Network Interaction Patterns within Brazilian ICT4D Initiatives

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I, Fernanda Scur confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm this has been indicated in the thesis

Abstract

This research examines the communication processes operating within social networks in the context of Brazilian Initiatives focusing on Information and Communication Technologies for Development. Conceptually, the thesis explores three bodies of literature in the Brazilian context: development theory, digital ICT in development practices, and partnership collaboration. It draws on this literature to build a framework to understand the processes involved at the intersection of these three areas, particularly drawing on concepts borrowed from systems (Bateson, 1979; Maturana and Varela, 1992; Luhmann, 1996; Capra and Luisi, 2014) and complex network theories (Granovetter, 1973; Watts and Strogatz, 1998; Barabási, 2003; Benkler, 2006).The main question that the thesis seeks to answer is:

> *What role do individual actions play in forwarding or hindering effective collaboration at the unfolding network interaction patterns of ICT4D initiatives?*

Through an explicitly systemic and participatory approach, the thesis focuses on the on-going dialogue among partners in the organizations in which I worked, as well as their interpretation of these processes, through qualitative methods including participant observation, focus-group discussions and individual semi-structured interviews. Proxys for data collection and analysis were derived mainly from three aspects: (1) the network topologies; (2) the communication level; and (3) knowledge production and exchange.

This research contributes empirically to discussions on the use of systemic approaches and social network mapping methodologies applied to ICT4D partnerships. It concludes by testing such approaches in practice through the suggestion of an adaptable framework for effective collaborative action. This framework accounts for the diversity of contexts and also the small amount of time that ICT4D initiatives usually make available to discuss their partnership mechanisms. The hope is that this will empower practitioners, researchers and decision-makers with knowledge around the emergent networks of the initiatives into which they are inserted, so as to harness their creative potential towards project's successful outcomes.

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Abbreviations

ASL	Associação de Software Livre (Free Software Association)
CESMAR	Centro Social Marista (Social Marist Center)
C4D	Communication for Development
CGI	Comitê Gestor da Internet (Internet Steering Committee)
DEPROTEC	Desenvolvimento de Projetos Tecnológicos (Technological Projects Development)
EAR	Ethnographic Action Research
FISL	Fórum Internacional de Software Livre (International Free Software Forum)
FOSS	Free Open source Software
GKP	Global Knowledge Partnership
IBASE	Instituto Brasileiro de Análises Sociais e Econômicas (Brazilian Institute for Social and Economic Analysis)
IBM	International Business Machines
ICT4D	Information and Communication Technologies for Development
ICTs	Information and Communication Technologies
MDG	Millenium Development Goals
MPA	Multiple Perspectives Approach
MSPs	Multistakeholder Partnerships
MVP	Minimum Viable Product
NGO	Non-governamental Organization
PPPs	Public-Private Partnerships
OID	Oficina para Inclusão Digital (Digital Inclusion Workshop)
ONID	Observatório Nacional de Inclusão Digital (Digital Inclusion National Observatory)
PRA	Participatory Rural Appraisal
RRA	Rapid Rural Appraisal
SAP	Systems, Applications and Products
SNA	Social Network Analysis
SAST	Strategic Assumption Surfacing and Testing
SSM	Soft Systems Methodology

Acknowledgments

As I started off this process as a part-time distance-based student, I thought this was going to be a solitary endeavour. Despite all the difficulties I have faced, isolation was not one of them. Thanks to ICTs I was able to stay connected with my peers at the ICT4D Collective and also to engage with so many more people around the world who enjoy from the same research interests as I do.

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1 ICT4D Initiatives: Establishing the research context

1.1 Introduction

The goal of this research is to contribute to the work of practitioners, researchers and decision-makers in ICT4D initiatives who are interested in creating effective collaborative environments between project stakeholders. With the emergence and increasing convergence of digital Information and Communication Technologies (ICTs), the grid of interactions such as human/human, human/technology, human/culture and human/nature is becoming diversely, dynamically, and uncontrollably complex. Southern (2015) argues that there is an increasingly decline in trust between individuals; while technology offers the opportunity for better and improved communication, we are losing the ability truly to connect and communicate with each other in a meaningful way. A key question concerns how these processes come into form and how can we influence them or at least be aware of them to help forward the fundamental structural changes our current social system needs to undergo (see Chambers, 1997; Mansell and Wehn, 1998; Capra, 2002; Pamlin, 2002: Meadows *et al.,* 2004; Kothari, 2005) in order to drive our current economy in a sustainable direction (Pamlin, 2002).

