 57,675 inhabitants. The Cahora Bassa, electricity is sold to nearby South Africa, Zimbabwe and Malawi.

UNESCO founded the Chitima CMC in 2006, and its management was entrusted to Thinu la Chitukuko. The People who manage this CMC are mostly local teachers, members of the local association.

The CMC provision of services is hindered due to the inadequate provision of electricity and bad electrical installation in the main building, such that the radio services provided only work for six hours a day with breaks for two hours in each six-hour of operation. The telecentre part of the CMC has four new computers and offers OnTheBox TV service. Despite the presence of computers, this CMC does not provide computer training, as the necessary electrical equipment uninterruptible power supply (UPS) and voltage stabilizer is damaged for the new and the existing computers.

The services most used by the community are photocopying, water provision, and radio talk shows that address community needs and social dilemmas. Frequent users are young students and teachers seeking the existing technological infrastructure. Housewives also collect water at the CMC water tank.



Figure 4:4 The Chitima CMC (RE-ACT Project 2011 Field Trip)

4.2.2 Dondo

Dondo District is located in Sofala Province and has 77,532 inhabitants. The district CMC was founded in 2004 and its management entrusted to the Associação dos Serviços Comunitarios de Sofala.

The CMC provides services such as photocopying, printing, document typing, and, since 2011, computer training (Word, Excel, PowerPoint). This CMC broadcast radio signal is capable of reaching parts of Beira, which is the largest and most developed city in central Mozambique. The community radio services range from announcements and necrologies to renting antenna time to specific entities to broadcast their shows. The technological infrastructure comprises three computers in the training room and one at the radio station.

Most of the users of the CMC are students, teachers, and people from the community seeking to use the CMC infrastructure to broadcast local shows and other events.

4.2.3 Quelimane

Quelimane is the administrative capital of Zambezi Province. It is the fourth largest city of Mozambique with a population of approximately 200,000 inhabitants in a town of approximately 25,000 km².

In 2006, the Catholic Church, with support from UNESCO, founded the CMC Nova Radio Paz, located on the first floor of the primary school São Carlos Luanga. The people who manage the CMC are two Catholic nuns, supported by young people from the local community who are awaiting placement at the local university.

The technological tools used in this CMC are five computers, four of which are allocated to the training room and one to the radio. The CMC provides training in ICT (Word, Excel, PowerPoint, Internet). The Internet courses are provided only to people who have already acquired ICT training at the CMC.

The community radio provides radio services like announcements, music selection, and radio training for the community.

This CMC is known for introducing talented radio presenters to the other local radios in the city. The CMC provide radio DJs to two of the local radios because the CMC is unable to compete with the salaries provided by the city's existing commercial radios.



Figure 4:5 The Quelimane CMC (RE-ACT Project 2011 Field Trip)

4.2.4 Sussundenga

Sussundenga is a district of Manica Province, with a population of approximately 128,866 inhabitants (2007, INE). Sussundenga District's main economic activity is agriculture.

The CMC of Sussundenga was founded in 2001 and its management entrusted to the Institute of Social Communication (ICS). Unlike most of the CMCs within the RE-ACT project, the Mozambican government oversees this CMC, and its broadcasts and activities are directly overseen by the ICS, a government entity.

The CMC provides services such as basic computer training (Word, Excel, PowerPoint), photocopying, faxing, and brochure making for students. Apart from its local programs, the community radio also broadcasts the RM signal. The local programs encompass topics such as civic education, health awareness campaigns (mostly about sexually related diseases), and social issues. Additional services, such as catering, are also provided.

Technological tools: The CMC has eight computers, six of which are used for basic computer training; the remaining two are in the radio station and the manager room, respectively.



Figure 4:6 The Sussundenga CMC (RE-ACT Project 2011 Field Trip)

4.3 The northern provinces

The northern part of Mozambique comprises the provinces of Nampula, Niassa, and Cabo Delgado. The city of Nampula has a population of approximately 471,717 (UN, 2014) inhabitants, making it the third largest town in Mozambique. Nampula was established in 1960 when the Portuguese drained a swamp and built it. The city has grown more than expected, partially due to the existence of a commercial railway between Malawi and the port of Nacala.

Northern Mozambique is also famous for the Island of Mozambique, which includes coral-block mosques and houses, the oldest surviving Arab architecture of the twelfth century to be found in Mozambique.

The Niassa and Cabo Delgado provinces have the highest number of people working in agriculture applying primitive farming techniques, involving few tools and animals.

4.3.1 Cuamba

Cuamba is a city in Niassa Province in Mozambique, northwest of Mount Namuli. It lies at the junction of the railway line from Nacala Port (the main and biggest commercial harbor in the north of Mozambique) and the city of Nampula. Cuamba District has a population of approximately 56'801, and the town's main economic activity is agriculture. This town is home to the School of Agriculture of the Catholic University of Mozambique.

Apart from the CMC, there are two telecentres in the town owned by TDM and the local Catholic parish.

The CMC was founded in 2006 and its management entrusted to the Associação da Rádio comunitária de Cuamba.

Technological tools this CMC offers basic computer training (history of computers, Word, Excel, PowerPoint, and the Internet). Similar to the Morrumbene CMC, this telecentre has only one computer that is connected to the Internet, located in the reception area, and it is available for public use. The computers in the training room are not connected to the Internet.

Other services offered are photocopying, printing, and bookbinding and fax facilities. Additional services are provided, such as radio journalism training for the community and broadcasting the signal for TVM. The CMC also offers language courses as a way to financially sustain the community radio. These services are provided with the support of five computers in the training room, two in the radio, and one in the reception. This CMC is also responsible for maintaining the broadcasting equipment of the National Television Channel (TVM).

The People who manage the equipment in the telecentre are six employees hired by the ICS; they are paid on a monthly basis. Sixteen volunteers assist them, and 80% of the volunteers work as radio journalists. Their main task is to acquire and compile community news. The remaining 20% of the volunteers work on the telecentre; they handle training people in ICTs.

Users of this venue are mostly students and teachers from the local and surrounding towns.



Figure 4:7 The Cuamba CMC (RE-ACT Project 2011 Field Trip)

4.3.2 Chiure

Chiure is a town located in Cabo Delgado Province in northern Mozambique, and it has a population of 230,044 (2007, INE). The town is located along the road that comes from Pemba, the capital of the province. The town is known for its rich mineral resources.

The Chiure CMC was founded in 2006 and its management entrusted to the ICS; the CMC offers a basic computer course (Word, Excel).

Technological tools used for training are six computers, and the CMC hosts the antenna for the national television. The radio also provides services such as announcements, broadcasts of RM, civic education, and health awareness campaigns, mostly on sexually related diseases and social issues.

The People staff with lower knowledge about computers as much of the staff after training find better employment possibilities elsewhere.

Users are usually students, farmers, and government officials.



Figure 4:8 The Chiure CMC (RE-ACT Project 2011 Field Trip)

4.3.3 Ilha de Moçambique

The Island of Mozambique lies off northern Mozambique, between the Mozambique Channel and Mossuril Bay. It has a population of around 14,000 people (2007, INE) and is part of Nampula Province. It is a UNESCO World Heritage Site, and it is quite well known by international tourists. The island is rich in history, as it was the former capital of Mozambique. It attracts international

NGOs and associations as well as people who want to open up activities in tourism (especially restaurants). It is well provided with suitable accommodations.

The CMC was founded in 2007 and is managed by the Associação dos Amigos da Ilha de Moçambique. This CMC does not provide computer training, but there are other venues on the island that do. Some associations are based on the island, and many of them have telecentres (Millennium Village). Other ICT providers in the island are the “Projecto Oceano” (Project Ocean), targeting young people, and the SAMANI, an Italian NGO offering basic computer courses to the community for free.

The CMC offers the local community services like dedications, necrologies, announcements, interviews, and radio training for volunteers. The CMC also provides photocopying, typing and scanner facilities, and access to multimedia content.

The CMC has just one working computer in the radio station and no computer at the community’s disposal.

The users of the CMC are mainly students or other people of the community in need of photocopies.



Figure 4:9 The Ilha de Moçambique CMC (RE-ACT Project 2011 Field Trip)

The CMCs here described they vary consistently in resources and services they offer. The figure below summarizes the services currently available at each of the presented venues:

- a) Community radio and photocopies are always present;
- b) ICTs courses are also very present, except, at the moment, in Chitima, Dondo, and Ilha de Moçambique;

-
- c) Each venue, then, differ in some different services peculiar to the place, ranging from scanning, printing and fax facilities, to television signal, language and civic education courses, cinema and local newspaper;
 - d) Finally, the Internet is available to the public just in 2 out of the 10 CMCs.



Figure 4:10 The 10 CMCs services provided (RE-ACT Project 2011 Field Trip)

4.4 Improvement Actions

Improvement actions in the RE-ACT project were co-designed during a workshop, held in Maputo in April 2012, where CMC directors, and a network of people and institutions (MCT, CIUEM, CAICC and UNESCO) connected to the CMCs in Mozambique, were invited. CMCs' directors participating in the workshop were nine: from the south of Mozambique (Xinavane, Morrumbene), the centre (Dondo, Chitima, Quelimane, and Sussundenga) and the North (Chiure, Cuamba, and Ilha de Moçambique).

The aims of the workshop were:

- (i) to present the results of the previous data collection and
- (ii) to co-design improvement actions to be carried out during the next seventeen months of the project.

Improvement actions for each CMC had an initial budget of 1500 USD and were intended either to purchase technical material or to develop the CMC Staff and the concerned communities.

The workshop had the duration of two days, with two sessions per day; during the sessions the following topics were covered and discussed:

- Presentation of interview results
- Presentation and group work on pictures
- Brainstorm on possible improvement actions
- Individual meetings to negotiate a specific improvement action

As shown in Table 1, workshop sessions were programmed to support the co-design process, providing an opportunity to bring innovative solutions and numerous debates on which improvement actions should be chosen, and how they should be run.

Session title	Modality	Goals	Main Actors	Output
Presentation of Interviews results	Oral Presentation + slides	Give a feedback on the interview done the year before Make CMCs directors on strengths and weaknesses of CMCs	RE-ACT team	Food for thoughts for the following sessions
Focus Group on pictures	Group work	Gather CMCs' directors feedback on pictures Make them aware of strengths and weaknesses as perceived by all local actors	CMCs directors divided in two groups RE-ACT staff as facilitators	Presentation of each group about portrayed strengths and weaknesses of CMCs in Mozambique
Presentation of RE-ACT team's analysis on pictures	Oral presentation + slides	Give feedback about photo-elicited data and how it was connected to the interviews	RE-ACT team	More food for thoughts for the following sessions
Focus group on possible improvement actions	Group work	Brainstorming on possible improvement actions Reflect on key design elements: real target groups, real needs, possibilities of the CMCs to help	CMCs directors divided in two groups RE-ACT staff as facilitators	13 possible improvement actions presented by CMCs' directors Discussion and feedbacks
Individual meeting to negotiate one Improvement Action for each CMC	Meetings with CMCs' staff members, one at a time	Negotiate one Improvement Action to be implemented Agree on the implementation process Sign an agreement contract	3 people from the React team and 1 director	Signed contract for the chosen improvement actions

Table 4-1 Sessions of the first Workshop

The focus group interactions provided conditions to outline the different perceptions of MCT, CIUEM, CAICC, CMC directors and UNESCO. From the session two philosophies can be outlined about how they perceive the PAVs; the first philosophy we outline is a dynamic approach, which addresses PAVs as a technology for development by itself, using critical internal dynamics to provide universal access to ICT. The second is a deterministic approach, which we have subdivided into utopian and dystopian (Davison, 2001). The utopian regards technology as a mean of salvation that will lead humanity to progress (Coenen, 2007), while dystopian contradicts utopian by considering technology as a disruptive, alienating, harmful and noxious agent for people.

With the analyses done during the field trips, we have understood that the dynamic approach fits the discourse of the initiating agencies, the utopian and dystopian discourses matching the CMC staff and local community respectively.

The initiating agencies such as UNESCO and MCT use a dynamic approach towards the CMC. They perceive the CMC to be a source of information and service providers with the ability on their own to generate income and make the CMC financially sustainable. Initiating agencies when established the CMC created conditions for the technological infrastructure of each CMC to be comprised of at least four computers, one multi-functional printer, and a radio station capable of covering on approximately 100 km ray. The agencies provided training for the CMC staff on journalism, computers, and management of the technical infrastructure. The staff was trained to be able to teach local communities ICT training (basic windows, word, excel, PowerPoint, and the Internet). The communities based on the premises of the PAVs have been presented these venues by initiating agencies as locations where they could obtain knowledge and information paying a small fee.

The CMC staff use a utopian approach when using and adopting the CMC on a context where access to knowledge and information is a privilege, not a right. The team is comprised of locals who are not in most cases employed; they gain their living working for the community on the CMC. Furthermore, the CMC electricity, water, repair of the technological infrastructure, access to the Internet is not free. The paradox occurs on how each social group perceives the PAV, as initiating agencies are looking at sustainability with small fees for access to ICT, communities look for information and knowledge, the

staff looks for income. The paradox generates discontent feeling between stakeholders. Initiating agencies reframe their investment priorities or experiment different approaches to mitigate the design gaps.

The CMCs are established in a context where knowledge and access to information is a valuable asset to avoid becoming insolvent increases the cost of knowledge and information. The community carries on their activities with the gap between the haves and has not, becoming a noxious agent in the community. The misaligned or paradox perceptions create unfavorable conditions for the CMC to be effective in serving a broader set of the community.

During the implementation of CMC improvement actions focus group sessions were conducted to bring forward interaction between participants from the local community (civil society) and CMC staff, we ensured that stakeholders discourses, mobilization discourses, and oppositional discourses presented relevant ideas and involvement in a non-hierarchical form. Having natural communication channels available for expressing not only task-relevant but also socially and psychologically relevant information was necessary to analyse how culture, knowledge, and gender influences the discourse of stakeholders(Rehm et al., 2012)

This approach allowed CMC directors to become acutely aware of CMCs' strengths and weaknesses and also understand the social influence that CMCs have in daily community activities. Inclusive decision-making and participatory community meetings are known as key features in traditional rural African communities (Winschiers-Theophilus et al., 2010) Studies have emphasized the importance of idea generation; idea screening and concept development (Kaplan, 2010). The photo-elicitation, an interview technique used in social and ethnographic research, which consists in bringing photos into a research interview (Rega et al., 2012). Photo-elicitation was applied by taking photos and showing them to interviewees, or by the interviewees took the pictures, and then commenting them with the researchers, as it was the case in Re-Act. The photo-elicitation part was brought to provide participants to reflect on their experiences. The CMC directors were presented with 195 photos classified as photos that demonstrated something that staff and users dislike and something that can be improved in the CMC.

This process allowed CMC directors actually to perceive what local communities

clustered in social groups perceived to be the strength and the weak points of their CMC. It provided the understanding of what the CMC needed to improve.



Figure 4:11 the photo elicitation analyses session

CMC directors understood the importance and utility of acquiring social and financial sustainability. The CMC Directors addressed the social sustainability as an essential condiment to bridge or solve sustainability issues, by changing their behaviour allowing local communities to participate actively in the CMC activities. Directors were also interested to and concerned about the changes and behaviours that would emanate from the improvement actions. The concern prompted intervenient to evaluate the possibility of further introduce to local communities and beneficiaries of the improvement action the opportunity to discuss and select on their view what type of service the CMC could implement.

Community ownership and localization of services are a major factor when formulating the services to be provided to community, allowing people to search for solutions to real

life problems using a similar need to summarize it or condense what may be complex perceptions of someone else appearance and behaviour (Ments, 1999).



Figure 4:12 CMC Director drafting an improvement action

With this understanding, it was easy to understand that local communities had to create specific task forces our group works, to evaluate the selected improvement actions. This understanding placed Directors aware of the need to take the lead on choosing one improvement action to be defended in front of their community, if accepted to be implemented, the RE-ACT team would work as supporters of the project, not as implementers.

Improvement actions had to be co-designed taking into consideration, the social group needs, identification of the improvement action beneficiaries, and procedures for the CMC (radio and telecentre) technical infrastructure to support the implementation of the project.

Chapter Summary

The CMCs are established in a context where knowledge and access to information is a valuable asset to avoid becoming insolvent increases the cost of knowledge and information. The community carries on their activities with the gap between the haves and has not, becoming a noxious agent in the community. The misaligned or paradox perceptions create unfavorable conditions for the CMC to be effective in serving a broader set of the community.

The groups of stakeholders have different perceptions regarding the CMC, meaning that the dynamic approach fits the discourse of the initiating agencies, the utopian and dystopian discourses matching the CMC staff and local community respectively.

To create a reasonable ground of understanding and demonstrate to all stakeholders the different perceptions, a workshop was held at the University Eduardo Mondlane, in Maputo in April 2012, where CMC directors, and a network of people and institutions (MCT, CIUEM, CAICC and UNESCO) connected to the CMCs in Mozambique, were invited. CMCs' directors participating in the workshop were nine: from the south of Mozambique (Xinavane, Morrumbene), the centre (Dondo, Chitima, Quelimane, and Sussundenga) and the North (Chiure, Cuamba and Ilha de Moçambique).

Chapter 5 Collection of papers

In this chapter the selected articles are part of this “cumulative” thesis is presented; this chapter highlights two phases of this study. While the former chapters involve the generation of contextualized information and data collected from focus group sessions, observation, interviews, and photos, this chapter focuses on presenting the outcome of improvement actions co-design in the second phase of the RE-ACT project.

Five articles are part of this section, one of the papers is a literature review, which highlights taxonomy of factors considered important to consider when co-designing improvement actions with developing communities.

The literature review provides insightful information about the knowledge and taxonomies required to understand how effectively co-design can be used to support communities. The conventional development paradigm asserted on the premises that developing countries could be propelled to development path by knowledge emanating from developed nations; the new wisdom gives priority to design partnerships and participation by the civil society as the best method to achieve sustainable development. Hence in the literature review, the focus is placed on the generation of knowledge coming from the community as an asset to be used and cherish. This approach brings forward the contribution and role of project stakeholders in the process of co-design.

The literature review is followed by a case study performed in the Morrumbene district where cohesion and strength relations between researcher and community created favourable conditions for the deployment of a social and financial sustainable application. The improvement action was framed and reframed several times, until consensus, and mutual understanding between intervenient was attained. The commitment was observed by how intervenient devoted time, knowledge, attention and patience to design and draft the final solution.

The Zambezi province provided one of the most fruitful and delicate case studies in the project. The improvement action conceived for the Quelimane CMC was to provide ICT training for the underprivileged youth living in two nearby orphanages and contribute to enhancing their confidence with technology. The intervention had as objective to acquire

social recognition and opportunities on the job market for stigmatized and unprivileged youth from the city. This case is analysed, looking at the most important factors underpinning its successful implementation.