We are still far from understanding the implications of the technological changes our world is undergoing. It is especially important to note that when it comes to ICT for Development (ICT4D) initiatives, those aspects mentioned above are often not taken sufficiently into consideration. Many agree that development project mainstream methodologies are reductionist and standardizing (as discussed in Escobar, 1992; Chambers, 1997; Slater and Tacchi, 2004; Kothari, 2005), and ignore the plurality and complexity of the communities those projects are implemented "on". Indeed, impact and evaluation assessments, one of the most discussed problems of development projects (Chambers, 1997; Kothari, 2005), emphasize that the whole process is in need of a serious revision. This research's perspective is that if ICTs are to be used to help reduce poverty, they should be developed within a framework that takes into consideration how complex and unpredictable the interactions are among the diverse stakeholders involved in such processes are, and at the same time, integrates sustainability and ongoing critical assessment approaches (Capra, 2002; Chambers, 1997; Pamlin, 2002; Slater *et al;* 2003).

The main research questions that this research intends to answer are therefore two. The first, relates to dialectical processes between the systemic dimensions explored in this chapter:

> *What are the relationships between network topologies and communication processes within Brazilian multi-stakeholder ICT4D initiatives, and why do they function as they do?*

The second relates to the unfolding social networks within ICT4D project collaboration and the specific role of individual stakeholders within these processes, with the goal of acknowledging actions that might assist in generating effective collaborative action:

> *What role do individual actions play in forwarding or hindering effective collaboration at the unfolding network interaction patterns of ICT4D initiatives?*

The hope is that with the knowledge gained from this endeavour, guidelines that will assist researchers, decision-makers and practitioners of ICT4D initiatives can emerge, as well as a contribution to the debate of systemic approaches and complex network theories within ICT4D research. In this light, this first chapter outlines key areas that have been insufficiently addressed in previous research, and about which it seeks to make a significant contribution. Section 1.2 provides an account of the broad field of development focusing on three main realms. First, Sub-section 1.2.1 focuses on mainstream practices, as these generate some of the fundamental mechanisms that are increasingly being criticized as hindering the implementation and sustainability of development projects. Second, Sub-section 1.2.2 narrows the discussion down to the role of digital ICTs in such practices, either as potential catalysts or as tools that if not used with a critical view, might hinder such processes. Third, Sub-section 1.2.3 discusses the relevance as well as some of the fundamental challenges of monitoring and evaluation processes, a key mechanism for the successful implementation of ICT4D initiatives. Section 1.3 provides an account of the Brazilian context in which the case studies observed are inserted. Sub-section 1.3.1 focuses on Brazilian development more generally, so to contextualize some of the general mechanisms of Brazil's social development. Sub-section 1.3.2 explores ICT4D practices in the Brazilian context. Section 1.4 problematizes ICT4D partnerships as the main focus of my research. Sub-section

1.4.1 provides an account on ICT4D project management practices and sub-section 1.4.2 explores in more detail the need for establishing useful guidelines for effective collaborative action in such partnerships. The final Section of this chapter synthesizes the previous ones and also introduces the next chapter, in which the conceptual framework that supports the observation of the issues discussed is developed.

1.2 Development and ICTs

1.2.1 Mainstream development discourse

> '(...) development is about paving the way for the achievement of those conditions that characterize rich societies (...)' (Escobar, 1992:25)

Many of the social and economic realities of Asia, Africa and Latin America were shaped based on development strategies produced by the 'First World' (Escobar, 1992:22). It is even possible to design a genealogy of development studies (see Figure 1) according to either theoretical hegemonies or processes. Even though there is much critique coming from other perspectives, such as post-colonial, post-modern and feminist, these usually conform to a similar chronology (Kothari, 2005).

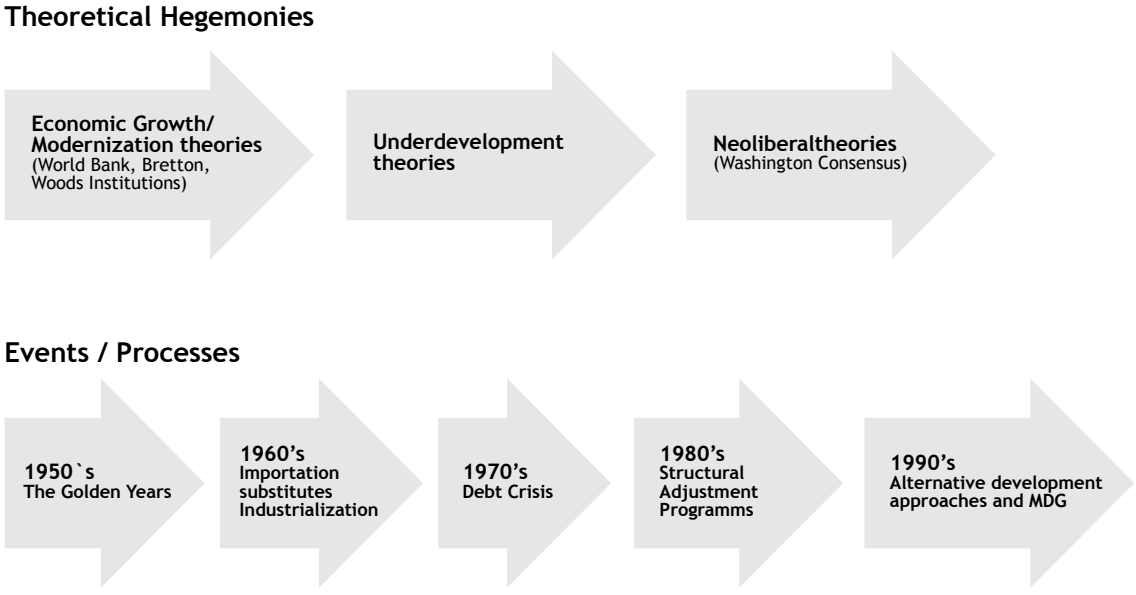

Figure 1: Development studies genealogy according to Kothari, 2005 (illustration by author)

Development mainstream discourse is supported by and resembles Western systems (Escobar, 1997; Chambers, 1997; Kothari, 2005; Capra, 2002) which help to increase, rather than reduce differences between 'First' and 'Third' World countries (Capra, 2002; Chambers, 1997; Escobar, 1992; Kothari, 2005), by also neglecting other views and ways (Escobar, 1992; Capra, 2002). The vast institutional structures formed by governments, international organizations, universities and local development agencies assure the hegemony of the practices in the field (Escobar, 1992), which are generally focusing on economic growth as the main driver and indicator of development (Unwin, 2006). To exemplify this, Jeffrey Sachs (2005:35) suggests that 'in the most disadvantaged environments, modern economic growth has been delayed until today'. He goes on: '(...) Higher living standards that were imaginable two centuries ago; a spread of modern technology to most parts of the world, and a scientific and technological revolution that still gains strength (…)'(Sachs, 2005:4). Friedman (2005:399) reinforces this by noting that 'David Dollar and Art Kray conclude in their book "Trade, Growth and Poverty", economic growth and trade remains the best antipoverty program in the world'. This reinforces a tendency to rely on consumerism as an adequate anti-poverty strategy, despite a growing tendency towards sustainability practices that state, among other things, the necessity of conscious consumerism.