The final but not least case study is concerned with the subjective assessment of attitudes, opinions, and behaviours; such approach in research generates results in non-quantitative form, which has to be subject to rigorous quantitative analyses. Such analysis has been performed in the Ilha de Mozambique case study.

Figure 5:1 demonstrates the status of the journal articles, and the outlined presentation of the entire chapter.

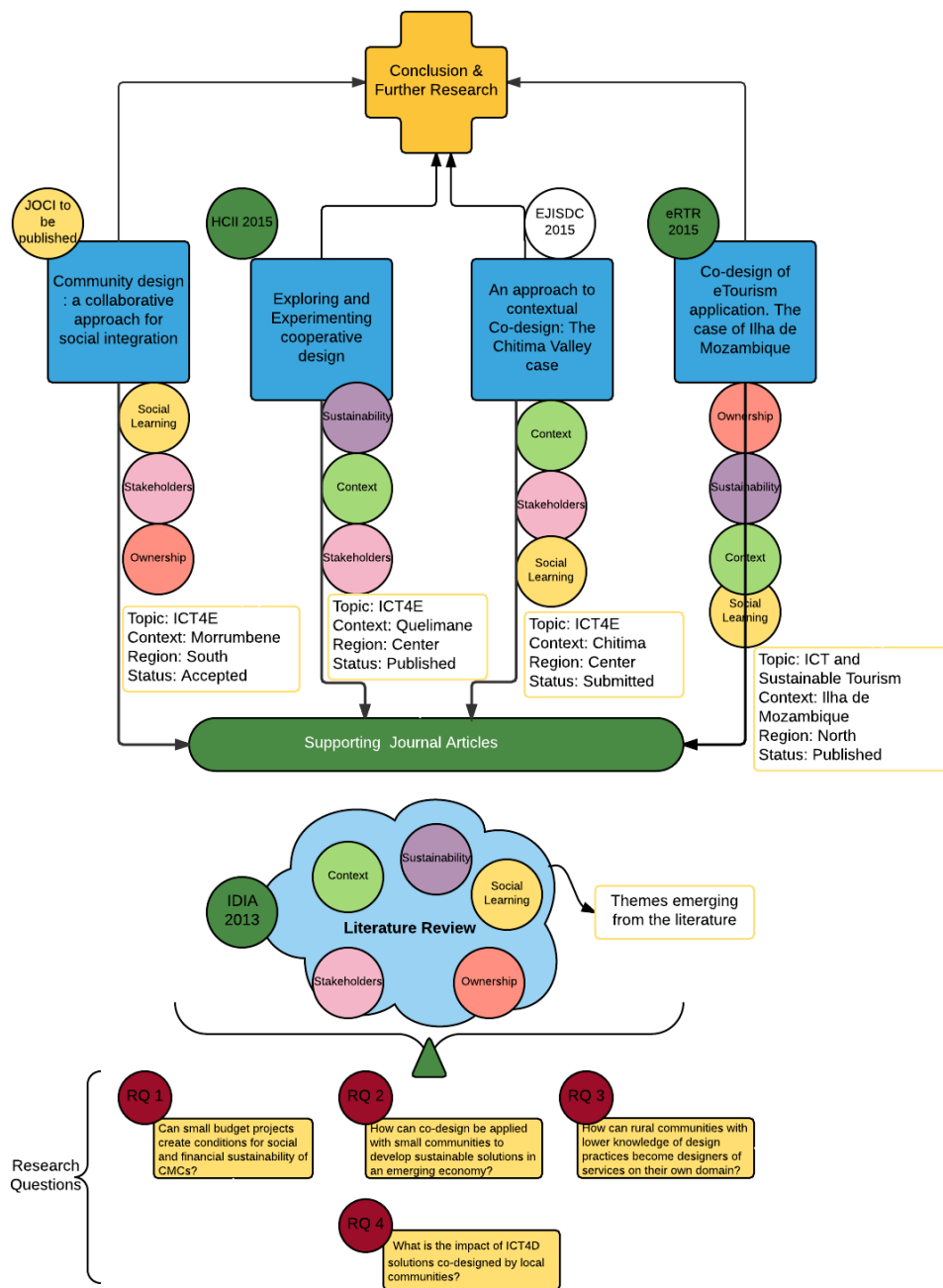


Figure 5:1 Overview of publications

Co-design in ICT4D: a Literature review

David, S., Sabiescu, A., & Cantoni, L. (2013, November). Co-design with communities. A reflection on the literature. In Proceedings of the 7th International Development Informatics Association Conference (IDIA) (pp. 152-166).

Preface

The purpose of this literature review is to present two epistemological perspectives of co-design evolution within the last decade. The literature review seeks to provide an overview of co-design implementation in ICT4D and developing scenarios. It is also presented a comparison between other design flavours and underlined the main differences.

Abstract: This study reviews the literature focused on co-design with communities, studying its applicability in the field of Information and Communication Technologies for Development (ICTD). Texts dated from 2002 to 2013 have been surveyed, covering both subjects: “co-design”, and “development”. Based on their disciplinary orientation, three clusters were identified: (1) information and communication for development, with a focus on developmental goals; (2) information systems, with a concern for technology design; and (3) social design, in which social issues are prioritized. The analysis reverted on the identification and discussion of the themes emphasized in the literature as the most important aspects for linking co-design activities with development. Five themes emerged from the analysis: stakeholders, context, ownership, social learning, and sustainability. The paper defines each theme and shows how it has been approached differently in the three clusters of related literature. This review is meant to inform future co-design studies in community settings, by providing a map of the most important research issues in this field coupled by considerations on how different disciplinary orientations – developmental, information systems,

and social sciences – are likely to imprint their peculiarity on approaching and dealing with these issues.

Keywords: Co-design, community informatics, ICT for Development (ICTD), participatory design.

5.1.1 Introduction

The goal of this study is to investigate and conceptualize a thematic framework for the analysis and applicability of co-design in the field of Information and Communication Technologies for Development (ICTD), aiming at supporting researchers, practitioners, individuals, and institutions seeking to co-design ICTs with local communities in developing contexts.

Information and communication technologies (ICTs) are widely acknowledged in the developing context as important resources for socio- economic development. Although resource constraints limit the existence of most common public or private access venues that exist in the developed context. To meet community development joint ventures between Governments, non- governmental institutions and business entrepreneurs have invested significant resources in the implementation of public libraries, telecentre, Internet café, schools and other forms of public and private access venues, aiming to provide access to ICTs in the developing context (Sey, 2008).

The most common ICTs access venues created in the developing context are telecentre, community multimedia centres (CMCs), cyber cafe, millennium villages and libraries (Gomez, 2012).

In 2001 a cooperation development project between the United Nations educational, Scientific and Cultural Organization (UNESCO) and the Swiss National Science Foundation (SNFS) meant to implement 40 CMCs in 35 different countries. CMCs are an aggregation of a community radio and a telecentre.

The technical infrastructure that comprises the CMCs developed by UNESCO and SNFS, were a digital radio and a telecentre. The radio broadcasts in local languages managed mostly by locals; with coverage not higher than 100 Km, unlike commercial radios it does not run for profit (David et al, 2013). The Telecentre is defined as a physical space that provides public access to ICTs, notably the Internet for educational purposes,

photocopies, fax, telephone services and other social services to prompt socio-economic development (Reilly & Gomez, 2001).

These venues have contributed to transform the communities into spaces for local information and communication.

As such, these study is concerned with understanding how technology design is marked by its applicability in the developmental field, and what are the underpinnings, explanations and implications for the tendencies to involve users in the design process of public and private access venues, as characteristic of co-design initiatives. This investigation requires a comprehensive vision of what design is, in its cultural and historical dimensions, what role was played by the user in the historical evolution of design, and how does its application for developmental goals mark different approaches in the design process and its outcomes.

Design has been around since the birth of humanity, with other denominations that evolved through time. The craftsmanship model of production characterizing the beginning times of design required that end-users and producers be fully involved in the conception, development, and evaluation of products (Shah et al., 2009). With the industrial revolution, mass production emerged, positing a divide between end-users and the whole production cycle (Castellacci, 2004). End-users or clients became mainly targets of marketing and selling activities.

From the industrial revolution, marked by the transition of manufacturing processes from hand production methods to machines, up to now, several inventions (electricity, domestic appliances, communication media, transportation means) have become fundamental to life (Brewer et al. 2005). Design “as a plan or scheme devised by a person for something that is to be implemented” (Bernhard and Bürdek, 2005) became highly specialized, and left little space for the involvement of end-users in the design process. More recently, inclusion of end-users within the design process has emerged again, as required by higher standards and increasing competition on the quality levels (Wheelwright, 1992).

A similar path may be recognized in the evolution of approaches to technology design for fostering socio-economic development. ICTs have been acknowledged as a contributing factor for the improvement of socio-economic conditions in developing countries (Mann

2004, Sahay, 2005). Approaches to technology design for serving these goals are marked by transition from a conventional development paradigm and top-down methods to increased attention and sensitivity to the bearing of local socio-cultural factors and involvement of the local people in developing contexts in the design process.

The conventional development paradigm was based on the premises that developing countries can be propelled on the development path by knowledge and innovations emanating from developed nations (Waisboard, 2001). The design of technological innovation was therefore fully conceived by experts in developed countries and transferred in developing areas. This approach was applied on the Lincos, an example of foremost export of western technology. The Lincos project was a high profile and well-financed project, that aimed to drop recycled shipping containers filled with high-tech (telecentre) into previously unconnected areas around the world (Braund & Schwittay, 2006). Its success was impeded due to inattention to design features, variety of cultural factors and underlying motivations (Sterling & Rangaswamy, 2010).

On the contrary, a new understanding of development gives priority to design partnerships and participation by the civil society as best method to achieve actual acceptance/adoption, and hence sustainable development (Sonnenwald, 1997). In this paradigm, user involvement in the design process has been taken as one central factor for technology innovation that has relevance and can be used sustainably in a socio-cultural context (Waisboard, 2001).

The co-design process is further shaped by different research and disciplinary orientations. For example, information systems researchers are concerned with the intertwined processes of technology development and organizational change, while social sciences researchers place emphasis on the role of the socio-economic context on shaping technology usages, and on their impact in building towards sustainable community development (Avgerou, 2010).

These considerations framed the approach in conducting the present study, based on a review of the literature on co-design for community development. The study sheds light on how different theoretical and disciplinary strands mark differences in approaching co-design, and evidences three core disciplinary orientations: ICTD, information systems, and social design. After outlining different definitions of co-design in each strand, the

paper proceeds with an outline of the main themes emphasized in the surveyed literature as the most important aspects linking co-design activities to community development goals.

5.1.2 Methodology

In order to find relevant documents, a combination of two keywords has been used: “co-design” and “development”. Queries have been done on the Electronic Journal of Information Systems in Developing Countries (EJISDC), and on the CoDesign International Journal of CoCreation in Design and Arts, then a snowball sampling method was employed, using the documents retrieved to identify other related documents. Beside EJISDC, the journals of Information and Technologies & international Development (ITID), Information Technologies for Development (ITD), African Journal of Information and Communication (AJIC), International Journal of Design (IJD), and Journal of International Development (JID) have been searched following the snowball approach.

The applied technique resulted in a first list of 189 documents. These were analyzed, then reduced to a final sample of 36 fully relevant items, considering the following criteria: the studies surveyed had to (i) be related to co-design and communities, (ii) include case studies or reviews related to development, education programs, and (iii) provide clear evidence when social aspects were investigated. Only research papers, conference proceedings, literature reviews, books, and doctoral theses have been included in the sample. Notes, master theses, and non-research contributions were not taken into consideration in this study. Selected documents were then grouped depending on their approach and on the field where co-design interventions were applied.

The analysis indicated that co-design as a design technique is applied in the field of ICTD, having a relation with information system (IS), as well as in social design (SD). This prompted the creation of three research areas where co-design is studied and applied: (1) ICTD, (2) IS and (3) SD, as shown in Figure 1. The documents classified as ICTD are those in which co-design has been used to serve goals related to education, health, climate change, waste management, social communication through the use of ICTs, and to reduce digital divides and gaps between rural and urban communities. The documents categorized as IS are those where design is presented as creation of software or hardware

that has inherent value to modern society. The SD-related documents, concern a collective resource approach to design of a wide range of products, process, services and activities that has the explicit goal of “industrial democracy” in design.

Furthermore, the documents included in this study were also classified according to the geographical location of presented cases studies.

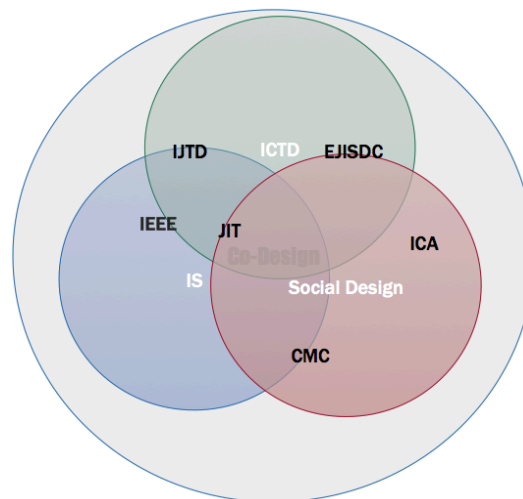


Figure 5:2. Journals presenting co-design manuscripts clustered along three main research and disciplinary areas

5.1.3 Co-Design studies at a glance

From the 36 selected documents, 26 are conference proceedings, 9 are journal papers, and 1 is a Phd thesis.

Studied documents were published between 2002 and 2013, and distributed in the three research areas. IS has the highest number of documents, with 11 conference proceedings, 5 journal papers and 1 Phd thesis. The field of ICTD comes second with 10 conference proceedings and three 3 journal papers. The field of SD has 5 conference proceedings and one 1 journal article.

It is interesting to note that the field of IS has the highest number of manuscripts. The result is supported by the fact that IS has been the pioneer field exploring the design paradigm through the need to provide e-governance, information and communication

means to rural communities using web applications and mobile technologies (Sanders, 2008).

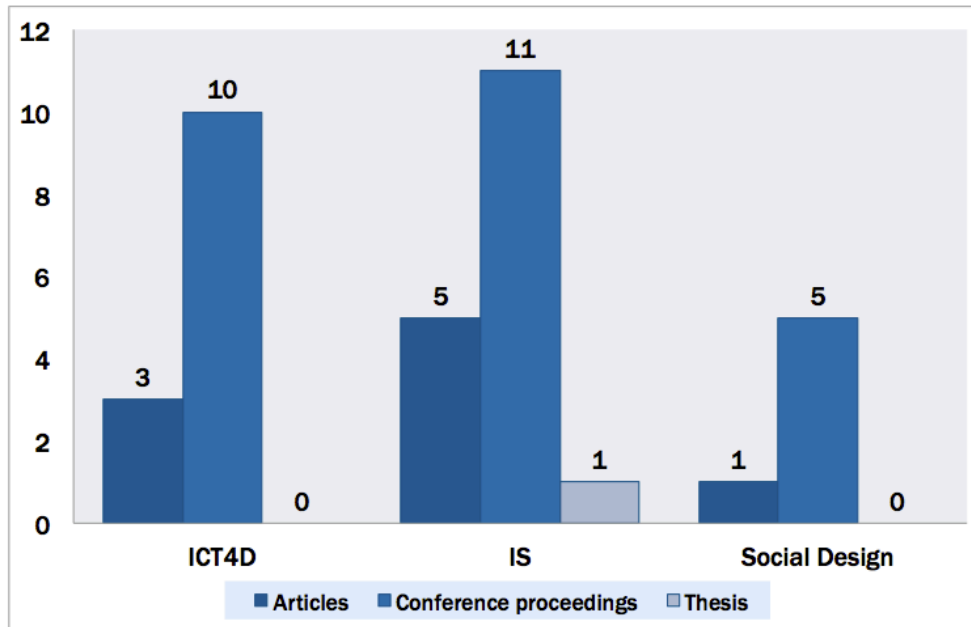


Table 5-1 Manuscripts clustering according to research area and type of publication

The figure 3 shows that the highest numbers of countries with case studies applying co-design are located in Europe where eight countries have implemented co-design projects (Denmark, Finland, Italy, German, Spain, Sweden, Netherlands, United kingdom), followed by the Asian continent (China, India, and Singapore), Africa (South Africa and Ghana), and North America (Canada and USA). The other continent where projects applying co-design with communities are presented is the Pacific (Australia). When accessed by country, the highest numbers of co-design projects are located in United Kingdom with 6 projects; India, Sweden and USA with 3 projects each; Australia with 2 projects; followed by the remaining countries with one 1 project each.

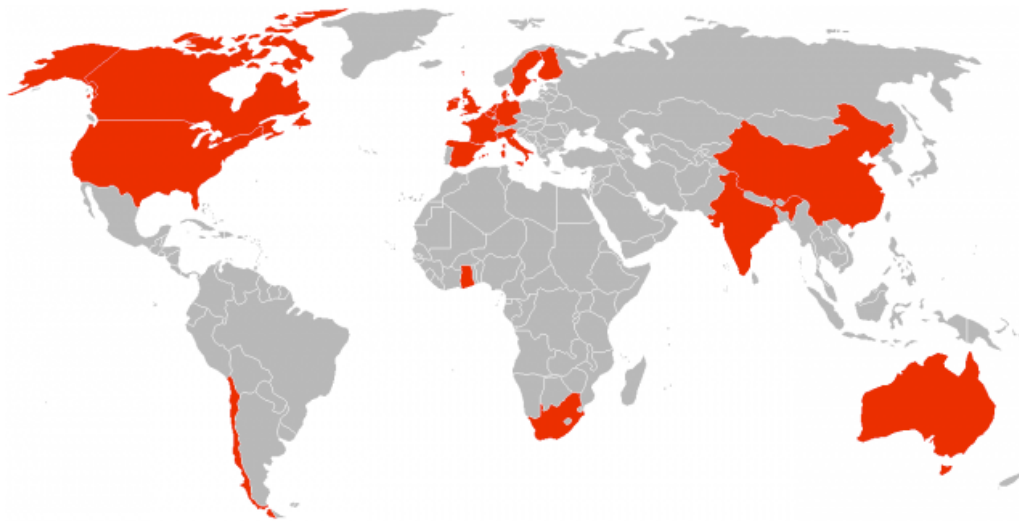


Figure 5:3 Geographic provenances

5.1.4 Defining Co-Design

The emergence of co-design can be linked to two design approaches: user-centred design and participatory design. In the 1970s, design firms initiated an approach that came to be known as user-centred design: at this stage the driven process was to reproduce or translate user knowledge into principles and prescriptions that designers could work with (Santos, 2000). The underlying principles were that designers should understand users and their needs and build trust to increase the efficiency of design outcomes through dialogue and participation. By giving a prominent place to the user, it was thought more useful and relevant design ideas would emerge (Nisbett and Wilson, 1977).