Moreover, the standardising and simplifying character of much institutional development practice fosters the bureaucracy it supports and it is supported by, such as 'the poor', 'the mal-nourished', 'the illiterate', 'pregnant women', 'the landless' (Escobar, 1992; Chambers, 1997). This ignores the complexity and plurality of the systems it wants to reform, favouring the minimization of administration, simplifying monitoring and evaluation processes which in turn eases the overload of bureaucracy itself, corruption, time-bound target-oriented top-down approaches and political influence (Chambers, 1997), as well as absolving development professionals of examining critically the foundations of the field in ways they might be increasing inequality, differences and the hegemony of western systems (Escobar, 1992; Kothari, 2005). In addition, even though new processes come into play, as with participatory approaches, they are usually superimposed onto older processes (Chambers, 1997). This is a typical mechanism of the 20th century (Giddens, 1990; Latour, 1994), where we are not capable yet of digesting, at a cultural scale, the fast pace of the information ubiquity

process (Pierre Lévy, at the 5th corporative internet forum held in Porto Alegre,2009) and therefore have not yet developed proper mechanisms to deal with it. ICTs, as argued below, foster this problematic (see also Capra, 2002; Southern, 2015). These issues are developed further in Chapter 2, Section 2.3.2 (p. 64).

More than 20 years of criticism has challenged the dominant paradigm briefly described above (Chambers, 1997; Escobar, 1992; Kothari, 2005). According to Escobar (1992:27), many scholars agree that instead of finding new alternatives in development, such as Rapid Rural Appraisal *aka* RRA, Participatory Rural Appraisal *aka* PRA or Ethnographic Action Research *aka* EAR, the need is to find an alternative to development itself by running away even from new dominant discourses that serve more to rescue it from itself, 'through fashionable notions' such as 'sustainable development', 'grassroots development' and 'ICT and development', 'or to restructure social realities in the Third World in line with the symbolic and material requirements of a new international division of labour based on high technology' (Escobar, 1992:26).

There is a need for a critical view when using such 'fashionable' notions like the ones above, for the way they are conceptualized might be only reinforcing hegemonic views of the systems of power (Escobar, 1992; Woodhouse and Chimhowu in: Kothari, 2005; Unwin, 2005), by reducing complexity in the system such as 'knowledge' corresponding to 'profit' and furthermore 'profit' being acknowledge as something 'good' (Rasch, 2000). Moreover, this alternative to development mainstream discourse should respect 'all kinds of knowledge, ideas and innovations that take place in the intellectual commons – in villages among farmers, in forests among tribe people and even in universities among scientists' (Capra, 2002:201).

In this light, Chapter 2 (p. 41) explores approaches that take into consideration the multiplicity of views that come together in the contexts of ICT4D initiatives, focusing especially on communication between individual stakeholders and how their actions might forward or hinder effective collaboration. As a starting point in making the case for such approaches, Section 1.4 of this Chapter (p. 39) discusses the main challenges of ICT4D Partnerships. However, before jumping into the more specific issues with which this research is concerned, Section 1.2.2 below provides an account on how digital ICTs influence the issues described in this Section.

1.2.2 Digital ICT in development practices

> '(...) If language originated in gesture, and if gesture and tool making (the simplest form of technology) evolved together, this would imply that technology is an essential part of human nature, inseparable from the evolution of language and consciousness (…) from the very dawn of our species, human nature and technology have been inseparably linked (Capra, 2002:58)'.

The structures of space and time by which we configure our living experiences are constantly being rearranged (see also Chapter 2, Section 2.3.2, p. 64) and ICTs have always played a key role in this re-structuring, through the increasing speed of information transfer over long distances (Benkler, 2006). This is not a new process. However, what is remarkable about digital ICTs is the scale at which they are being introduced. As an example, Richard Sennett (2007:167) comments '(…) the iPod, capable of storing and playing ten thousand three-minute songs. How, though, would you go about choosing the ten thousand songs, or find the time to download them? What will be your principles for sorting out the five hundred hours of music contained in the little white box? Could you possibly remember the ten thousand songs in order to choose which one you wanted to hear at any given moment?' We have never had such vast amount of data available and being transferred at such high speeds (Unwin, 2006; Lévy, 2009). Indeed, the task of keeping pace with the digital technological advances of our time is a difficult, if not impossible, task even for the most technology savvy ones.