Research in engineering systems and software design prompted a new model or approach in design to emerge, from user-centred design to participatory design (PD) (Schuler & Namioka, 1993). The user-centred design approach considered users as subjects who provide expertise to formulate and conceptualize an idea or service (Ehn, 1993). The PD approach, pioneered by Kristen Nygaard, was described as a set of methodologies, a mindset, and an attitude towards accepting that people have different perceptions of the design process. These perceptions and perspectives can be articulated only if users themselves are provided with appropriate tools to express them (Sanders, 2003). Consequently, PD covers theories and practices, which consider end-users as full participants in the design process.

Co-design is seen as the step forward from user-centred design, and closely associated with participatory design. Some studies describe user-centred design as a United States driven approach, and PD as a Northern European approach (Sanders, 2007). These two approaches have been influencing each other in their historical evolution, and marked the way co-design came to be defined and understood. Co-design can be considered “an updated term of participatory design”, as it shares its key principle of involving all stakeholders in the design process in order to ensure that the end-product meets user needs, and has a high rate of adoption (Steinmueller, 2001).

The review shows also that there are strong similarities among the definitions of co-design in the fields of ICTD and IS, and a slight difference when it comes to the field of SD.

The approach to co-design in ICTD is shaped by the concerns of practitioners, researchers and international development organisations with raising public awareness and spreading ICT knowledge and skills to promote sustainable community development (Kang, 2010; Freeman, 1984). Nevertheless, there is also contention on the role of ICT in promoting development, in particular because countries development priorities might be different (Ramachandran and Kam, 2008; Kroczeck et al., 2013).

Co-design refers to the conception or creation of artefacts drawing on a shared vision, social learning and mutual understanding among all key stakeholders, taking into account that all those involved in the design process have somehow different perspectives and expectations, which should be adequately considered (Fien et al. 2007). Co-design is thought to result in higher quality of system requirements, higher system quality, a better fit between the system and users, and higher users or customers satisfaction (Kaza, 1988: 75-81). Better value for users due to proactively reduced development time and costs on system testing is also mentioned as a key benefit (Steen et al., 2011: 53-60).

The field of SD defines co-design “as a plan or method to do something” placing beneficiaries in positions of power and influence in the design and implementation process (Murcott, 2007). The main idea is that one can design an unlimited number of views on reality but to be considered effective design, every view implemented should present different social groups as beneficiaries, and reflect their views – something that can be done best by involving the beneficiaries in the design process (Markus and Keil,

1994). Therefore, to optimize the value of co-design, instead of designing technology that can be pushed towards communities, a bottom-up approach rooted in social learning should be employed.

5.1.5 Results

The literature review has shown five key themes – stakeholders, context, ownership, social learning, and sustainability – which are closely associated to the concept of co-design with communities. The quantitative findings indicate these themes as the most representative ones in the definitions and concepts presented in the disciplines analysed, yet the importance assigned to each of them, as well as approaches in defining and tackling them, are quite different. In the following sections, the key themes will be presented.

5.1.5.1 Stakeholders

A stakeholder is defined as an organization, a social group, a community or an individual who can affect or is affected by the achievement of the objectives set by an organization or initiative (Heeks and Kenny, 2002). The relationship between stakeholders and ICT design and development is emphasized by the sample of surveyed studies that employed field research and mixed research methods (qualitative and quantitative).

In their position of project stakeholders, local communities are on the one hand contributing to the success of initiatives by investing their own resources, and on the other are affected by a project's success or missed outcomes. Co-design creates opportunities for communities to contribute with their social and cultural knowledge in the design process, providing information to designers about their local context (Thompson, 2008), cultural habits, and taboos. Studies positioned in the ICTD literature, and in particular those implemented in developing contexts, note that communities tend not to use artefacts designed for their own benefit, in some cases due to local taboos and beliefs (Parker and Gallagher, 2007). This raises attention to the importance of properly identifying and involving the right stakeholders, who may be identified not necessarily by geographical location, ethnicity, or economic level, but by the common interest they have in a project (Narayan, 1995). Gaps in participation may therefore be formulated in terms

of whose interests are represented. Several groups may be systematically excluded from participation even if their interests are at stake, for instance women (Kanji and Greenwood, 2001). Mismatch of benefits appears when during co-design sessions a community is represented by a single person of relevance in the developing context structure (Parker, 2007). These co-design processes tend to end in “design-reality gaps”, or missed outcomes (Proenza, 2001).

Studies conducted in Africa and Asia point out the benefits that designers and academic practitioners gain from working with communities, ranging from increased efficiency, sustainability, and adoption, to the effectiveness of the delivered ICT solutions. There is a higher quality and effectiveness in decision-making, which leads to the deployment of relevant activities for program development. The participation of the right stakeholders reduces the potential presence of conflicts and resistance to change. The involvement of influential people in the community (traditional leaders, religious leaders, government structures, political figures) creates space for social acceptance (adoption) and the effective employment of local expertise. These elements are determinant for ICT projects’ success (Albinsson et al., 2007; Kleine and Unwin, 2009).

5.1.5.2 *Context*

The notion of *context* begins to appear in the co-design and participatory design literature in the 1990s, when co-designers and participatory designers started to take this aspect into consideration and link it to others such as *empowerment* and *effective design* (Ehn and Badham, 2013). The local context emerged as important amidst discourses on the design-reality gap, brought to light by the evaluation of ICTD projects in developing areas. These evaluations highlighted the important place of cultural values, habits, and taboos, and their bearing on the development of artefacts that are deployable and practical (Avgerou, 2008). As Avgerou (2001) argues, technological innovation in developing countries has often been done through the transfer of solutions that proved successful in developed contexts. Yet, the value and fit of these solutions in new socio-cultural contexts can never be taken for granted.

There is no universally agreed definition of *context* in the literature surveyed. Many studies tend to refer to it generally as the socio-cultural and physical environment in

which a social group lives. The notion of *context* and that of *culture* appear to be very closely related. Those studies that give accrued importance to the local context tend to embrace social constructionist theoretical perspectives, which emphasize the interpenetration of the social and technical sphere (Avgerou, 2008). In this theoretical perspective, *context* has a quality of dynamism and evolution, and includes equally physical places, artefacts, and people. The focus falls on invisible patterns of relatedness that link people, artefacts, and activities (Dourish, 2004). This take on context contrasts with the positivist outlook in which the context is the outer environment surrounding people and the activities they perform (Dourish, 2004). While this perspective can be and has been employed in accounting for the local context in technology interventions, it has some important drawbacks. Especially, it tends to see it as a stable entity open to be studied and represented from an outer, objective stance, and it disregards the relation with people and their activities (Dourish, 2004: 4-5). On the contrary, a constructionist view of context emphasizes the key role of the local people in defining meanings, understandings and usages of technology as they interact with it in their own social milieu. Thus, it provides a theoretical foundation to the importance of involving local people in the co-design of technological solutions.

The way *context* is understood can be linked to differences in methodological approaches. Studies that point to the importance of the local context favour a bottom-up approach, where relevant design solutions are sought through the involvement of local people (Avgerou, 2010). Studies that indicate more broadly the importance of the local culture tend also to employ ethnographic approaches (Crabtree, 1998).

The papers surveyed agree that communities are the ones that know best their own life context, and are therefore the most entitled to contribute to expanding knowledge for the implementing agencies. Local knowledge is thought to be fundamental for the success of an initiative especially for initiatives concerned with local knowledge production and communication (e.g. Rodil et al., 2012; Winschiers-Teophilus et al., 2010). When the aim is to create culturally representative and locally useful artefacts, it becomes fundamental to conceive the design process starting from a local viewpoint, and allowing activities and design solutions to emerge from it (Rodil et al., 2012), favouring community involvement in all design stages. Nevertheless, the literature outlines as well some of the reasons for

failing to take into proper consideration the local context. Studies point to the challenges faced by researchers and practitioners during fieldwork, such as the lack of basic resources as well as communication barriers (Zaharia, 2008).

5.1.5.3 *Ownership*

The concept of “community ownership” is linked to the success of a project and its capacity to become sustainable. It has been argued that by participating in the design of technology artefacts, a community may be prone to develop a sense of owning the artefact, which quickens the process by which it is appropriated and integrated in its practices (Ramirez, 2008). Yet, caution should be paid in establishing a direct relation between a community’s participation in design and the development of a sense of ownership. Not all forms of community engagement are likely to foster this sense of ownership.

The co-design process creates a framework in which a certain dynamic of interaction between stakeholders (local and external) is generated and nurtured. It is believed that a sense of ownership emerges when the community provides meaningful contributions from the beginning stages of the design process, starting with the definition of priorities, and leading to what Ramirez (2008) calls “ownership of the problem and its solution”. Fake or superficial forms of involvement would likely fail to achieve this result. Parker and Gallagher (2007) generated the notion of *empty promise* where “communities are quick to recognize an empty promise of a greater artifact”. The co-design literature indicates this is likely to occur when consultation with community members bears no reflection on final decisions, and where bottom-up deliberation continues to be trumped by top-down directives (Walsh et al., 2006).

The relation between ownership and sustainability is emphasized in the analysed documents. Many of them indicate that apart from financial aspects, one of the chief reasons for failure lies in the fact that projects are not embraced by the communities (Kujala, 2003). On the other hand, studies point out that through community involvement comes understanding, and with understanding comes public support and commitment (Harris et al., 2003). Studies indicate as well that communities in developing areas have not been participating enough in co-design processes, or the studies reporting community

involvement fail to outline precisely how much a community contributed to the development of the artefact (Merkel et al., 2004).

5.1.5.4 Social learning

Social learning refers to the sharing and development of adaptive group strategies for individual learning based on observation and problem solving in group settings (Sanders, 2005; Huxham, 2000). Sanders and Stappers (2008) place social learning at the heart of current changes in the design landscape, characterized by the emergence of new forms of collective creativity. Co-design with communities at the same time promotes and relies on social learning, which is seen as a process of knowledge advancement through exchanges between a local community and the design team (Conruyt et al., 2010). The *social* in *social learning* relates to the collaborative nature of the co-design process. Learning takes place through participation in-group settings, through sharing and exchange (Sanders and Stappers, 2008).

Learning is also a condition for local people's effective participation in design decisions (Hearn et al., 2009). ICTD studies tend to emphasize the importance of learning as participation in the co-design process especially for producing artefacts that represent or store representations of local identity, culture, and knowledge systems (e.g. Rodil et al., 2012; Verran et al., 2006). In these cases, knowledge of the local context, culture and history are used to better define the functionalities and uses of the technical artefact to serve community needs for knowledge production and communication. These practices are successfully introduced when a person from the community is prior trained by researchers on the topics at hand (Ramachandra et al., 2007), as it takes time to design technology that is related to the context and culture when design is conducted by people outside the community (Winschiers-Teophilus et al., 2010).

5.1.5.5 Sustainability

Sustainability can be defined as “the ability of a project or intervention to continue in existence after the implementing agency has departed” (Harris et al., 2003: 2). Economic or financial sustainability refers to the long-term ability of ICT projects to generate enough income to meet their operational and maintenance costs (Johnson, 2000). In the

studies surveyed, two aspects of the relation between the co-design process and sustainability can be identified.

Firstly, it has been argued that the co-design process itself can be instrumental to boosting a project's potential for sustainability, if people's involvement in design contributes to fostering a sense of project ownership (Ramirez, 2008). At this level, a community's social capital, inclusive of communal values and aspirations, needs to be accounted for as a crucial factor for sustainability (Simpson, 2005). By becoming involved in the initial stages of the design process, people are prone to embrace and integrate its solution in their practices. Moreover, they may become sensitive to the identification of communal issues that can be adequately met by technology usage, and knowledgeable of socio-technical aspects that they can apply in activities promoted after a project's completion.

Second, studies point to the importance of including local members in decision-making and management of financial issues. Financial sustainability is one of the greatest challenges ICTD projects face (Zaharia et al., 2008), and co-design projects are not an exception to it. This aspect is entangled with the duration of typical ICTD projects, as in many cases donors have a limited time and resources to set-up and develop a project (Kumar and Best, 2006). ICTD projects tend to be created with a business plan that oversees the generation of sufficient money ensuring continuous access for communities at a lower cost. This aspect has not been given sufficient attention in many community-based initiatives (Roman and Colle, 2002, 2003; Harris, 1999; Harris et al., 2003). Based on repeated evidence of past projects failure, the literature shows the importance of co-designing a business plan with the joint involvement of financial donors, implementers, and beneficiaries (the local communities) in the planning process (Luk, 2008).

5.1.6 Conclusion

This paper described the results of a literature survey on co-design with communities serving community development goals. The studied documents were grouped according to their research and disciplinary area, focusing in turns on developmental issues (ICTD), information systems, and social design. The survey highlighted five themes that were found to be most closely connected to the process of co-design with communities – stakeholders, context, ownership, social learning, and sustainability. These themes

converge into a frame marking the conditions and impacts of successful co-design processes with and for communities.

The ICTD greatest stories denominated as successful projects are those who enable local initiatives, partnership mixed with trust between communities and development agencies, government. Where local communities do not see the outsiders as white counterpart (Tilly, 1998).

The studies present local communities as owners of certain skills that support western entrepreneur/innovators who deploy on a co-design or participatory design know-how to real local communities' problems when it comes to foster social changes and evaluate the impact of the ICTs (Warschauer, 2004).

Most of problems in ICTD projects deal with people-issues; identified as most important the way stakeholders participate, inform and communicate involvement, this are communities greatest concern. If all intervenient of the development project share the same interest and are owners of an idea, materialization becomes only a coordination task, where as an individual idea, to be implemented by many entities becomes one's efforts to create a co-operation dilemma.

The lack of contextualization and knowledge of social structure makes it difficult to run a financially self-sustaining ICT venue. The implementation of social development projects should not be focus only on technical means to deliver services. There are social aspects that emerge after Governments, non- governmental institutions and business entrepreneur's funds fade. The social aspects range from difficulties to maintain the technical infrastructure; capability to address community needs which leads to problems to sustain the venue.

The presented key themes found to be treated differently in the three literature streams outlined, and in chronological evolution from the early years of co-design studies and initiatives in community settings to the present day. These themes demark key topics permeating the state of the art literature, and also delineate the areas that researches and academic practitioners should focus on, or take into consideration in their critical analysis and set-up of future co-design initiatives.

Exploring and experimenting cooperative design

David, S., & Cantoni, L. (2015). Exploring and Experimenting Cooperative Design. In *Design, User Experience, and Usability: Design Discourse* (pp. 149-156). Springer International Publishing.

Preface

Co-design approaches can have several tastes; it all comes down to how focus group sessions are handled and the level in which users are entrusted with core responsibilities of the co-design process. This paper addresses the research question 1 (Can small budget projects create conditions for social and financial sustainability of CMCs?). In this paper the co-design process is entrusted to the local community of Morrumbene, they produced a website, under the distant observation of the RE-ACT team.

Abstract: This paper describes a community co-design approaches performed in rural Mozambique. It discusses the experiences and experiments performed in a community multimedia centre towards creating services with inherent values for daily activities. The design approach pursues a holistic interpretation of community needs emerging new and creative applications for future community binding.

Keywords: community design, co-design, development, tourism, and education.

5.1.7 Introduction

The sub-Saharan African confronts development problems, reflected in high unemployment, digital divide, access to health, and education (Oyedemi, 2009). To tackle

these issues donors and sub-Saharan nations devoted significant financial and human resources to venture in Information and Communication Technologies (ICT), creating public access venues or ICT venues. Public access venues or ICT venues are venues that provide access to computer and Internet services, open to the public. They are also defined as a place that offers public access to information with services available to everyone, and not directed to one group excluding others (Kuriyan et al., 2010). Examples of public access venues established in sub-Saharan Africa are telecentres, community radios, cybercafés, millennium villages, and libraries.

The birth of public access venues expected to improve efficiency in government service deliver and contribute to development, an approach recognized to satisfactorily promote digital inclusion through technology, information access and development of ICT skills (Sey et al., 2013). The public access venues have higher social impact on users; delivers benefits that touch aspects of the users livelihood, including culture, language, education, communication, access to information and leisure.

This paper presents a collaborative approach used to design a solution with inherent value for the community of Morrumbene. The case shows how involving individuals, social groups, and organizations provide conditions to create an environment to produce a social and financial sustainable solution.

The rest of the paper is organized as follows: in the next three sections, we present the overview of public access venues in Mozambique, context, and the methodological framework used in this research. The last two sections present the outcome and discussion around stakeholders, context, ownership, and sustainability.

5.1.8 Public access venues in Mozambique

Mozambique is a country located in the sub-Saharan Africa, bordered by the Indian Ocean on the east, Zimbabwe on the west, Tanzania and Malawi on the north, and South Africa on the south. The country has approximately 70% of inhabitants based in the rural areas (Organization, 2010).

In 1999, Mozambique witnessed the establishment of two public access venues in Manhiça and Namaacha district. These venues were conceived to provide access to

computers, ICT training (word, excel, power point, graphic design), public phone, fax, photocopy and Internet (Gaster, 2001).

Communities information, technology needs and leisure were satisfied during the first years of implementation; the demand for ICT courses and services were high and exclusive to the telecentre.

With appearance of mobile technologies in the country, community needs shifted, with mobile phones becoming affordable and social sustainable compared to telecentres, the mobile industry growth casted shadow on the two existing telecentres (Sey & Fellows, 2009a).

Sustainability of telecentres remained a key challenge, addressed in the year 2000, by a scale up project financed by the United Nations Educational, Scientific Cultural Organization (UNESCO), the scale up project consisted in increasing the technological infrastructure in the telecentre, merging telecentre with community radio on the same venue (Naidoo, 2001; Vannini & Rega, 2012).

The RE-ACT¹ team, in 2011 performed field trips throughout all provinces of Mozambique to collect data about communities' perception and adoption of CMCs.

The CMCs in Mozambique face three common problems stretching from, financial sustainability, access and meet local needs, and inability to equip or get assistance (Kuriyan et al., 2010), (Baia et al., n.d.; Van Zyl & Vannini, n.d.) (Salomão David, Vannini, Sabiescu, & Cantoni, 2013a).

These problems arise when the income generated doesn't cover operating costs; or exist other venues in the vicinity providing similar services at a lower cost. In some cases communities are not aware about services offered by the CMC, or the services offered priceless for the communities.

The CMCs are located in rural areas where to repair, purchase or perform preventive maintenance on equipment is financial not feasible.

¹ RE-ACT: social Representations of community multimedia centers and ACTIONs for Improvement, a research and development project run by the Università della Svizzera Italiana and the University Eduardo Mondlane, from Mozambique (2011-2014).

The community adoption of CMC is understood basically on how communities perceive the CMC; adoption of CMC services is low in locations where the communities perceived the CMC as being a technology provider, adoption is high in locations where CMC is perceived as a space for social and cultural exchanges.