Digital ICTs were introduced in the development field during the last two decades of the 20th century and they still carry the ambiguity of serving either as catalysts in helping the poorest or reinforcing mechanisms that serve the richest's urge for short-term profit (see Pamlin, 2001; Unwin, 2006). To reinforce this notion, Mansell and Wehn (1998) presented an overview of the history of digital ICT in development at the time it was written, presenting a vast amount of data and graphics for analysis. However, it presented rather ambiguous views as well: on the one hand, data usually conform to simplifying and standardizing processes, such as results of analysis characterizing an entire country, exemplifying the dominant approaches criticized in the previous section; and, on the other side, criticizing this very same notion and emphasizing the need to be aware of what they called 'shifting ethnoscapes', or the emergence of new/old ethnicities, new social movements and sub-cultures which pose 'real and conceptual

challenges to nation/state centred models' (Mansell and Wehn, 1998:144). As discussed by many (see Chambers, 1997, Kothari, 2001, Friedman, 2005, Unwin, 2005) and stated by Capra (2002:145) 'the new geography of social exclusion includes portions of every country and every city in the world'. Mansell and Wehn (1998: 10) claimed that 'the emergence of new capabilities is closely linked to the progress of scientific and technical innovation'. However, this statement ignores the emergence and plurality of views and ways of doing that are not covered by mainstream scientific knowledge (Escobar, 1997; Chambers, 1997; Capra, 2002; Tacchi et al., 2003). Mainstream development reports (see for instance, World Bank Development Report: Digital Dividends, 2016; International Telecommunications Union Report: Measuring the Information Society, 2014; United Nations Development Programme: Human Development Research Paper, 2010) and writers (Sachs, 2005; Friedman, 2006) generally assume that digital ICTs, which are mostly developed in richer countries (Unwin, 2005), are a catalyst in helping the poorer in their way out of poverty. Although at a political level the discourse generally claims a focus on 'ICT literacy' or 'capacity building', on an operational level, these initiatives end up focusing fundamentally on information and technology access (Unwin, 2005), rather than appropriation. Such focus on access depends on various factors regardless of the discourse. Digital ICTs demand a fairly complex infrastructure within which to function such as power supply, internet connection services, hardware implementation or technical support. This is especially true in very poor places, such as isolated villages in Africa or remote Brazilian native Indian tribes where digital ICT4D initiatives face deep infrastructure barriers (Scur, 2005). It is not surprising that, even though such projects claim that they are enhancing 'ICT literacy' and 'capacity building' alongside infrastructure implementation, many do not pass beyond this first phase. These projects are, among other factors, time- and budget-bound. Thus it is almost impossible to reach their ambitious agendas, due to the complex and diverse structures that merge together to form a new evolving system.

Mainstream development practices usually support a simplification and standardisation of processes for the purpose of control (see Chapter 2, Section 2.3.2, p. 64). This comes at the cost of not taking into account the social and cultural diversity that initiatives for development usually entail and therefore the need to deal with them in more creative and innovative ways regardless of infrastructure, time-bound or budget issues. For

instance, ICT4D initiatives usually fail to take sufficiently into account the needs of end-users. Those on the supply side, as argued by Unwin (2005:57), 'must understand and listen to the specific demands and cultural sensitivities of the communities with which they are working'. Furthermore, when examining projects that have already passed the initial infrastructure problems and enjoy the time to focus on appropriation issues, it is also shown that the task is not an easy one to be accomplished. The well-established government project Acessa São Paulo in Brazil (http://www.acessasp.sp.gov.br/, accessed January 14th, 2016 in Portuguese), for example, claims to have helped to get access to more than 1.000.000 people on their website to this date. Despite the impressive quantitative data presented, when I visited one of the locations of the programme back in 2008, I was able to see the struggle of some educators to implement initiatives that foster creativity and technology appropriation. They kept Fridays free from workshops and motivated people to come and try out what they learned over the week. However, an educator expressed the following thought:

> '(…) most of the people just come in for the free internet, and such a large number of people having access do not mean there is social change actually happening.' [1]
>
> (*Informal conversation, Metaprojeto, 10.10.2008*)

In the light of the above, one of the goals of this research is to pursue a framework that will help forward the role of ICTs as catalysts in effective collaborative action between different ICT4D stakeholders, while attentive to the possibility that the opposite can also happen. This framework also envisions the multi-disciplinary, multi-focus and especially the multi-stakeholder character of many ICT4D initiatives.

[1] Original: '(…) A maioria das pessoas vem pela internet grátis, e um número tão grande de pessoas tendo acesso não quer dizer que há mudança social acontecendo realmente.'