5.1.9 Morrumbene

The Morrumbene district is located in the centre of the Inhambane province, approximately 450 km north of Maputo. It has a largely dispersed population, approximately 110,817 inhabitants, and land extension of 2,608 km² (Kampango, Cuamba, & Charlwood, 2011). The district is known for its wonderful beaches, tranquility, vibrant culture, and resorts built with a mixture of western and local architecture. The district's main economic activities are fishing, tourism and agriculture. The fishing and agriculture activities are for subsistence (artisanal) while tourism has been developing rural areas, and rising demand on local agriculture and fishing industry (Cardinale, Chacate, Casini, Chaúca, & Helge Vølstad, 2014).

The Ministry of Science and Technology (MCT) founded the Morrumbene CMC in 2010, and its management entrusted to the local association, denominated *Associação Juvenil a Chama*.

The CMC offers basic computer training (word, Excel, Power Point, Access and Internet). The Community Radio transmits in Portuguese and Xichangana, and covers the entire Morrumbene district plus the neighboring district of Maxixe and parts of Homoine. Additionally information services like newspapers, seminars, Internet, and cinema on weekends are also provided (Rega et al., 2011a).

The CMC has 14 volunteers' mostly local teachers pursuing a degree in education and students of 10th and 12th grade, all members of the local association.

The communication infrastructure in the district has several limitations; the telephone line doesn't reach the location where the CMC is established, they rely on mobile phones to acquire information. The broadband infrastructure used is a very small aperture terminal (VSAT), with free access up to 6 GB per month financed by the MCT. Other options such as mobile companies are also available with data packages pricy.

5.1.10 Methodological Framework

The methodological framework used is co-design following a similar path of participatory design, although it's seen as an evolutionary approach to technology design for socio-economic development.

The methodology is associated with two approaches: an inclusion and empowerment approach, characteristics that gained increased attention in the more mature years of Information and communication technologies for development (ICT4D) research and practice (Avgerou, 2008)

Co-design refers to the conception or creation of artifacts drawing on a shared vision, social learning and mutual understanding among all key stakeholders, taking into account that all those involved in the design process have somehow different perspectives and expectations, which should be adequately considered (Salomao David et al., 2014). Literature in community design outlines stakeholders, context, ownership, social learning, and sustainability as problem domains to be addressed during socio-technical experiment (Camara, Nø era, & Dunkley, 2008), (Salomao David et al., 2014).

The methodology framework to empower, provide learning conditions and ownership to communities, we have followed in every phase this project implementation three codes of conduct:

1. Communities views, and concerns about technology had to be respected;
2. Every participant, regardless of his education background, social status, is an expert on his own domain, and his opinion had to be taken in consideration;
3. The main source of design ideas and innovations are from the community;

The co-design process used at the Morrumbene district was a participatory assembly for inclusion and sharing of ideas, only concluded when consensus about a topic was reached (Winschiers-Theophilus et al., 2013).

The process followed two distinct phases:

- Focus group sessions; and
- Website design;

5.1.10.1 Focus group sessions

The RE-ACT project aimed at creating an “improvement action” for the Morrumbene CMC, the notion was to co-design a technological solution with inherent value for the community.

The process to select and implement the improvement action had two distinct focus group sessions, the first session held at the University Eduardo Mondlane (UEM) and the second at the Morrumbene district.

The improvement actions were small budget projects co-designed such that implementation was to be performed by the CMC overseen by the community, and RE-ACT team. The improvement actions envision to be implemented by the Morrumbene CMC was a tourism website, idea conceived during the first co-design session held at UEM.

This first co-design session had as participants’ nine CMCs directors, representatives of the MCT, UNESCO, and UEM entities that performed the establishment and scale up project of CMCs in Mozambique.

The second stage of the focus group had three sessions held at the Morrumbene district.

The first focus group session held in Morrumbene was devised to build relationship between co-design session intervenient, and to acquire knowledge capabilities, area of expertise, contribution, and limitations of participants.

To not limit, but manage expectations and enable participants to voice their view, all sessions in Morrumbene where lead by the CMC, who started presenting the idea of improvement action, consisting in the tourism website. The local community rejected the idea, voice concerns about inclusion and declaring that tourism entrepreneurs and authorities have their websites in English, designed, hosted and maintained elsewhere.

With unviable conditions to produce, the website question where raised by the CMC.

“What should we implemented that will allow inclusion of all social groups in the district?”

Through the second session discussions consensus was reached to invite actors with relevant information and knowledge about community core activities; invited this actors, the sample of participants comprised members of police, health service, fisherman association, local entrepreneurs, resort owners, teachers, local youth and religion entities.

The second session produce fruitful discussion around the services that have inherent value for district social groups, unanimity was reached to design a website about the Morrumbene district with the aim to connect people from the district based in and outside. The website had to contain information about the education sector, police information (safety and local reports), health information and information about commerce.

As the website would only connect people from the community with knowledge and access to computers or smartphones, in this regard was decided that the information should be shared using Short Messaging Service (SMS). These messages were to be sent only to people who subscribed to website categories; exception was placed on urgent police and health information that would be sent to all registered numbers.

5.1.10.2 Website design

The website design was carried by the CMC, overseen by the community and the RE-ACT team.

The CMC was responsible for defining and present the website template using joomla; was also responsible to collect information from the community and host on the website.

Training and selection of open source technologies for the website and SMS platform was the responsibility of the RE-ACT team. The solution selected for the SMS platform was PlaySMS, compatible with Hypertext Preprocessor (PHP); the RE-ACT team and MCT ministered training on these technologies.

The community was responsible for testing de solution, evaluate the financial sustainability, and ensure local events, and occurrences were part of the SMS solution.

The CMC and RE-ACT team performed the verification and evaluating, the community was informed once a month on a radio program. The website and the SMS were verified and analyzed using observium network management, and Google analytics;

5.1.11 Result

This section will focus on the relevant results related to: (1) communities participation; (2) empowerment; (3) ownership; and (4) sustainability.

The co-design process resulted in a community website (<http://www.cmcmorrumbene.co.mz/>), consisting of information about the CMC, community radio, government, police, school results (primary, secondary), local publicity, public opinion quiz, and a webmail.

To include higher number of people in the community, an SMS solution was designed to provide quick information to the community about the local market price (fish, vegetable), health tips and security related issues.

The CMC staff was trained in web-design and progressively introduced new features in the website. The training brought to CMC staff independence, and confidence when it comes to using web design tools. The training brought new coding ideas and functionalities like visitor's statistics (day, week, and month), staff biography, etc.

Their participation became active and decisive on local practices and use of technologies for social inclusion mitigating the difference of access of information between people with 3rd generation mobile devices and 2nd generation (Warschauer, 2004).

As the number of people registered for the SMS service increased to 134 in the first month, to sustain the SMS service the community emphasized the need of selling some of CMC services in exchange for SMS balance or balance transference.

As communities best know their life context and therefore most entitled to contribute with finding solutions for local problems (Weinberg, 2009), the community proposed the CMC that services such as cinema tickets, radio announcements and music selection to be charged based on SMS recharge or balance transference. To use alternative types of currency might seem unusual to some people (Davenport & Beck, 2013; Krugman, 1994), literature on forms of money suggests that what works best is to have a currency that fits a specific purpose or mean for payment of a specific service (Boyle, 2011). This option proved to be acceptable by members of the community who were part and non-part of the co-design initiative.

5.1.12 Conclusion

Community's focus groups sessions undoubtedly provided liberty of expression to participants; The RE-ACT team followed the approach of assembly gathering during the

session, as this is a community local and traditional costume. This created conditions for cohesion and strengthen relations between researcher and community.

Although when working with communities' goals are framed and reframed several times, every co-design session produced consensus, and mutual understanding between intervenient. Commitment was observed by how intervenient devoted time, knowledge, attention and patience to design and draft the final solution. Emphasizing and trying to find shared solutions for domain problems is an exploration of spaces where meaning dialog sparks and invite possibilities to share past experiences and contextual knowledge. Communities' skills, knowledge and ideas are values, resources that were explored to the full extent they produce communities views and concerns mainly on sustainability.

Ownership of designed solution: was attained during the involvement of all core business in the district. It was also achieved by providing freedom to change, veto, and reformulate the final solution.

The inclusive framework on the website design was equality, respect, and perception. Was visible the union of individuals of social and political differences working, and sharing ideas and competencies.

Community design: a collaborative approach for social integration

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Preface

In this paper, we explore a different concept of applying co-design, by working with orphans from the Quelimane city. The design perspective explored in this paper brought produced human proactivity, trust actions later described as special condiments for successful co-design.

The paper addresses RQ3 and RQ4 (see section 6, table 6-2). The co-design of services for marginalised youth of Quelimane demonstrate that rural communities can act as designers of services that benefit the community, creating conditions to reduce the digital divide within the community. This case study shows orphans having the opportunity to have classes that allow them to have summer jobs at any local. The opportunity itself is a positive impact for a stigmatized orphan.

Abstract: This paper outlines an analysis of an action research initiative undertaken within the research and development project RE-ACT (Social REpresentations of Community Multimedia Centres in Mozambique and ACTions for Improvement) on Community Multimedia Centres (CMCs) in Mozambique. The project set out to study the perceptions about CMCs held by different social groups and consequently to assist local stakeholders in the design of small projects for improving the performance of CMCs. The paper focuses on the second part of the project, in which nine CMCs with a representative coverage of Mozambican regions were involved in the co-design of development actions for the provision of

new services with inherent relevance for the communities. Actions were designed through the cooperation of the CMC directors and staff, the affiliated communities, and the RE-ACT team. The implementation was entirely managed by the CMC staff, with remote assistance from the RE-ACT team. The nine cases had different rates of success, ranging from successful ones to failure in achieving the objectives set. The paper focuses on one of the most successful cases, involving a CMC located in Quelimane, which aimed to provide ICT training addressing particularly underprivileged youth. Through the project, 79 youth were trained in using ICTs and managing radio programs in one year. The paper offers an analysis of this case and outlines the most important factors underpinning its successful implementation.

Keywords: co-design; Community Multimedia Centre (CMC); public access venue; community development; underprivileged youth; action research.

5.1.13 Introduction

The African continent is home of 33 of the 50 poorest countries in the world; the continent has 60% of the population living with less than 2 USD per day (Benatar, 2002). The world's developing nations live on the frontline of social instability, diseases, conflicts, corruption and climate change (Collins et al., 2009; Desjarlais, 1996). In the quest to find solutions to mitigate developing nations frontline problems, governments and donors have invested early approximately 800bn USD in Information and Communication Technologies for Development (ICT4D) (Heeks, 2010).

Since the early years of ICT4D, when Public Access Venues (PAVs) were the reference of discipline, the investment in ICT4D has been contested for two main reasons:

1. investment and expenditure in ICT4D find path from developing nations to developed countries (Heeks, 2008), where digital gadgets are produced;
2. there is a lack of empirical evidence of ICT4D having any record in creating varieties of economic outcomes to solve the world's poor frontline problems (Patra et al., 2009).

PAVs were embraced as general ICT4D euphoria in the early 1990s, with more than one hundred donors funding PAV projects (Bailur, 2006). Telecentres were the first type of PAVs deployed in the developing context. However they failed to rise to their developmental potential, due to lack of relevant services for developing communities,

insufficient staff training, and lack of programs by which people in the community could effectively expand their knowledge. The design of associated products and services did not take enough into account local practices. In fact, developing nations can be active members of today's knowledge societies; this, however, implies recognizing the importance of developing regions cultural heritage as a fundamental background of a community identity and patrimony (Morley et al., 2002; Vecco, 2010). ICT can provide added value to cultural heritage pedagogy, education and learning (Ott & Pozzi, 2011; UNESCO Chair USI, 2016).

This paper seeks to present how shared perceptions on ICT4D can strengthen the relationship between different society spheres, empowering a social minority group to participate actively in community ICT4D design. The paper reports on the research and development project RE-ACT (Social REpresentations of Community Multimedia Centres in Mozambique and ACTions for Improvement).

RE-ACT worked with Community Multimedia Centres (CMCs), the Mozambiquan most used type of PAV, which combine a telecentre with a community radio. The project had a twofold aim: (i) to investigate the social meanings, perceptions, awareness, and understanding that different stakeholders attribute to CMCs; and (ii) to design and implement services with inherent relevance for the concerned communities, aiming to improve the performance of the nine CMCs involved in the project.

This paper focuses on the second part of the project, the "improvement actions", implemented in the city of Quelimane. The improvement action conceived for the Quelimane aimed at providing training in ICT for the underprivileged youth living in two nearby orphanages, and thus contributing to enhance their confidence, social recognition, and employability in the job market. This case is analysed looking at collaboration, social learning and sustainability as the most important factors underpinning its successful implementation.

5.1.14 Community Multimedia Centres and Improvement actions

Mozambique is one of the world's least developed countries, with approximately 15 million inhabitants living in rural areas, out of 23 million people. The nation has a gross domestic product (GDP) of about 33 billion USD in 2015 (CIA, 2016). Mozambique has

also embarked on pilot projects to deploy PAVs for rural development (UNDP, 1990) aiming to increase access to information and reduce the digital divide. The most common forms of PAVs deployed in Mozambique are telecentres, CMCs, cybercafés, Millennium villages, and libraries (Gaster, 2001; Macueve, Mandlate, Ginger, Gaster, & Macome, 2009; Rega et al., 2011a).

The CMC is a PAV that combines telecentre facilities such as Internet, fax and phone services (Reilly & Gomez, 2001) with a radio broadcasted in local languages managed mostly by locals (Salomão David, Rega, et al., 2013)

RE-ACT “improvement actions” projects were small budget projects designed by CMCs’ staff and local communities with the support of the RE-ACT team. Their purpose was to improve the social and (possibly) financial sustainability of CMCs. RE-ACT action research project supported the design of CMC improved services, while enabling the local stakeholders to take full agency over their implementation. Project activities aimed also to create bridges that linked the CMC and the communities they served, lowering barriers for adoption of ICT services provided by the CMCs.

Improvement actions were conceived during a workshop held in Maputo at the University Eduardo Mondlane (February, 2014). The nine CMC directors, together with initiating agencies representatives, were invited to analyse the information gathered during the first phase of the RE-ACT project and to co-design possible improvement actions to be implemented with their CMC. The improvement actions selected by each CMC (Table 1) show a foremost concern with education, followed by the promotion of local economic welfare through revenue-making activities such as tourism.

CMC	Improvement action	Beneficiaries	Type
Cuamba	Basic maintenance training	Community	Maintenance
Chitima	The Internet for teachers and students	Students	Education
Chiure	Basic support training	Community	Maintenance
Dondo	Creating a Cinema	Community	Entertainment
Ilha de Moçambique	Tourism platform for the island	Community	Tourism
Morrumbene	Local web platform	Community	Tourism
Quelimane	Train underprivileged children	Orphans	Education
Sussudenga	Training in Informatics	Students	Education

Xinavane	Training in Informatics	Students	Education
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Table 5-2 improvement actions in the RE-ACT project

5.1.15 Communities and cooperative design

Over the last few decades, action research has been growing as both a research culture (Schuler, 2009) and a family of methodologies counter-acting traditional notions of knowledge and power, to the extent of engaging communities in shaping the design of the research (Acker et al., 1991). Action-oriented research is usually associated with interpretative (Uttal, 2005) and critical theory inquiry paradigms (Guba & Lincoln, 2005), requiring flexible research designs and a concern with producing practical, actionable knowledge that can inform practice and positive social change (Creswell, 2007). While action research has been labelled with diverse names, ranging from participatory action research, co-design to action-oriented research (Argyris, 1996), the central tenet and driving factor underpinning this diversity is the concern with placing research in the service of the people (Reason and Bradbury, 2005). A common way to differentiate action research from participatory research is to stress either the action taking or the participatory aspects in the research undertaken. Action research is mainly devoted to producing action outcomes and sustaining social change to the benefit of the stakeholders involved. The final aim is to come up with practical solutions to issues that concern people from different social groups or communities (Fine et al., 2000; Gaventa, 1993). At the same time, action research is equally a learning endeavour: it seeks to equip participants with skills on reflective thinking, decision-making, and action taking (Adelman, 1993). When it comes to adoption and appropriation of ICT, empowerment and contextualization of these initiatives decrease the chances of minorities or the least powerful group accepts novel technologies, due to their inability to criticise the artefact or end product (Wajcman, 2013). Users' involvement in the design process allows ownership and contextualization of the technological solution and decreases the risk of falling into design-reality gaps (Nhampossa, 2005; David et al., 2013).

There is increasing evidence in the literature on the benefits of involving local stakeholders in design. The approach to co-design in ICTD is shaped by the concerns of

practitioners, researchers and international development organisations with raising public awareness and spreading ICT knowledge and skills to promote sustainable community development (Freeman, 1984; Kang, 2010). Co-design in this context implies at once that a project draws on a shared vision, fosters social learning, and promotes mutual understanding among key stakeholders, taking into account that those involved in the design process have somehow different perspectives and expectations, which should be adequately considered (Fien et al. 2007). Co-design is thought to result in higher quality of system requirements, higher system quality, a better fit between the system and all intervenient (Steen et al., 2011: 53-60).

5.1.15.1 Case in Focus: ICT Training for the Quelimane Underprivileged youth

This section provides an in-depth view into one of the case studies in the RE-ACT project, involving the CMC in the city of Quelimane.

5.1.15.1.1 The Quelimane CMC

Quelimane is the fourth largest city of Mozambique, located in the Zambézia province. It has a population of approximately 225'000 inhabitants, 40% of whom are less than 15 years old (INE, 2012).

In the past two decades, several initiatives have been implemented for improving access to information and technology in Mozambique. One of such initiative is Nova Radio Paz, a community radio founded by the Catholic Church in 1998. A community radio is a radio station that broadcasts in local languages, in this case in Portuguese and Chuabo, managed by local people and broadcasting to a limited area (usually not further than 100 km of ray). The radio is operated by the local Catholic cathedral and covers the entire municipality of Quelimane. Unlike commercial ones; this radio station does not run for profit. Its main competitor is Radio Moçambique (RM), the national radio broadcaster. In 2006, UNESCO, the Centre of Informatics of the University Eduardo Mondlane (CIUEM), and the Swiss Agency for Development and Cooperation (SDC), implemented an expansion project that consisted of adding to the existing Nova Radio Paz a telecentre overseen by the National Institute of Information and Communication Technologies (INTIC) (David et al., 2013). The Community Multimedia Centre (CMC) of Quelimane was born, as the aggregation of a telecentre and a community radio.

The Quelimane CMC is located on the 1st floor of the São Carlos Luanga primary school. Three classrooms are used as community radio, telecentre, and library. This CMC offers basic computer training (MS Word, Excel, and PowerPoint) in the telecentre, and courses of radio journalism and interview techniques within the community radio. The computer training course lasts for two months, two hours per day, Monday to Friday. The CMC also provides access to the Internet, fax, photocopies, typing services, printouts, and radio announcements (Rega et al., 2011). The CMC had five computers, four of which were allocated for computer training and one to the community radio. The CMC management is entrusted to a Catholic nun, which is supported by four local volunteers. These volunteers are young people who graduated from high school and are waiting for placement in the local university.