1.2.3 ICT4D monitoring and evaluation processes

> '(There is a) pressing need for monitoring, evaluation and participatory impact assessments of on-going ICT projects and initiatives, especially with regards to their effect on the economic and social livelihoods of communities (…) (Michiels and Crowder, 2001:2)'

Impact assessments and sustainability are two of the main problems encountered in ICT4D initiatives (Chambers, 1997; Halder and Willard, 2003; Slater *et al*., 2003; Unwin, 2005). It is easier to quantify the access to technology rather than develop and report about a project that would have as its main focus the appropriation of technology for evaluation purposes. Such evaluations usually try to quantify the knowledge being produced rather than knowledge that is being reflected upon (Habermas, 1968).

Inevitable conflicts of interest and ways of working which are not communicated among partners are among the causes of this. Several writers (See Chambers, 1997; Michiels and Crowder, 2001; Pamlin, 2002; Halder and Willard, 2003; Unwin, 2005; Slater *et al*., 2003; Draxler, 2007) agree on the fact that highly institutionalized organisations, such as the ones coming from the public or for-profit sectors, are usually structured to demand short-term results from the projects they seek to implement and fund. As already stressed, there is very little empirical research on the real impact of such projects on local livelihoods. What we have, instead, is a vast literature (see for instance, Mansell and Wehn, 1998 or the World Bank 'ICT at a Glance Tables', 2016) based on macro-level and quantitative analysis, on methodologies that often ignore the plurality and complexity of the communities (see Chambers, 1997). These analyses often lead to a sense of frustration, not only to local partners, but also to the external partners, because there is no clear vision of the benefits they were trying to achieve in the first place (Unwin, 2005). As an example, in a conversation with a coordinator from one of the most successful ICT4D Brazilian initiatives, Acessa São Paulo (http://www.acessasp.sp.gov.br accessed January 15th 2016 in Portuguese), the daily struggle to make an impact on people's lives were frequently mentioned. According to the initiative's coordinator, it is easy to quantify how many people sit in their labs daily, as exemplified by the banner that displays quantitative information on the initiative's website, such as how many million accesses or how many internet Centres were implemented. However, to attest how many users are reflecting upon and sharing the

knowledge gained is a different story. This is indeed a very successful initiative from the point of view of access, and since the lead partner is the government of São Paulo, the project is economically sustainable. However, grassroots individual partners and stakeholders do not feel the same way just by looking at those numbers. Fortunately, alternative monitoring and evaluation approaches that aim to reach deep into more qualitative aspects of project processes are increasing in number (see for instance Chambers, 1997; Checkland, 2000; Figueroa *et al.*, 2002; Halder and Willard, 2003; Slater *et al*., 2003; Jackson, 2003; Lennie and Tacchi, 2013; Lennie *et al.*, 2015). Chapter 2 of this thesis (p. 41) builds further on such ideas.

1.3 Research context: Brazilian ICT4D initiatives

This section lays out the context in which the case studies observed are inserted. Exposing the situational context of the initiatives is a key mechanism within the approaches employed in this research (see Chapter 2, p. 41), and this section assists in creating an initial common ground. First, Sub-section 1.3.1 provides a general context of Brazilian social development. Second, Sub-section 1.3.2 focuses on the specific ICT aspect of such development, from infra-structure to the movements and public programs that compose the mosaic of the history of ICT4D initiatives in Brazil.

1.3.1 Notes around Brazilian development

> 'A ruling class of consular and managerial character, socially irresponsible, against a "mass-people" treated like slaves who produces what it does not consume and only operates culturally as marginalia outside the literate civilization in which it is immersed.' (Ribeiro, 1995:163 about the essence of the Brazilian people)

The Brazilian context described in this section is just enough to show its more general characteristics that are useful for the theoretical and comparative means of this thesis. To understand Brazil's context today and how Brazilian people see themselves, it is necessary to go back hundreds of years, thanks to the initial technological revolution that first allowed Europeans to cross the Atlantic. Brazil's 'civilizing' process was part of the first 'world economic system', in which Europeans (especially the Portuguese) expanded across the oceans and conquered, plundered and evangelized people from

Africa, Asia and especially the Americas (Ribeiro, 1995). As a result, the 'face' of Brazilian people is a diverse mosaic of colours, cultures and customs.

The first century of Brazilian exploration and slavery endured a great miscegenation process. In this process, the dominant class was composed of the Europeans and their interbred sons and daughters. As such, Brazilians still did not have a national identity and this also facilitated the second round of European migration between the 1700s and 1800s (Freyre, 2006). According to Ribeiro (1995), this lack of national unity was exceeded by the country's growing industrialization and mass communication media, which came to sew the Brazilian patchwork quilt more evenly.

An important aspect that emerged as a legacy from the above process was the unaltered Brazilian dominant class since its inception to this day (Freire, 1970; Ribeiro, 1995; Freyre, 2006). Brazil has never had a native dominant class; the European settlers established a social organization in such a way that it would deny any other cultural forms that were not their own:

> '(...) our most terrible heritage is to take always with us the scar of a torturer printed in the soul and ready to explode in the racist and classist brutality. It is this, which glows, still today, in so many Brazilian authorities predisposed to torture and hurt the poor that fall into their hands.' (Ribeiro, 1995:108) [2]

Brazil's urbanization, mirroring many other developing countries, is chaotic and it took its boost from the arrival of seven million immigrants during the European employment crisis of the 1870s. Moreover, industrialization with the promise of a new and better life caused a rural exodus of astonishing dimensions. The urban population jumped from 12.8 million in 1940 to 80.5 million in 1980 (Ribeiro, 1995). This is worsened by the fact that none of the cities were prepared to receive such immigration. Figure 2 illustrates well the scenario of Brazilian's chaotic urban development. Figure 2 below exemplifies the scenarios in which the in-depth case studies of this research take place.

[2] '(...) nossa mais terrível herança é levar sempre conosco a cicatriz de um torturador impressa na alma e pronta para explodir na brutalidade racista e classista. É isso que aparece, ainda hoje, em tantas autoridades Brasileiras predispostas a torturar e machucar os pobres que caem em suas mãos,'

Figure 2: A land of contrasts: Paraisópolis Slum in São Paulo. Source: http://www.jssj.org/article/une-photo-pour-penser-les-inegalites/, accessed January 16th, 2016)

Urging to deal with the dislocated masses, Brazilian modern industrialization can be divided in two main moments. The first was through President Getúlio Vargas, who offered his support to World War II allies in exchange for the construction of the National Steel Mill Company and the devolution of Brazilian's iron deposits and other smaller national companies. The second moment was through President Juscelino Kubitschek in the 1950s, who granted all sorts of aid such as land, tax exemptions and loans, thus attracting numerous companies to implement their subsidiaries in Brazil. Nevertheless, Brazil's chaotic development continued to increase the distances between classes and inequality thrived.

Despite the growing inequality, Ribeiro (1995) observes that throughout Brazil's development history, the employers 'class' remained untouched. Throughout all government systems, from the colonial times to the monarchy, and now to the Republic, it was always the same class that perpetuated its power over what he calls the 'mass-people'. Development mechanisms in Brazil have usually resembled and favoured dominant class views, in line with the discussion on mainstream development discourse in Section 1.2.1 (p. 18).

All of the processes above can be seen as part of what makes the Brazilian people known by an inherent creativity in dealing with its misfortunes. There are a number of public

policies/programs, NGOs working in a localized fashion and also independent movements focusing on social development and helping the poorer. Moreover, Brazil is also known for being the cradle for many social democratization practices, such as Participatory Budgeting (http://www.participatorybudgeting.org/ accessed December, 26th 2015) and Paulo Freire's (1970), educational philosophy whose practices are recognized worldwide, even though its ideals are not widely practiced in Brazil, due to the very same processes reported in this Sub-section. Next, I explore ICT4D practices within this context.

1.3.2 ICT4D in the Brazilian context

It is difficult to contextualize ICT4D initiatives in Brazil, due to the great diversity of paths, movements and programmes that happened and still happen simultaneously. This history is as multifaceted as is the formation of the Brazilian people (see Section 1.3.1 above). This Sub-section provides a summary of the most notable landmarks from the past decades (see Figure 3 at the end of this Sub-section), so to provide a minimum context to understand the scenarios of the case studies involved in this research.