Frequent users of the CMC are office workers, students, teachers and business entrepreneurs. The CMC is not the only institution providing radio and ICT services in the city. The public and private sectors offer similar services, yet prices are much higher. These institutions have made larger investments and, due to their financial capacity, can provide competitive salaries. This often attracts the trained staff from the CMC, who leaves the community centre to work for these private institutions. The telecentre part of the CMC has difficulties in finding ways to attract volunteers and staff. By contrast, the radio is successful in its attempt to attract radio staff, as its reputation is solid and widespread in the Centre and North of Quelimane. Nonetheless, volunteers of the radio do also leave for better positions: during the past two years, the radio has attracted volunteers from other provinces, who in few years come to be hired by public sector enterprises like Radio Moçambique (RM) and the Television of Moçambique (TVM).

Technical support for the telecentre part of the CMC is provided by the Centro de Apoio à informação e comunicação comunitaria (CAICC) (Rega et al., 2011). CAICC is a unit within the CIUEM that provides ideas for sharing information and resources between CMCs; it has a green line and postal line to either receive calls related to technical problems or fix damaged components of technological devices. As for the community radio part, support is provided by the Fórum Nacional das radios comunitárias (FORCOM), an organisation that acts as a lobbyist unit to promote and defend the interests of community radios (FORCOM community radio stations, n.d.).

5.1.15.1.2 Key beneficiaries: The Quelimane underprivileged youth

Like many others in the sub-Saharan region, the city of Quelimane faces social phenomena that range from having a very young population (INE, 2012), high fertility rates along with low child survival, AIDS epidemics (World Bank, 2007) and social exclusion phenomena. One of the groups that most susceptible to social exclusion is the one of orphans. With the support of the Diocese of Quelimane, the Institute of Social Security (INAS), and the Association Namuali, the city has been maintaining three orphanages: Casa Esperança, Aldeia da Paz and Casa Família. Other orphanages like the Sangariveira were transformed into women's correction facilities, while the orphanage Eduardo Mondlane was sold and today hosts the Universidade Pedagógica.

The lack of orphanages forced the creation of seven houses that provide care to underprivileged children. There are also houses that do not permanently host children. These new houses created a difference in denomination, such that the people living in the orphanages are called internals and people living in the houses are called externals. Internal orphans are those who live in the orphanage and do not have a family, either because they have run away due to family abuses, or because they were abandoned. The external orphans are those who have a house of their own but no elder person or relatives to care for them. Table 2 presents the number of people living in each orphanage, by age and gender.

Nr	Orphanage	Internal	External	Age	Gender
1	Aldeia da Paz	35	30	7-19	Female
1	Casa Esperança	85	100	7-17	Mixed
3	Casa Família	60	100	6-18	Male

Table 5-3 Orphanages in Quelimane

The orphanages are dependent on welfare organizations, grants from government, donors, and fundraising activities. The orphanage management has also adopted innovative ways to provide care and expand relations between in-house residents and the outside world

with a project known as Ataca, where anybody can be an educational tutor or a friend of a person leaving in the orphanage.

Attention to the inclusion of underprivileged youth has been on the agenda of governmental and non-governmental bodies in Mozambique. The Mozambican government has introduced reforms to primary education, notably the introduction of interdisciplinary, bilingual curricula, learner-centeredness and new teaching pedagogies (Guro & Weber, 2010). The government is paying increasing attention to the impact of investment in education for development and poverty reduction by increasing earnings from employment and boosting the employability of the young labour force (Ez et al., 2012). The relationship between public education and economic development is far from well-defined, and global tendencies such as reduction of public spending on education, and health programs can negatively impact on schooling for traditionally marginalized communities (Carnoy, 2000). Despite the fact that these marginalized social groups are the labour force for tomorrow, they face high social discrimination. Social discrimination originates from how society perceives them. Prior studies provided evidence that 10 to 17-year-old boys or girls felt discriminated when their social situation became a reason for public debate that does not result in protection of their rights, when questioned about their living conditions, and when the lack of a paternal or maternal authority becomes a topic for derogatory conversations (Corcoran, 2002; Cornish & Ghosh, 2007; Liepins, 2000; Sokoloff & Dupont, 2005). Within this pattern, the special case of those underprivileged and young orphans stigmatized as HIV carriers stands out (Robson et al., 2006). Children from HIV positive mothers are often left under the care of their grandmother, cousins or aunts, who later stop caring for them under the excuse that they do not have the means to support them.

This stigma has corrosive effects on the Quelimane underprivileged youth, and generates an illness in the rest of society, leading to social differentials and lack of respect and compassion towards the underprivileged youth. For the underprivileged, stigmatization generates a viral load of hatred, a struggle that finds expression through minor vices taken from a tender age, known in many social contexts as “bad habits”: drinking, smoking, and sexual misbehaviour. If not properly dealt with, these can escalate to self-inflicting, anti-social or deviating behaviours such as taking drugs, gambling, prostitution, and theft.

These bad habits and vices are tightly connected to neglect and abuse, and to the desire for social recognition and acceptance (Burnham, 1993; Jones, 1993; Sacramone, 2006).

5.1.15.2 Cooperative design of services for the Quelimane CMC

The aim of the improvement action devised by the Quelimane CMC was to boost on a micro level socio-economic opportunities for the Quelimane orphans, through the provision of training in ICTs and radio services. ICTs training sought to improve skills in computer usage (MS Word, Excel and PowerPoint, The Internet and social networks), while the radio course aimed at training people in radio journalism and production of radio programs. The actions were addressed primarily at the Quelimane orphans, for whom ICTs training was intended as a tool for facilitating their social recognition and integration.

The core concept for the actions took shape in two moments: during the above-mentioned workshop in Maputo with all involved CMCs' coordinators, and through a focus group in Quelimane with CMC staff, representatives of the social groups that would have benefitted from the actions, and representatives of the whole community. Two researchers in communication sciences specialized in ICT4D comprised the RE-ACT team, and were also present in both phases. The CMC staff included the CMC director, the telecentre responsible, two radio volunteers and the secretary. Three eldest boys and girls from Casa Esperança and Aldeia da Paz represented the underprivileged community benefiting from the improvement action. Housewives, teachers, business entrepreneurs, and government employees, randomly selected among regular CMC's users by CMC staff, represented the Quelimane community.

The Quelimane focus group session was held in the CMC, where the improvement actions were to take place. To ensure that the underprivileged communities participated actively, the RE-ACT team had to understand the orphan's reality, get immersed in their daily activities, and understand their constraints when dealing with stigmatization.

To ensure that the workshop would produce useful results, the RE-ACT team provided to participants an overview of ICTs and the CMC's capabilities to deliver information through the use of technologies. Members of the Quelimane community understood the main role that ICTs play on their activities, with a special focus on mobile phones and

computers. From the various interactions, it emerged that the community members see these devices as essential elements in their daily activities. The devices were used to alleviate stress by turning on the music, get informed by turning on the radio, and communicate with relatives through social networks and communication services like Facebook, Whatsapp, and Twitter.

The underprivileged youth merely related to the use of radio and showed curiosity about using mobile phones and computers to talk and make new friends using social networks like Facebook and Twitter. They also inquired about how the radio works on mobile devices and computers, as these features were not part of their reality. The knowledge about these technologies was everyday knowledge for most of the participants, but not for the orphans. Members of the community and the CMC staff perceived that they had taken for granted that those technologies were part of general, background knowledge, shared by everybody. Therefore, the decision was made that the most relevant service to be provided to these youth was ICTs training, inclusive of teaching on the potentialities of Internet and social networks.

It is indisputable that the rest of the community and the CMC staff had already entered the co-design process with an ideal perspective on what the improvement actions would be. The predefined idea of the improvement actions idealised by the CMC staff reverted around the provision of courses for ICTs training (MS Word, Excel, PowerPoint). During the focus group, this initial idea was shaped and advanced with attention to the needs of underprivileged youth, in order to increase their employability chances. In particular, the discussion focused on their needs for social recognition and improved social status. One practical result of this discussion was an expansion in the training content, with the addition of teaching content on the use of Internet and social networking, as well as three courses related to the radio: on radio journalism, production of radio programs, and multimedia technics for radio. These courses were to have as participants both the orphans and the rest of the young people, this last group paying a course fee. Part of the technological infrastructure, course materials and the training expenses for the orphans were financed by RE-ACT.

The workshop discussions also tackled the issue of different learning capabilities, as people rarely learn in the same way, but rather fashion learning around their pre-existing

attitudes and abilities. One practical outcome of the discussion was the decision to provide a computer to each orphanage, to enable the orphans to practice during and after attending the courses. Community members probed the idea of allowing the underprivileged youth to express the knowledge acquired during training in a radio program to lower the risk of forgetting what learned during the courses. They also insisted that the CMC had to be a venue where knowledge is applied to benefit both the privileged and the underprivileged ones. Co-design participants welcomed ideas; with the first idea implementation has to be first accepted by the National institute of social security (INAS), the entity that has the capability to oversee if these activities don't interfere with the youth ability to attend regular school, mentally and physically, socially or morally is not dangerous for the welfare of underprivileged youth.

For the project implementation, the RE-ACT team was assigned the task to prepare relevant educational material for the courses, and to acquire the technological infrastructure to harbour this initiative – computers, recorders, Wi-Fi routers, internet providers, etc. Although Quelimane has experienced a significant increase in quality of life and income, the costs for computers, printers, and other ICTs related materials were much higher compared to Maputo, the capital city of Mozambique. Therefore, the RE-ACT team, based in Maputo, was in charge of sending the technical material to the CMC. A collaboration with CAICC was fundamental in this phase, as the centre provided access to their postal channel to exchange documents and technical materials with the CMCs.

Young people participating in the improvement actions were selected among boys and girls who had completed the 8th grade (year) of formal education. The 8th grade in the Mozambican education system corresponds to the first year of secondary education in the European system. An exception was made for the orphans, whose reading and writing skills could be equal to or higher than an 8th-grade student, even if they did not complete it. These skills were acknowledged with a school declaration. As shown in Table 3, it was decided that the total number of orphans participating in the improvement action was to be 33 for the entire duration of the project. 15 had to be girls and 18 boys, from Aldeia da Paz and Casa Familia respectively.

Nr	Orphanage	Nr. Orphans	Age group	Gender
1	Aldeia da Paz	15	12-17	Girls

2	Casa Familia	18	13- 17	Boys
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Table 5-4 Beneficiaries of the improvement actions

5.1.15.3 Implementation and results

The ICT training was planned to spread on 18 months, from May 2012 to December 2013. The implementation was handled autonomously by the CMC, while the RE-ACT team provided remote assistance. During this time, the CMC staff drafted trimestral progress reports, sent through electronic email to the RE-ACT team. The first report was about the financial situation of the project, while the second was related to the implementation of the project and its associated constraints.

The implementation of the action deviated in several ways from the initial plan, yet the challenges found were met by the local implementation team with on-the-spot solutions, so that the project came to surpass the objectives it had set.

Initially, the CMC had concerns about the capacity to train the required number of underprivileged people requested by the RE-ACT team. Due to that concern, the CMC consulted the community and the RE-ACT team, and consequently decided to involve in the first batch only the youth from the two orphanages. The first group of people trained by the CMC were 14 youth from both the orphanages (6 girls and 8 boys). Their courses were held from the months of June to October.

The second group of the course did not include girls as the responsible for the girls orphanage considered that it was not an acceptable behaviour and example for the younger girls in the orphanage that elder girls left the orphanage in the morning only to return at the end of the day. This was a major setback but a promise was made that during the summer holidays (November to January) girls would be allowed to attend the courses again. Later on, the orphanage administration decided that the girls would not be attending the course, due to an event that occurred in one orphanage. One of the girls who were to participate in the improvement actions became pregnant, an event which entitled the orphanage administration to enforce restrictive measures upon the girls overseen by them. For the subsequent months, it was necessary to bring boys from external orphanages to “fill” the spaces left by the girls.

The content of the courses also evolved in relation to the ideas brought in by the trainees. The first people trained by the improvement actions in the CMC presented an idea of a novel radio program to the CMC management and RE-ACT team. This radio program was related to communication of childhood matters and later evolved to a more informative program about youth trends, famous personalities, music, and exchange of information about youth visions and challenges of coping up with independent living as a young adult.

The program was aired by the community radio every day from 9:00 AM to 10:00 AM at the beginning. After its evolution, the program started to be aired twice a week. The program started its first stage during the month of November 2012. Its second phase started in December 2012 and stopped airing in February 2013. Most young people from the Quelimane city, normally students of the 8th to 10th grade, welcomed this program. The radio program was evaluated as highly successful by its listeners, based on an assessment obtained through the phone interactions held during the radio program.

This radio program proved to be a venue for obtaining a better job for its leading star one of the youth underprivileged, who was invited by the Radio Paz of Quelimane to be part of their radio station, obtaining a fixed-term contract. This fact stimulated the rest of the group to work towards reaching the same or higher professional levels.

Overall, 79 students from both the orphans and the rest of the community were trained in the first year of the project, a number much higher than the initially planned number of trainees. Table 4 presents the distribution of people trained in ICT and radio courses.

Item	Non-orphans		Orphans	
	Female	Male	Female	Male
ICT Training & Radio Course	8	13	6	20
Only Radio Course	6	10	0	16
Total	79			

Table 5-5 Number of people trained in the Quelimane case

5.1.15.4 Discussion

This paper described a successful case of collaboration among an international project team, a CMC, and community beneficiaries, for the design and implementation of a small budget project to improve CMC's services. The improvement action performed in the

Quelimane CMC can be considered a success not because of its alignment with initial goals, but because of the manner in which activities and goals were constantly revised by the teams to cope with emerging challenges, while at the same time keeping a clear orientation towards set targets. The project succeeded in delivering training on ICTs and radio for both underprivileged and non-underprivileged youth in Quelimane. Yet, in many ways, the training deviated from the initial plan. For instance, the girls in the orphanages could not attend the courses due to restrictive measures set by the orphanage administration. Some significant and unexpected results were achieved, that in many ways exceeded the initially expected outcomes. Overall, the project trained more youth than initially planned. Also, one of the notable results was that the ICTs and radio training provided a foundation for the creation of a successful radio program that targets the youth community of Quelimane.

The case of the Quelimane CMC proved to be more successful than the other ones included in the project RE-ACT. The analysis of the underlying factors for the success of the co-designed improvement actions indicated that the most important ones revert around five aspects:

1. commitment of the local implementation team;
2. proactivity and local initiative;
3. alignment between stakeholders' competences and tasks in the project;
4. high perceived self-efficacy of local stakeholders;
5. equalitarian relationship among stakeholders.

In this project, enabling the participation of all stakeholders from the design stage of the improvement action, and entrusting the local team with full power over implementation, helped to achieve intended goals. The accent fell, thereof, on the collaborative design of the actions, towards opening local agency for the implementation phase. This flexible approach to action research design is not novel. There have been similar approaches in which action research was customized for the needs of the context and the project goals, complemented with other methodologies or boosting the levels of local participation either towards the design or the implementation stages of the project development (e.g.: Ospina et al., 2004; Spinuzzi, 2005; Bowen, 2009).

First, the improvement action in this CMC was successful because the people managing the CMC were committed to the project, and held high the cause of improving the life of the underprivileged youth. This commitment was especially evident for the CMC managing nun, who was in charge with overseeing the adequate implementation of the courses. The resource management was impeccable, and attention was paid to keeping the staff working on the project motivated with resources acquired from the community course fees on a pro rata basis.

Second, the local stakeholders – both the CMC staff and the communities’ representatives involved – demonstrated proactivity in the implementation of the project, devising new approaches and steps to meet the encountered challenges. The project activities were always adapted to conditions, making the best of what was available or feasible. Actions not planned in the initial phase were also conceived. For instance, a computer was installed in the orphanages, to allow youth to practice their newly acquired skills. This and other examples of local initiative reflect the demonstrated commitment of the local implementation team. Proactivity in the project implementation can be related to the fact that the local implementation team felt they owned the project; it was as much their project as it was one set up through an international joint venture.

Third, such high level of proactivity was possible due to an adequate match between the stakeholders’ expertise and assigned roles, tasks, and responsibilities in the project. The RE-ACT team gave advice on the best technological deals and oversaw the design of the courses. The project implementation was entirely managed by the local CMC staff, with inputs in relevant points from the beneficiaries and the RE-ACT team. The inclusion of individuals from the community skilled in project planning and management, proved to be a line of support for the CMC management. This distributed expertise ensured an optimal investment of available resources. ICT4D projects created in the early stages of ICT4D didn’t had a business plan that oversees the generation of sufficient resources like information, exchange of ideas and partnership to ensure continuous access to ICTs at an affordable cost. This aspect was not given sufficient attention in many community-based initiatives (Roman and Colle, 2002, 2003; Harris, 1999; Harris et al., 2003) and the Quelimane CMCs are not an exception. In the case of the Quelimane CMC action, having

a skilled implementation team was also instrumental to efficient and wise management of the resources.

The effectiveness of this distributed expertise and the high level of local initiative can be related to a fourth aspect, regarding the level of trust held by the local stakeholders in their capacity to carry over the project tasks to completion in a satisfactory way. This self-trust is well captured by Albert Bandura's (1998) concept of 'self-efficacy', referring to "beliefs in one's capabilities to organize and execute the courses of action required to produce given levels of attainment" (Bandura, 1998: 52). Bandura also argues that people are more driven to action when they perceive that their action is likely to bring along the desired effects (Bandura, 1998). In this case, given that the stakeholders covered action areas aligned with their expertise, they were equally confident they could carry out the tasks well and motivated to invest the needed effort to bring them to completion.

Fifth, the relationship between stakeholders, which was characterized by equalitarian inputs in decision-making, inclusiveness and mutual trust. During the co-design phase, no member had the upper hand, rather inputs from all stakeholders were weighed and considered on an equalitarian basis. Local stakeholders demonstrated critical thinking in the way contributions from the RE-ACT team were discussed and negotiated. The local members of the staff would not act as to please the RE-ACT team members. For instance, while the RE-ACT team proposed a large number of trainees initially as a target, the CMC staff negotiated the number regarding local human resources and infrastructural capacity. Also, the CMC management and the community representatives have understood the potentialities of international collaborations, and a trusting relationship was built during the entire process between the CMC and the RE-ACT team. This proved to be vital for effective communication and joint work, and for putting on the table problems and concerns as they were. This high level of trust did not lower the agency of the local implementation team by assigning a higher workload for the RE-ACT team. Rather, in many instances, the RE-ACT team acted as advisor for actions managed by the local team autonomously.

An approach to contextual Co-design: The Chitima Valley case

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Preface

This paper introduces the concept of using co-design as a method to produce sustainable course for teachers in a rural underserved area of Mozambique. The case study addresses RQ3 (see section 6, table 6-2), by creating conditions by showing how people with low knowledge of design practices collaboratively design an improvement action aimed at improving the conditions of the education sector. The case analyses the challenges that hinder the practical implementation of ICT4E in rural Mozambique, and brings forward the notion of adding non-education experts, supported by education experts to co-design education packages.

Abstract: Mozambique, since 2009 introduced ICT for Education for the 8th to the 12th grade students. Several challenges hinder the practical implementation of ICT4E, has been noted, in ICT4D one can oftentimes find a design-reality gap, which hinders – or even stops – intended positive effects to become reality. This paper explores the co-design process of so called “improvement actions”, a contextual participatory approach that provides understanding and accentuates how people experiences artifacts, interfaces, systems, and spaces is applied to support the use of ICT4E in the town of Chitima valley. It also focuses on the activities, steps taken by different actors to create a shared artifact to mitigate a community issue.

5.1.15.5 Introduction

Information and Communication Technologies (ICT) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer, network hardware and software (Kleine & Unwin, 2009). Donors to projects in developing countries, attracted by the combination of hype and hope generated by ICT, have altered the funding priorities and pushed ICT up the development agenda; The idea of ICT leading to closing up distances, creating a level playing field and permitting leapfrogging to an information economy, began to materialize (Heeks, 2002b). There is an assumption, in this, that developing regions can be part of today's knowledge society, which, however, implies recognizing the importance of developing regions cultural heritage as a fundamental background of a community identity and patrimony (Morley et al., 2002; Vecco, 2010). ICTs can provide added value to cultural heritage pedagogy, education and learning (Ott & Pozzi, 2011). ICTs can also be used to address the high school drop-out rates experienced in sub-Saharan Africa (Mulkeen & others, 2007), as ICT in education encourages learners-centered, inquiry based and collaborative learning approaches (Kozma, 2008).

Mozambique is a sub-Saharan nation, rich in cultural heritage, with several ethnic groups (Shangaan, Makonde, Chokwe, Cena, Indians and Makua), where cultures and traditions of Bantu, Swahili, Indian and Europeans co-exist.

Mozambique, since 2009, with the support from donors and international development agencies, has engaged in introducing ICT for Education (ICT4E) for 8th to the 12th grade students (Muianga et al., 2013). However, by analyzing the present situation of ICT4E projects, and in particular in districts and administrative posts of rural Mozambique, we grasped that ICT4E is provided only in theory and focuses on education for ICT instead of using ICT to support education (Muianga et al., 2013). Several challenges hinder the practical implementation of ICT4E in rural Mozambique, as, for example, the cost of infrastructure, maintenance, availability and stability of electricity, learning frameworks, and socio-cultural resistances (Kouwenhoven, 2003).

In most cases, three ICT actors exist where schools are established: the School itself, the Community (Council), and Community Multimedia Centres (CMC). These three actors don't interact to address education problems and acquire socially sustainable solutions

(Groenendijk et al., 2008). CMCs are structures combining a community radio and a telecentre (Rega et al., 2013). In the Mozambican context, community radio broadcast in local languages, with coverage not higher than 100 Km, and the telecentre provides ICT training encompassing but not restricted to Microsoft word, excel and power point (David et al., 2013).

The present paper looks at the provision of ICT4E in Mozambique, specifically the Chitima Valley, a rural region in the Tete province, with the primary aim of answering the following research questions:

RQ1- Can non-education experts, supported by teachers, co-design an ICT4E sustainable course for teachers in a rural underserved area of Mozambique?

RQ2- Can teachers in a rural underserved area of Mozambique adopt innovative teaching and learning methods through ICT4E?

This paper explores the co-design process of so called “improvement actions”, a contextual participatory approach that provides understanding and accentuates how people experiences artifacts, interfaces, systems, and spaces is applied to support the use of ICT4E in the town of Chitima valley. It also focuses on the activities, steps taken by different actors to create a shared artifact to mitigate a community issue.

5.1.15.6 Rural Mozambique ICT

As innovation often spurs out of constraints, emerging areas offer a fertile playing field for novel services to be developed. Both illiteracy and ICT illiteracy are common in emerging regions, which restrict the potential numbers of ICT users. Mozambique has ventured to introduce telecentres, community radios, and ICT Schools: Telecentre were hailed as the 90s panacea for digital divide and later recognized as the highest ICT program implemented in Mozambique with a partial failure. The failure of this projects is interconnected to stakeholder's expectations, inadequate management training, and sustainability issues. People entrusted with the administration of the Telecentre were not trained in how information can contribute to development, instead Telecentre managers know most about computers but do not know how to link Telecentre potential to community pressing concerns such as health and education (Salomão David & Cantoni, 2015).

Community radios, on the other hand, provided a platform for sharing ideas tips and explore techniques to improve social and economic well being to communities living in inaccessible areas. The programs broadcasted by community radios are designed for all social groups within a community; the principal languages used are local languages. These conditions associated with the price of the radio receivers proved sufficient for community adoption and use of the radio services. While the Telecentre is a location that provides services to people who are literate, with the capability to generate information or consume externally-generated information often in a different language than the spoken by the community (Grieco et al., 2008).

Since 2004, Mozambique joined the scale-up project which consists of merging Telecentres with community radios, creating a new public access venue known as CMCs promoted by UNESCO (Moiana et al., 2007).

Since 2012, a new model of CMCs, mainly based on the technical and spatial characteristic, has been developed and started to be implemented. According to the Minister of Science and Technology (MCT), since 2013 to 2015, 20 CMCs have been installed in rural Mozambique with the final goal of this policy provide access to ICT to all the districts of the country in the following years.

UNESCO is still supporting the “old” CMCs by donating some technological material (computers, printers, etc.): Presently Mozambique has to 58 CMC, situated in all the provinces of the country.

Rural ICT schools in Mozambique are mainly classrooms created in Mozambique to provide ICT training to Students from the 8th to 12 grade. They face context-specific challenges in addition to those commonly experienced in school. Currently, there isn't research information about the impact of ICT schools. The ICT schools mandate is to support the education system by substantial solve disadvantage education problems in rural communities closing the gap on ICT for education.

5.1.15.7 Setting the stage: The Chitima CMC

In this section, we describe the Chitima Valley and its CMC. The CMC of Chitima is located in the Tete province, on the Cahora Bassa district; the Cahora Bassa district host Africa's fourth-largest artificial lake and the largest dam and producer of electricity in

Sub-Saharan Africa, the Hydroelectric of Cahora Bassa (HCB). The district has a population of approximately 86,641 (“Demographics of Mozambique,” 2014) the district primary economic activities is the production of electricity, fishing, agriculture, and commerce.

The community of Chitima has heterogeneous characteristics diverging from the region interior; the district harbors doesn't only harbors locals it is also home for people from Zimbabwe (Bindura) and Malawi (Nyimba).

The Chitima CMC will be described using the Web Communication Model (WCM) (Cantoni & Tardini, 2010). The WCM model builds mainly on four essential elements two of them deal with “things” (a and b) while the other two are concerned with “people” (c and d).

Contents and services offered by the CMC;

Technological tools address the technical infrastructure (hardware and software);

People describe the group of individuals who manages and provides services using a specific technical apparatus;

Users are the pillar that focuses attention on the panel of people or social structure that uses an individual artifact;

The Chitima CMC provides Community radio services that work from morning to night, with intervals of 2 hours, it broadcasts in Portuguese and Ndongue; radio coverage covers only the Chitima valley, during the radios intervals photocopy service are provided. CMC provides clean water for the community.

The technological infrastructure present in the CMC is comprised of 4 computers which were donated by UNESCO but were not used effectively due, to electricity oscillation.

The people who are responsible for managing the CMC are members of the local association Timula Chi Tukuma. They are a staff of 8 volunteers, from which 4 of them are teachers at the Escola Secundária do Vale de Chitima. And the remaining four people work at the radio station and helping the community acquire clean water at the CMC premises.

The Chitima CMC is falling to attain social and financial sustainability, the number of people visiting the CMC has drastically reduced, needless to say that the services provided are not used by the local community.

In this project we gave the possibility to the CMC of Chitima to implement an “improvement action”, a project co-designed to create services with inherent value for local communities (Rega et al., 2011b). The selected improvement action by the CMC of Chitima was to provide training in ICT to teachers to enable them to use ICT in classrooms.

The Escola Secundaria de Chitima is equipped with 42 computers with each ICT class having 40 students. The ICT course is given by one teacher; the class is supposed to take 90 minutes, from which 30 minutes are used for theory and the remaining 60 are used for practices.

The schools did not share resources neither with the local communities nor with the CMC. With this project, we tried to merge CMC people in training with the ICT schools aiming to create a shared sustainable education approach. Our approach consisted in letting teachers acquire training on ICT in the CMC and, later on, training students at the School in a better and efficient manner. As not always students can use computers from the schools for learning and perform homework, it was expected that they used the CMC.

5.1.15.8 Co-design and ICT4E

The world has evolved to a magnitude where ICTs are a central aspect of today's globalized world. The last decade saw a huge diffusion of ICTs projects in the world, with education acting as a primary mean for the promotion of ICTs within developing communities (Fuchs & Horak, 2008).

This transfer and diffusion approach, associated with the tenets of conventional development, based on the premise that developing countries can be propelled to development path by knowledge and innovations emanating from developed nations (Avgerou, 2008). The design of technological change was therefore entirely conceived by experts in advanced countries and transferred to developing regions. The evaluation of projects fueled by this vision revealed that the transfer of innovation with no attention to local factors incurred a high risk of failure (Avgerou, 2008). In this paradigm, user participation in the design process is considered an essential element of creating technology that has relevance and sustainable use in a particular socio-cultural context.

The last decade saw researchers and designers moving increasingly close to users of what they design especially in the developing context in areas such as education (Elizabeth B-N Sanders, 2003). Sanders and Stappers (2008), define co-design as:

“to the creativity of designers and people not trained in design working together in the design development process.”

Co-design follows a similar path of participatory design, although it is seen as an evolutionary approach to technology design for socio-economic development. The approaches to co-design will be a close collaboration between all stakeholders involved in the design process, with a variety of professionals from different backgrounds, perceptions, ideas and knowledge having culture as the primary asset for communication. Nevertheless, attention has to be placed on barriers and enablers to the creation of shared understanding during a co-design session. Kleinsmann and Valkenburg (2008) distinguished three interfaces to be taken into account during design: organization, actor, and project. The three interfaces deal with different barriers and enablers, meaning that effectiveness in creating shared understanding does not only depend on face-to-face communication, but also on project management and project organization (Kleinsmann & Valkenburg, 2008).

Previous research (Aktaruzzaman et al., 2011; Kozma, 2008; Younie, 2006) on ICT policy implementation and reform in the education sector have shown that change is either very slow or tends to fail because management, funding, technology, ICT training and impact on pedagogy tend to be a complicated procedure to be assimilated by implementers (Younie, 2006). ICT needs to be implemented on multiple fronts, both materially - concerning ICT infrastructures - and culturally - generating attitudes that value ICT4E. Hence, the process of applying ICT4E in developing regions is clearly a complex process, requiring an extended collaboration with different community actors down to teachers and students at the micro level.

5.1.15.9 Methodology

During the improvement action co-design, participants included researchers, CMC staff, local community members (stay-at-home moms, students, government officers, local businessperson and the HCB ICT staff) with different contexts, age groups, media uses

and capabilities, but with same cultural values. In our view, this design partnership should seek to solve problems, but also try to identify problems worth being solved by empowering the community to express their point of view and discover the solutions for the education system in place.

We employed co-design (Sanders, 2003) because it emphasizes the direct and active participation of all stakeholders; being an ongoing design perspective, co-design can change according to design intervenient perspectives and perception. Co-design can harness the collective infinitely expanding a set of ideas and opportunities that emerge when all people who have a stake in the process are invited to interact (Sanders, 1999). The approach here adopted has four stages (Sanders & Stappers, 2008), each stage being applied independently with specific objectives.

- The say and think phase spurs dialogue;
- The do and use a common ground on the co-design solution;
- The know, feel, and dream is used to evaluate expectations, align the design artifact with the intervenient desire;
- The make phase, where the object is being used as a service or application.

5.1.15.10 Contextualizing: - say and think

We propose persona's, scenarios and focus groups as supportive tools to capture the user's goals and integrate them into the service to be created with users becoming co-creators.

As tools for interaction, we have used the traditional community gathering scenario, a component that enables people interaction (Marcus, 2011). To allow people to express their opinions, and secondly to freely propose new alternatives and concepts. As the primary interest during the co-design process is to understand the relationship between teachers and technology provided by the CMC, we are also concerned with the kinds of relationship people are interested in having with technologies. In this situation, this means concentrating on allowing intervenient to understand or find connections and identifying relevant applications or services that can be created using the resources available.

We focus on how contextualizing the dialogue, understanding the intervenient role in the community, spur discussion about random issues, culture, health, education and general knowledge. The community as users knows best their context, contextualized and non-

contextualized dialogue provokes community members to collaborate, build possible scenarios and perspectives for social problems.

5.1.15.11 Application: - do and use

Researchers conducted interviews and used community methods like participatory observation and focus group sessions to gain a consensus within the social group about what had to be created as an improvement action and identify community members with sufficient will and power to establish and hold a base for the operation and management of the improvement actions. Sessions were audio recorded and analyzed. During this phase we try to gather evidence to answer to RQ1, to find plausible condiments that could prove that non-experts in education can effectively and efficiently co-design an ICT4E course for teachers. In general, the approach was used to bring forward a strategic design space where technology is seen as non-evasive for faculty and community. The idea was to absorb the idea of using ICT often in ICT rooms instead of the blackboard and the high quantity of notes that the students were given.

Parents requested teachers to turn often the computers during the ICT course instead of using hypothetical examples for word, and excel, which some students are well familiarized. Teachers requested additional material, training, and capacity building to become technology experts responsible for providing better ICT classes.

5.1.15.12 Expectations: - Know, feel, and dream

This stage of co-design allows cultural variations and dynamics to emerge following an honest approach to participatory design (PD). The socio-cultural habits guide the interaction, thus, conflicts related to power relations or cultural-specific issues arise between the participant who publicly and openly express their opinion on a particular issue. This seemed to be a contra productive approach, but we soon understood that who best knows the context, is the local community, the community should strive to find and create the better conditions to builds the learning material with the support of their cultural objects, stories, and local examples.

To provide teachers with the best and updated ICT training, the CMC would invite each trimester during the extent of the improvement action the HCB ICT staff to train teachers

in ICT, assist the CMC on computers maintenance and evaluate students progress. The researchers were responsible for providing computer parts, projectors and didactic material. While the CMC staff was in charge of managing the CMC and creating physical conditions for the use of computers. The community was responsible for inquiry students about the ICT courses and allow students to spare some of their free time to visit the CMC for ICT practical classes.

This process aimed at generating a social change approach based on the idea of social empowerment of citizens within the community allowing them to participated in the reform movement. This process endorsed the community to change cultural attitudes when it comes to how ICT viewed with the focus being on an internal change aimed to create better ICT education. Teachers were eager to participate actively and acquire better training capable of allowing them to become experts in technology. Transparency on ideas, concepts and enthusiasm are the outcome of emphasizing the creation of learning outcome focused on cultural impressions.

5.1.15.13 Connecting people: - Make

This stage resulted in a service to be used by teachers; the service comprised two phases, the first step teachers were to receive training in ICT from the HCB ICT staff. Teachers had also to create and acquire material for ICT classes on the Internet, provided by the local Internet Service Provider (ISP), who did set up an internet connection to the CMC. The second stage the teachers had to offer assignments to students using ICT in which the students were entitled to use the CMC computers to solve the problems.

Initially, the participants of the improvement actions were to be only teachers. During the make phase, it was decided that the students had to be also part of the project whit them acting as evaluators' of the teacher's capabilities. Pupils in the 8th, 9th, and 10th grade were to be the ones participating in the project. The CMC was responsible for using the acquired resources to increase the number of computers and earn revenues to pay for the electricity bill by selling internet connection during the evenings. To evaluate the development of the improvement action, teachers were requested to categorize their ICT operational skills in operating system management, word, excel, power point and the internet (social media). The scale used for the evaluation is the Likert scale ranging from

‘not at all’ to ‘a lot’, we cross check the notes from the people who provided the training to teachers.

Figure 1 demonstrated the approach phases used to design the improvement action in the Chitima valley.

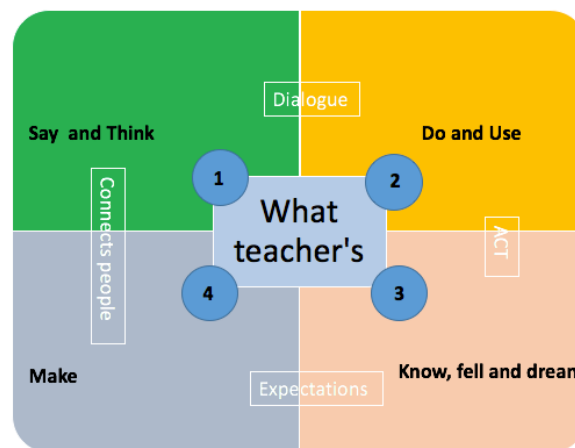


Figure 4 – co-design approach

5.1.15.14 Results

In this section, findings will be presented related to the ICT infrastructure, teacher’s, student’s, community participation in the improvement action. The section will also present the impact the community working as designers, their usage of ICT4E and learning effects.

a) Teachers, students and infrastructure

The approach adopted to train teachers at the Chitima CMC in ICT4E was a contextualized reform triggered by the local consensus around the urgent need for more ICT knowledge and effective ICT education for students. The approach had as unexpected outcomes:

1. Reform on the secondary school curriculum;
2. Increase pedagogical resources;
3. Students collaborating in volunteer activities; and
4. Professional development of teachers.

The teachers training program resulted in positive attitudes towards ICT, allowing teachers efficiency in creating maps, control features for students grades and prepare their classes more efficiently and effectively.

Internet exercises developed by teachers allowed students to find other learning methods and technics to learn mathematics and physics with illustrative examples. Broadband enabled better collaboration between teachers from the Chitima Valley and Songo District. The educational activities related to ICT classes increased instead of a regular papers teachers came with new questions and exercises, a beneficial activity for students who felt challenged.

Although the broadband provided was a low connectivity (512kbs) that was not an inhibition factor for students to practice and browse for information at the CMC.

Students with doubts relied on the CMC staff to support them after the class and help with homework related to ICT or other subjects.

Best ICT students from the school, help the CMC working as volunteers, editing the CMC newspaper, and typing documents for the local community.

The professional development of teachers is not only related to participating on the training activities and putting in practice the learned activities. It is also related to renounce to free time and not claim training hours as working time. Teachers have also accepted to have on the job training, classes supervised by the local community with no prior arrangement, this openness tightened the collaboration between teacher and the local community.

The CMC computers became twelve; nevertheless, it was still not possible to all students at the CMC to be able to practice what they learned in the ICT classroom. Mobile phones were the second source used by pupils in the CMC premises to acquire information on search engines such as Google, Bing, and Yahoo using the CMC Wi-Fi.

b) Non-education experts training faculty

Teachers involvement in ICT training courses was adequate; teachers were trained by the HCB ICT team as pro bono public activity. Teachers were trained in Microsoft Windows 7, Word, Excel, and PowerPoint. Teachers were also trained in basic computer science, the Internet, social media and pedagogical use of these skills. Teachers reported developing computer skills and a refreshment on educational skills to teach ICT. Teachers

practiced at the CMC to sharpen their newly acquired skills, they additionally reported using the internet to learn and prepare lessons using PowerPoint. Teachers used the internet also to share material with other district teachers. Teachers were trained by non-education experts about a technological artifact that is from their domain. The HCB ICT staff provided the training bringing for each session an expert, providing at each stage the best available technician. During training sessions teachers shared knowledge with the staff about academic teaching techniques, and added value for the HCB staff team, who were interested in sharing expertise on the teaching techniques.

c) Faculty and students use of ICT for Education

Pupils and educators have used ICT4E and performed ICT-based activities both in school and at the CMC. Teachers reported that students can use ICT responsibly, meaning not engaging on the usage of the internet mostly for social networks, but to search efficiently for material related to assignments. The English reading level increased during the past 18 years, with pronunciation skills becoming the most problematic issue in the English class. The English class became a more informal process of learning as students tended to ask more about how to read and spell words seen on the news and information acquired on the internet.

Students who were assigned a teacher with high skills in their digital skills have more assignments related to ICT than the teachers who are less comfortable. Teachers are very comfortable in using PowerPoint presentations to illustrate concepts and pass information to students, while social networks are the handicap.

When questioned about the desire for more training, most of the teachers reported that basic computer science is fundamental to understand the confusing names of the computer parts and the numerals widely used by computer systems.

d) ICT learning effects

Teachers reported that ICT training had a powerful and motivational impact on learning outcomes, improving the writing skills of students, enabling them to present work in a neat and professional way. The type of ICT that pupils found particularly interesting was The Internet (45%), followed by PowerPoint (18%), Word (15%), Excel (9%),

Microsoft Windows (5%) and basic computer science (3%). There is 5% of students that didn't show evidence of using ICT for learning instead showed interest in social media.

5.1.15.15 Conclusion

In conclusion, the study aimed at answering to two research questions:

RQ1- Can non-education experts have supported by teachers co-design an ICT4E sustainable course for teachers in a rural underserved area of Mozambique?

RQ2- Can teachers in a rural underserved area of Mozambique adopt innovative teaching and learning methods through ICT4E?

To answer the questions we have adopted co-design, an approach that can harness the collective infinitely expanding a set of ideas and opportunities that emerge when all people who have a stake in the process are invited to interact (Sanders, 1999). Were all participants interventions are taken in consideration allowing them to express and interpret ideas and feelings that are often difficult to express in words (Sanders, 2003). Four steps were used during the co-design process (Sanders & Stappers, 2008), each stage being applied independently: [say and think]¹, [do and use]², [know, feel, and dream]³ and is [make]⁴, with the community using local capacities and knowledge to support the implementation of an improvement action to improve ICT skills of teachers to latter provide ICT training to students of the local secondary school.

This action itself answers to RQ1; it proves that provided the correct framework and understanding of what is hindering the proper provision of ICT4E and technology acceptance, communities can actively co-design to achieve an effective educational system and implement essential activities to create knowledge societies.

Local communities can co-design artifacts out of their domain of expertise if given space to dialogue openly about social constraints. Modern technology offers many means to improve teaching and learning in the classroom; ICT has the potential to support education across the curriculum and provide opportunities for effective communication between teachers and students in ways that have not been possible before (Kozma, 2008). Many educational systems worldwide are putting much work in the assimilation of ICT in schools, this process brings changes on the learning configurations taking institutions from the traditional education space to cyberspace education (Mioduser, Nachmias et al.,

2003). The teacher's familiarity with Microsoft Word, Excel, PowerPoint created favorable conditions for schools using ICT4E, bringing forward new school routine due to the assimilation of ICT in education. This process answers to RQ2. And it is corroborated by the local develop of educational content inventing exploration and appropriation of more advanced local resources being examples tutorial, slides using community content. This action promotes the emergence of new roles and approach on education.

A challenging aspect of building technology infrastructures in community informatics is that community groups have a tendency to treat the need for new creative solutions when there exists specific concern (Carroll & Rosson, 2007).

Co-Design of eTourism Application. The Case of Ilha de Mozambique

David, S., & Cantoni, L. (2015). Co-design of eTourism Application. The Case of Ilha de Mozambique. *Tourism and Co-Creation*. In e-Review of Tourism Research (eRTR).

Preface

This paper introduces the concept of using co-design as a method to produce conditions to create a sustainable ICT solution that enhances conditions for promotion of a world heritage site and local communities' business. The ICT solution acts main vehicles to create, host local content, information in formats usable in the web, and is also capable of providing to communities' conditions to use and learn ICT. Hence communities living the world heritage site of the Island of Mozambique find can acquire financial benefits and maintain a sustainable solution. The paper addresses research question RQ1 and RQ4. The small budget provided for this improvement action creates favourable conditions for the community of the Ilha de Moçambique to rip benefits from the tourism industry.

Abstract: As it has been noted, in international development one can oftentimes find a design-reality gap, which hinders – or even stops – intended positive effects to become reality. Among other reasons, a top-down approach, which tries to implement solutions designed and tested elsewhere, could be listed. To remove, or at least reduce this possible negative element, co-designing interventions have been proposed, in order to ensure a better understanding of local problems, culture, priorities, and requirements, as well as to promote wider adoption of developed solutions. The paper presents the case of co-designing an intervention in Ilha de Mozambique, a property enlisted among UNESCO cultural World Heritage. Involved parties have been the local Community Multimedia Centre, which

combines a community radio with a telecentre, and the association of micro tourism enterprises (mainly B&B). The designed intervention, as well as the design process and the development of the designed artefact – a simple online portal that features the Ilha, and the concerned micro-businesses – are presented and discussed.

Keywords: co-design; community; community multimedia centres;

5.1.16 Introduction

Mozambique has been a tourism destination in sub-Saharan Africa since the early 1990s, when the country witnessed the signature of the Roma agreement, a peace covenant that placed an end to a bloody civil war (1976-1992). During this period Mozambique also witnessed the introduction of information and communication technologies (ICT), especially the internet, computers and community radios (Rega et al., 2011a). The diffusion of ICT was propelled by the appearance of non-governmental organizations (NGOs) and the creation of the Centre of Informatics at the University Eduardo Mondlane (CIUEM), these duet perceived that ICT could help to climb out of poverty, produce constructive citizens, support science, and alleviate the literacy crisis.

The unification of Community radios and telecentres in Mozambique gave birth to Community Multimedia Centre (CMCs). In the Mozambican context Community radio is a radio that broadcasts in local languages, with coverage not higher than 100 Km. The telecentre part covers ICT training in word, excel and power point.

The CMCs have been the main vehicles to create local content, information in formats usable in the rural areas, they have the capability to provide to communities conditions to use and learn ICT (Churchill et al., 2004). Within a short period of their implementation in the rural Mozambique the CMCs became relevant sources to provide services almost exclusive to the urban domain. Nonetheless, little or almost no research has been conducted in Mozambique about the potentialities and contribution of ICT in the field of tourism.

The Mozambican government recognizes tourism as an instrument for local economic development, capable of affecting job growth and leading a number of positive long-term

consequences ranging from lower unemployment, higher labour force participation, to increase real estate value (Bartik, 1991).

This paper takes a central premise the discourses about local communities reaping benefits of tourism; hence the aim is at answering two research questions:

- RQ1: *can co-design be applied with small communities to develop eTourism solutions in an emerging economy?*
- RQ2: *what is the impact of eTourism solution co-designed by a local community?*

5.1.17 Literature review

Developments in ICT have changed both the tourism industry and its strategies, as now destinations have to compete at national and international level (Crouch & Ritchie, 1999). The destination management authorities (i.e., tourism offices, airline regulators, Municipalities, etc.) create financial conditions for the development of several platforms that range from websites to mobile apps, to CRS where organizations within the destination can provide information to travellers, enriching the destination information (Buhalis, 2003).

The United Nations World Tourism Organisation (UNWTO) in 1993 strongly emphasized that “*tourism should be a sustainable activity*”. Sustainability is a paradigm of tourism management strategies that seek to avoid short term exploitative practices in favour of long-term solutions that maintain and enhance the economic, environmental, social and cultural practices of a destination (D. R. Hall & Kirkpatrick, 2005). The United Nations Educational, Scientific and Cultural Organization (UNESCO) have been committed to conserve, protect and present worldwide values of our culture. The UNESCO World Heritage and Sustainable Tourism Programme in recent years has taken a new approach based on dialogue and stakeholder cooperation (UNESCO, 2010). This approach wishes to reduce the gap between local communities and tourism stakeholders, and to create awareness on the concerned value in order to better preserve it.

Co-design comes as a complementary conception of artefacts drawn on shared vision, social learning and mutual understanding, taking into account that all involved in the design process have different perspectives and expectations, which should be taken into account. Co-design activities can be analysed according to five distinct stages: social

needs, social changes, formulation, implementation, and review (David et al., 2013). *The social need* stage is the process that provides conditions to create a convivial situation, where conceptualization of community needs takes place, and aims at creating a link between stakeholders. In this particular case evaluation of technological infrastructure was conducted to verify the local partner conditions to implement the improvement action. *The social change* stage creates conditions to estimate the implications of the co-designed action and to identify key beneficiaries. *The formulation* stage drafts the artefact (Curtis et al., 1988), which should be socially and financially sustainable for all stakeholders, especially for the tourism entrepreneurs and CMC of the Ilha de Mozambique. *The implementation* stage produces an artefact created on a shared vision, providing conditions to guarantee empowerment and community participation. *The review* stage allows intervention to visualize the solution and perform changes.

5.1.18 The Methodology

In the northern region of Mozambique, between the Mozambique Channel and the Mossuril bay, there is a small island with 3 km length and 500 meters' width named the Ilha de Mozambique.

The co-design action in the Ilha de Mozambique consisted in creating a "convivial tool". A convivial tool is a solution that allows communities to invest their time to enrich the environment with the fruits of their visions and to use them to accomplish a purpose they have chosen (Elizabeth B.-N. Sanders, 2006). The selected tool in this case is a website to promote the island at the national and international level and to invest time in collecting information about its social, cultural, and touristic values.

The intervention on this improvement action were the local CMC director and two collaborators. Bed and Breakfast (B&B) owners, teachers, local government entities, housewives, and local business entrepreneurs, represented the community. Two PhD Students with computer science and humanities background formed the academic team. Two workshop sessions were devised in the Ilha de Mozambique to inspire, create, adapt, and plan the steps forward. During the first session held at the Ilha de Moçambique CMC, the CMC coordinator presented the main idea of the project, which was well received and supported by the local community.

Roles within the project were defined: the academic team was requested to produce a template for the website and to oversee the introduction of information on the platform. It was also requested that the academic team provide expertise and support to the CMC by phone and Internet. Such convivial interactions produced the website (www.ilhademocambique.org), which was well received by the community, whose maintenance was entrusted to the CMC and overseen by the community and the academic team.

The data for this study was collected using: (1) participant observation and field notes about the co-design process, (2) Google analytics to collect usages of the co-designed website, and (3) a survey to collect information about actual tourists. Field notes and participant observation were used to answer RQ1, while questionnaires and web analytics data were used to answer RQ2. Questionnaires were distributed through the B&B throughout a year period starting from September 2013 until September 2014; resulting in 28 usable responses from seven different nationalities – Mozambique, Brazil, China, Portugal, Italy, South Africa, and Argentina.

5.1.19 Findings

The co-design process to promote the island of Mozambique answered positively to RQ1, attesting that co-design can be used with small communities in an emerging economy to produce a eTourism solution, RQ2 was still to be answered.

Website visitors vs. travellers' origin: From September 2013 to September 2014, the website received a total of 710 visits; Visitors tend to access on average 2.03 pages and stay on average for 2.08 minutes. Website visitors are mostly from Mozambique, Brazil, Portugal, United States, Switzerland, Germany, Netherlands, Italy, Kenya, South Africa and the United Kingdom.

Information about the travellers who visited the B&B has been collected through a questionnaire distributed in two B&Bs: Casa Yasmin and Residencial Kero, provided a total of 28 questionnaires (16 and 12 respectively). Respondents were mainly from Mozambique with 8 travellers, followed by Brazil, China, and Portugal with 4 travellers each. South Africa had 4 respondents, trailed by Belgium and Italy with 2 respondents each.

Most respondents visiting the island of Mozambique are 25 to 34 years old 13 travellers; followed by 11 travellers within 25 to 34 years. The number of travellers decreases drastically within the 45 to 54-year-old segment, where the number of travellers is 4.

From the 28 respondents, 6 travellers responded that they acquired information from the Ilha de Mozambique website, which means that 21% of them used the co-designed website to prepare their travel. Furthermore, 4 travellers responded that they acquired information from lonely planet, and 4 acquired detailed information from the country's travel agency Sun Star International Travel Service (SSITS). Word of mouth is also presented as source of information about the B&B, which was mentioned by 4 travellers, and 3 travellers did not disclose the source of information. The remaining 7 travellers provided search engines such as Google, Bing and Yahoo as source of information.

5.1.20 Conclusion

This case study explored the implications of a co-design approach aiming at creating a community e-tourism solution in a developing economy. Based on the study results, the B&B received financial benefits from providing information about their services. The successful factor in this study is the number of users the website received in one year.

The limits for local community participation in tourism development process in developing countries have been the source of research and discussion (Tosun, 2000). In this paper, an approach towards mitigating the problem is provided. Local communities are empowered to promote destinations and within the process gain financial benefits. In this study, the B&B hosted 21% of the travellers who were referred by the CMC website. Responses to the questionnaire reflect the diversity of travellers, but it was an unequal distribution when compared to the website visitors. The questionnaire results also provide an indication that travellers from emerging economies tend to acquire information about destinations by word of mouth or travel agencies (Litvin et al., 2008).

Destination product portfolios present tangible, intangible goods and services. Normally, deciding a marketing strategy becomes a challenging task as there are multiple stakeholders in a destination with different aims, agendas, and expectations (Okumus et al., 2007). The co-design approach presented in this study draws a pattern to mitigate the

problem of deciding what and when to promote, by taking into consideration all stakeholders' needs.

Chapter 6 Conclusion

This chapter presents the findings of the three case studies that show the results of this report. This chapter is presented in six main sections: Section 6.1 addresses case studies outcomes and research questions; Section 6.2 show the lessons learned and recommendations; Section 6.3 discusses the theoretical and policy implications; Section 6.4 provides the limitations, and Section 6.6 presents further research.

6.1 Outcomes

These section the conclusions of the three case studies that form part of this cumulative dissertation. The findings will be presented per case study highlighting the contributions per each instance.

The *first article* (David and Cantoni, 2015, Exploring and Experimenting Cooperative Design) shows an infusion of local or traditional practices of gathering to strengthen relations between researchers and community.

This paper has attempted to present co-design as an approach to design, create, interact and integrated an artefact embedding social practices and daily activities. The artefact conceived carried views of many social groups from Morrumbene, due to the level of equality and respect between intervenient.

For the evaluation, website tools such observium network management, Google analytics, and a number of registered SMS users were used. The website exists to improve social cultural, and political relations, one cannot analyse or evaluate such system only in a quantitative method but must carefully integrate social, financial and cultural context to interpret the trends in the data.

The first twelve months of data show a high number of website visitors and SMS usage. The first twelve months were a challenge to the remaining financial resources forcing the committee to articulate and reformulate the artefact placing attention on financial resources. During this process, the RE-ACT team was partially present and purely as

observers. Consensus on changes was assured because the committee did meet every couple of months to re-design, reflect and evaluate the improvement action and adjust to community needs.

This *first paper* addresses the RQ1 (Can small budget projects create conditions for the social and financial sustainability of CMCs?).

We acknowledge that not all sustainability problems (social and financial) within the CMC initiative can be solved by solemnly adopting co-design. The design approach only cannot solve the CMCs problems. Instead, we argue that: regulators need to create small season grants to allow CMCs and communities established in CMC premises to co-design services with intrinsic value for communities. These services, supported by the technology provided by the CMC can generate resources and provide sustainability to the CMC for an extended period. As seen in the first phase of RE-ACT, CMC staff and communities entrusted to manage the CMCs in Mozambique perceive the initiating agencies and regulators to be responsible for providing sustainability.

When it comes to the sustainability of CMC, we have understood that four types of sustainability (financial, social, political and technological) need to be the responsibility of all parts involved. The income generated by this CMCs does not cover the running costs neither provide them with the ability to innovate or maintain the technological infrastructure. Rural communities income doesn't allow them to actively seek ICT training (word, excel, power point, the Internet) services as the cost of these services exceeds the monthly income of a household. Hence, to attain both social and financial sustainability becomes a problem for the CMCs forcing them to resort to the political entities present in the regions where they are established. With it, political neutrality can become stressful for all concerned.

There exists the need to bridge the digital divide and co-design can be used as an approach to implementing small projects with the potential to deliver information and knowledge to rural communities. For the CMC Services to become successful need to be adapted to local conditions. We learned from the services and artefacts created that they must include local environmental, cultural and economic conditions of users.

The *second article* (David, Cantoni, 2015, Community design: a collaborative approach for social integration) demonstrates how co-design can be applied with small communities to develop socially sustainable solutions. The co-designed improvement action in Quelimane showed that there exist other aspects to be considered while using co-design (commitment, proactivity, trust, and self-efficacy). The commitment was evident. This paper important result was the foundation for the creation of a successful radio program that targets the youth of Quelimane. Both the CMC staff and the communities' representatives involved – demonstrated proactivity in the implementation of the project, devising new approaches and steps to meet the encountered challenges. The project implementation was entirely managed by the local CMC staff, with inputs in relevant points from the beneficiaries and the RE-ACT team. The inclusion of individuals from the community skilled in project planning and management, proved to be a line of support for the CMC management.

These cases demonstrate how small budget projects can create conditions for rural communities to acquire benefit from projects run by the CMC. The detailed analysis of the nine improvement actions run during the RE-ACT project, adding to them the data collected (interviews and observations), provided insightful information about possible conditions to attain social sustainability. There is a direct relation between social and financial sustainability.

CMCs indicated that before the implementation of the improvement actions, most of their services were around the use of computers for ICT training. The services are aiming to include different social groups proved to be able to create favourable conditions for social groups outside the scope of CMC services, to become active users of the CMC services. The higher the number of people from the community using the CMC services the higher are the revenues earned. A fundamental aspect of social sustainability is the need to be capable of dealing with the diverse social groups and provide them access to ICT at an affordable cost. Common ICT4D initiatives target communities of the poorest of the poor, in a context with minimal resources. A narrow focus on the project does not suffice to surface the reasons for failure (Marais, 2011). Attention has to be placed on the scope of the project and tangible financial and social objectives for the daily community activities.

The community as beneficiary and patrons must be active partners in the systematic process of services design.

The island of Mozambique beneficiaries is up to date and is intrinsically active on the promotion of the platform for tourists who visit the island, although the CMC does not actively update the web platform.

People who work on the CMC have the tendency to get invited to another job once they do something very successful at the CMC. For example, one CMC who participated in this research revealed that the volunteer employee designated to update the web platform got a job offer by TDM to work on the promotion of Internet broadband project for the Nampula province.

The *third article* (David and Cantoni, 2015, Co-design of eTourism Application. The Case of Ilha de Mozambique) this article addresses RQ1 and RQ4. The study presents a quantitative content analysis of 28 questionnaires. Responses to the survey reflect the diversity of travellers, but it was an unequal distribution when compared to the website visitors. The survey results also provide an indication that tourists from emerging economies tend to acquire information about destinations by word of mouth or travel agencies.

This article explored the implications of co-design in e-tourism in a world heritage site aiming at developing an eTourism solution. The co-design approach presented in this study draws a pattern to mitigate the problem of deciding what and when to promote, by taking into consideration all stakeholders' needs.

The *fourth article* (David and Cantoni An approach to contextual co-design: The Chitima Valley case) addresses RQ3.

In this article, co-design is used to harness a set of ideas and opportunities aiming to improve how education is provided in the Chitima Valley. A Large body of the literature describes and prescribes how to design, but there is a poor understanding of what expert designers do in practice. In the David & Catoni (2016), differences were identified between participants, and activities were entrusted to each set of designers based on their expertise.

Ownership of the designed solution was a feeling, a sense of communities' participation in the conception of an idea from the early stages of the co-design process. The SSA communities' way of life is deeply rooted in a paradigm of "connectedness of all" where participation is an established practice observable in daily life (Winschiers-Theophilus et al., 2010). Allowing communities to participate on the co-design proved to be a time-consuming task, which brought inherent power relations between participants. The CMCs adopted the same approach later to co-design, reformulating existing services with community support. Community members learned about the co-design methodology on from RE-ACT researchers and approved the design process to solve contextual issues.

"Communities of practice are a group of people who share a concern, a set of problems, or passion about a topic and who deepen their knowledge and expertise in this area by interacting on an on-going basis" (Wenger, 2008).

The table (6-1) provides the summary regarding the relationship of themes addressed in each case study and the research question answered in each case study.

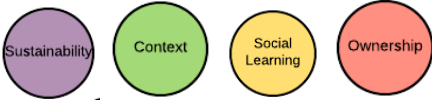
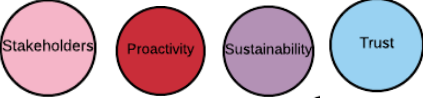


Number	Research Question	Literature themes	Article addressing RQ
RQ1	Can small budget projects create conditions for social and financial sustainability of CMCs?		David, S., & Cantoni, L. (2015). Exploring and Experimenting Cooperative Design. Publishing.
RQ2	How can co-design be applied with small communities to develop sustainable solutions in an emerging economy?		<p>David, S., & Cantoni, L. (2015). Co-design of eTourism Application. The Case of Ilha de Mozambique.</p> <p>David, S., & Cantoni, L. (2015). Community design: a collaborative approach for social integration.</p>
RQ3	How can rural communities with lower knowledge of design practices become designers of services on their domain?		David, S., & Cantoni, L. (2016). An approach to contextual co-design: The Chitima Valley case.
RQ4	What is the impact of ICT4D solutions co-designed by local communities?		David, S., & Cantoni, L. (2015). Co-design of eTourism Application. The Case of Ilha de Mozambique.

Table 6-2 Relation between articles and research questions

6.2 Lessons Learned and Recommendations

The Government and development agencies support the CMC program in Mozambique based on the rationale that having the skills and means to access computer and the Internet technology is essential to development. The CMC program is a top-down design, the MCT, is the entity responsible for the re-deployment of such centres aiming at having at least one centre in the 138 administrative posts of Mozambique. This vibrant desire prompted the government to secure foreign aid to invest in the existing centres, and new centres being launched with additional technology. The developments, such as the spread of mobile phones, low cost and low processing devices (Raspberry Pi, Intel NUC) have raised questions about the effectiveness, or long-term relevance of the CMC program and strategy (David & Cantoni, 2016). Since the deployment of the telecentres in Mozambique findings of the social and economic impacts or the populations that experience these impacts have not yet been presented, casting a shadow on the relevance of these CMCs in socio-economic development.

The critical impact of CMC in Mozambique is to facilitate the development of ICT skills, accomplished directly through ICT training or indirectly by providing space for exploration and experimentation of digital technologies. Except for the Chitima CMC, all other CMCs provide ICT training for people with lower personal income and education level.

There are limited or inconclusive downstream impacts of the CMC in Mozambique to provide sustainable ICT services for rural communities, the actual model adopted is similar in every province or administrative post under the assumption that all communities are the same.

The adopted CMC strategy is reinforcing the idea and belief that the new model should be expanded and strengthened placing technologies in high regard and excluding services. There exists a lack of an appropriate CMC model for rural settings, which face limited infrastructure and resource problems, enforcing the sustainability challenges for government and funding agencies on the long run.

To address the issue of sustainability we consider sustainability to be a financial, social, political and technological issue. The North and most of the initiating agencies such as

IDRC, and UNESCO created these centres assuming that the centres can find ways to be financially sustainable and political independence (Townsend, 2005; Fuchs, 1997).

To address all the four types of sustainability initiating agencies and regulators need to work towards creating grants, which will allow the CMCs to apply and produce services with added value for rural communities.

To attain technological sustainability, the regulators have to work closely to the centres, to provide assistance on the maintenance of the technological infrastructure. Example: The CMCs of Xinavane and Chitima soon after the end of the improvement actions were flooded, no assistance was provided to re-establish the centres. A regulator needs to be able to explore new technologies and introduce or work with local communities to understand favourable conditions for technology deployment and usage. The Mozambican regulators and communities were side-lined during the deployment of the CMCs; at a certain point, authorities central and local appeared to have fewer knowledge about the actual situation of the CMCs.

Small technical failures easily result in a complete break down when there is not technical support. It is tough to acquire technical experts to provide assistance to maintain equipment in Mozambique. Penetration of computers is still very low in comparison to other SSA countries. Even at this moment, the majority of the rural communities in Mozambique had never touched a computer, and most of the small businesses operate without computers. We learned from short approaches in Morrumbene and Xinavane that mobile phones, low cost and low processing devices (Raspberry Pi, Intel NUC) could bridge the digital divide at a lower cost. These devices create formidable challenges for developers and implementers of ICT solutions hence; the regulators will need to rise to the challenge and reformulate the CMC initiative to provide universal access to ICT.

As presented, volunteers, work on the CMC to cut labour costs, run most of these centres activities. Volunteers come from the community they reflect a variety of community social groups. However, we have to understand that most of these centres are located in disadvantaged areas, and the people volunteering on the CMC need to generate income for their families. The idea of volunteers in the Mozambican CMCs is opposed to the south concept of volunteers, in the sense that most of the volunteers in the CMC are paid, staff. The community needs to be provided relevant services, technologies and content,

through small grant projects, and services can be co-created to meet local community needs. Services created with funds from grants provided by regulators or initiating agencies can be low cost to allow disadvantaged social groups within the community to be included in the design and learning process.

Community expectations need to be addressed with particular attention to having full participation and effectively acquire community needs. It is important to provide rural communities with the limitations of the improvement action.

6.3 Implications

6.3.1 Theoretical Implications

As research in the social sciences and humanities becomes increasingly multidisciplinary, research managers and policymakers are relying more on multi-institutional research collaborations to develop robustly and diverse teams that can answer complex research questions. This approach was propelled by Northern development NGOs (NNGOs) changing the relationship with countries and local Southern NGOs (SNGOs) (Lewis, 2003).

With this change in relationships, innovative design techniques have been developed using multidisciplinary approaches. These multidisciplinary approaches were adopted as they are capable of providing a person /researcher with a good understanding and can assist in the conceptualization of Participatory Action and also with approaches such as co-design to provide an understanding of the social structures, cultures and perceptions of the study context. To understand organisational structures, studies have relied on having local partners take part in the design approach to mitigate the contextual gap, an approach known as the dearth theory for collaborative nodes (Moody, 2004). Thus, the primary focus of the dearth theory is the analysis of collaborations both at the community level and in research management. The artefact being an object of cooperation it is a must to establish the relationship between researchers and the local community.

In our case, we have seen the CMCs as an artefact for cooperation, and artefact that bridges a connection between northern and southern researchers and local communities.

So why pursue and value partnerships in research and development projects?

The assumption that innovation should focus on technological resources originated with the top-down approach in the early stages of ICT deployment produced tactically limited artefacts with lower impact, higher implementation costs, and lower community adoption. The top-down approach was implemented in several developing nations, and it marked what is now called the transfer and diffusion era (Avgerou, 2008). Several studies have sought to move to diffuse systems and now is considering contextual best practices and context specific issues, creating a design-reality gap by not empowering locals or allowing them only to participate in the introduction or access to techniques to use and manage technologies.

As an example of transfer and diffusion, we took the Canadian International Development Research Centre (IDRC) telecentre initiative, which in its early stages saw telecentres as a necessary service to promote universal access to ICT in developing nations. IDRC founded telecentres and employed wireless networks, assuming that the systems could be managed locally and sustainably using business models that shared the high cost of connectivity with local users (Emdon et al., 2014). The problem arises when local communities that live on less than 1 US\$ per day are supposed to use the telecentre actively and support the costs of an initiative they are not aware of or have not accepted as theirs.

IDRC's thinking shifted with the obvious sustainability issues faced by locals entrusted to manage the telecentres, as telecentre's managers were unable to provide, demonstrate, and communicate the investment impacts. The rise of other technologies and different types of public access venues such as cyber cafes and mobile telephones also negatively affected the IDRC initiative.

Hence, several research and development projects, including this one, see the social, organisational setting as part of the design or conception of an artefact, especially in a context where the social actors are to be end users of a particular artefact and active participants in sharing the cost and benefits of the technology.

Strengthening partnership and empowering local communities is a must in achieving the long- and short-term sustainable conditions to deploy an artefact.

The field of design is opulent on methods and techniques to use in research projects; practitioners and researchers argue that while some approaches and techniques are useful,

some others are time-consuming and too difficult to learn (Winschiers-Theophilus et al., 2013). This thesis deals with communities as designers, with researchers of partial community knowledge and context aiming to co-design and interact with social groups. Liberty of expression is attained if the participants trust all members within the co-design intervention.

We see an explicit implication to allow context, stakeholders, ownership, social learning, and sustainability as the main ingredients for the social inclusiveness of an action-research project. A premise of this approach is that to construct a new technological artefact, the organisational structures within a local social context must be involved in the conception of the object.

This thesis demonstrates the possibility of communities taking the lead in refining an existing object to create a productive solution, capable of generating solutions for daily community activities. This study also moves research towards a more convergent form. In concurrent studies, attention is placed on whether observations are generalizable across similar samples. On the first stage of the survey we seek to learn from the community by interacting about local practices and usages of ICT; on a second stage, we infuse the local practices with insights from cooperative design approach to better serve the global but locally diverse community.

The study handles and analyses conditions for deploying parallel studies by interacting and examining the notion of implementing a solution in one community and replicating the same one in another community. The study also presents elements that define and create an explanatory model, and it presents pitfalls and considerations in co-designing with communities.

Themes such as stakeholders, context, ownership, social learning, and sustainability are studied thoroughly in each social group where co-design was adopted. These themes describe key concepts that strengthen the refined notion of generalising deployment of ICT4D projects in southern social groups. Furthermore reinforcing the idea that one social group is not equal to another, even if they both belong to the same country.

In this study, when it comes to social groups, we present different locations of Mozambique, with differences in how communities perceive the artefact being examined.

It is important to understand that ICTs alone cannot improve people's lives. The use of ICTs needs to occur within a broader strategy that are tailored to deliver access to relevant services to digitally included communities, with the usage of tools and techniques that benefit the community as a group.

6.3.2 Policy implications

Hereafter, we draw conclusions about how co-design can impact specific social groups. For example: “Our co-design approach on the Island of Mozambique allowed local entrepreneurs to reap financial benefits from the improvement action project” (David & Cantoni, 2015). Co-design tells us that listening with attention to local communities can provide fruitful results, unlike implementing a plan without their consent. However, the rigour of our co-design approach does not give us assurances whether the same improvement action would have the same or any impact if replicated in a different community or if scaled up. To generalise results of a co-design approach is difficult; to do so, we would have to rely on assumptions, more or less reasonable, about whether the results would be the same.

While framing our case studies, we also faced challenges regarding implications for public policies already being practised in the country. One problem when reasoning about policy implications from case studies is that regulatory agencies have learned to work with the present policy system instead of working on community needs. For example, many CMCs are unable to combine resources from different sources, but they can cooperate with the variety of regulations placed on them by local governments. Their ability to work within the boundaries of the rules can imply that the present policy system is working reasonably well. It is working if we ignore the fact that the approach taken by regulators is unusual, as they allow CMCs to work without paying regulated taxes and without a policy for them to operate legally. Nevertheless, we understand that it is challenging for regulators to enforce CMCs to pay taxes unless small social programs for income generations are created.

One contribution of this study is to show how the government and regulators can interact with local communities, using the existing CMCs as a platform for interaction, to influence the development of local capabilities to address social needs. These case studies

illustrate the benefits of a diverse funding strategy and the local intervention of approaches to co-design and create services with inherent value for local communities. However, the current Mozambican policy infrastructure creates few incentives and many barriers to this approach of funding. The local administrative entities are unable to convey information to local ICT institutions promptly; for example, by the time a CMC hear about an opportunity to apply for a grant and by the time their application reaches the administration entities, the application period is normally closed. Therefore policymakers and administrators should work together to find ways to make life simpler for CMCs and to see how different funding streams and mandates can be implemented to work productively at the local level.

All forms of CMC ICT programs aim to respond to the survival needs, schedules, and government agendas. At the same time, they aim to provide development learning experiences and other services to everyone in the community. A comprehensive service strategy has to be created by working within a community to identify needs. These requirements provide understanding about the actions and services to be set up to address community needs.

The global participation of governments and regulatory entities on the deployment of ICT produced evidence of the need of a comprehensive understanding and strategic guide in the use of ICT in the South. The government of Mozambique sees clearly enough the diffusion of ICT as a way to empower local communities on a path to development. Regulator entities are juggling to embrace the government views and regulate the sector with efficacy. Some of the regulators of ICT in Mozambique are still very young, learning the primary steps of regulation. Increasingly, they position themselves to address the inequalities of information technology development, leaving the deployment and analyses of the impact of the ICT policies to NGOs and academia. Universities are expected to contribute to society by widening access to higher education; developing and applying research to contribute to local economic impact, and improving social inclusion. The academic landscape of research and development in Mozambique is in its early stages and does not yet focus on financing development or research processes. Northern institutions which host, train, and develop the research skills of Mozambican researchers found most of the existing research procedures. Researchers face difficulties in accessing information

and data sharing, and network contacts are constrained by the lack of collaboration workspace.

These factors, associated with the absence of financial capabilities on the part of the regulators, thus creating a gap in the implementation of ICT projects. While there are regulators or government institutions throughout the country, there are no policies that force these institutions to support CMCs or public access venues. For example, the MCT could help the CMCs' computer maintenance, as most of the CMCs are located in rural areas. At each location where MCT or government entities are located, they could visit the CMCs on a random or specific basis to support the maintenance of the CMCs' technological infrastructure, as fixing this type of apparatus is the biggest headache for the CMCs. The MCT has in all locations technicians with the capability to fix and support the CMCs in preventive maintenance.

Hence, during our work we understood that there is a gap between government, regulator, communities, and academia, a gap that can be solved by applying co-design. The government and regulators need to ease the administrative burdens and become involved with the community—not as an entity only with the mandate to set rules, but as an active listener.

As we have described, CMC managers face a continuous stream of judgments and pressure to acquire funds and allocate resources to provide relevant services to communities. One possible solution to this problem is to have the communities and CMCs co-design services to be submitted to the Government or private funding sources. The demand for accountability will emanate from funding sources and the community, but with the community acting as a partner of the CMC, the pressure, and responsibility to provide socially sustainable and financially viable solutions will be shared by all intervenient of the project.

A second aspect of the solution involves leading efforts on quality, innovation, and professional development as part of the community's agenda, anchored in CMC resources. One attribute observed in each CMC was a sense of inactivity and lack of creativity that the community could be entrusted to enliven. The community can bring an identity and a distinctive approach to CMC services. Creating an endless array of opportunities to support CMC staff members and guiding in t internal planning and

evaluation efforts; to observe and give feedback on direct services, and to brainstorm new possibilities and strategies.

We conclude with the conviction that improving CMC services is an important endeavour with significant payoff in communities' daily lives and activities. We believe this study contributes to a more complete, balanced, and grounded image of how CMCs and local communities can work together to create socially and financially sustainable services.

6.4 Limitations

This study's main limitation was the access to data. The Mozambican statistical agencies, government entities, and regulatory agencies are unable to provide information. The processes to request information are lengthy and bureaucratic which often results in a swap of information or pending requests.

Comprehensive rural ICT evaluation is a continuous endeavour encapsulating different stages of ICT utilisation by social groups and individuals in rural communities. Comprehensive evaluation required the evaluator to be sensitive to the rural environment especially need to be aware of any social, political, cultural or economic factor that can influence the assessment of the rural ICT project. The political and military tension, in Mozambique, did harm the evaluation of improvement actions. There were moments which the only possible method to reach the CMC were electronic means.

The conflict forced key actors of the improvement actions in (Dondo, Sussudenga, and Ilha de Moçambique) to move to urban locations or getting employment in different places.

Except the Sussudenga CMC, the remaining CMCs part of the RE-ACT project were entrusted to local associations, to be political neutral and serve the community. There exist political forces around the CMCs in Mozambique; despite the challenges, perceptions, effective communication with rural political forces is a must to create public awareness of the value of research.

6.5 Further Research

Further research is needed to create a sustainable integration of government services within rural communities. The government has difficulties to provide services to rural

communities in a domain where the CMCs already act as providers of access to ICT. A public and–private partnership (PPP) between the CMC and a government has to be further researched.

Such research has to aim at designing and evaluating strategies for using effectively and efficiently the CMCs.

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