The discussion around digital inclusion can be inserted in the core of the development of the internet itself in Brazil, mainly because of the influence of the Institute for Brazilian Social and Economic Analysis in the process (IBASE - http://ibase.br, accessed November 28th, 2015 in Portuguese). In 1984, IBASE was part of Interdoc, the first international non-governmental computer network in the country (Murphy, 2005). Motivated by the experience with the Interdoc network, IBASE launched a service called Alternex in 1989, which was the first Brazilian access provider to individuals. Until 1994 most Brazilian internet access was restricted to academic activities and IBASE's Alternex was the only 'exception to the rule' (Falavigna, 2011). Alternex started as a test for IBASE associated members only, and in 1992 it opened up access to individuals in general. It was also in 1992 that Brazil hosted the Earth Summit in Rio de Janeiro (https://en.wikipedia.org/wiki/Earth_Summit accessed November 28th, 2015). This was the first event where all computers were connected to the internet in Brazil, through IBASE's effort in collaboration with the United Nations. In 1995, again through IBASE's interlocution with the Brazilian Science and Technology Ministry, the Brazilian internet Steering Committee was born (CGI - http://www.cgi.br/ accessed November 28th, 2015

in Portuguese), with the objective to coordinate and integrate all Brazilian internet services. Coincidently, I started working as an intern front-end developer for the first host provider of the city of Porto Alegre in the same year.

Still in 1995, other civil society initiatives concerned with digital inclusion started to emerge. The first and most relevant one, because of its scale, was the Informatics Democratization Committee (CDI - http://www.cdi.org.br accessed November 28th, 2015 in Portuguese). CDI was the first initiative to bring the private sector at a greater scale as an agent of ICT4D initiatives through the donation of equipment and financing for projects focused on education of the poor, communitarian associations and informatics in the same initiative. CDI has been criticized by many Brazilian ICT4D and Free Software Advocates for giving preference to proprietary software (Falavigna, 2011). However, ideological disputes aside, the contribution of this particular initiative to the history of Brazilian ICT4D is remarkable, as it landmarked the beginning of private sector engagement in this field. CDI today is present in 15 countries.

In 2000, through a state government decree in São Paulo, the first public space for digital inclusion in Brazil was opened. This initiative led to the creation of the Acessa São Paulo programme (www.acessasp.sp.gov.br/ accessed November 28th, 2015 in Portuguese), which today is a digital inclusion programme of the São Paulo government. As a side note, my pilot field research was within this program (see Chapter 4, Section 4.2, p. 126). In the same year, the debate around ICT4D combined with public policies at a national scale started, in line with the global ICT4D boom (Fonseca, 2008; Falavigna, 2011). In 2001, the first Workshop for Digital Inclusion (OID - http://oficinainclusaodigital.org.br/ accessed November 28th, 2015 in Portuguese) was organized in Brasília, uniting for the first time civil society and federal government actors formally to discuss issues around the emergent Information Society. The last OID took place in a decentralized fashion in 2013, bringing to a total 13 editions of the event to this date. Between 2003 and 2008 ICT4D initiatives enjoyed great support from the government, and by 2005, most of the biggest digital inclusion programs were already in place, such as Acessa São Paulo and Telecentros.br, the federal government digital inclusion programme (Falavigna, 2011).

Meanwhile, smaller, independent movements aimed at technological appropriation and media activism were also taking place simultaneously. Those movements worked as symbolic collective spaces for individuals searching for a collective identity in the scenario of development and ICTs (Fonseca, 2008). The biggest one in this sense was the Brazilian Tactical Media Festival in 2003, a version of the European Next 5 Minutes Festival, which took place in São Paulo (http://www.tacticalmediafiles.net/n5m4/index.jsp.html accessed in November 28th, 2015). At this point the internet was starting to enter the periphery through government initiatives and the Free Open Source Software (FOSS) philosophy was gaining prominence (Fonseca, 2008). FOSS emerged as a technical solution for ICT4D initiatives at a low cost (both acquisition and maintenance). Many of the initiatives also had a concern for not using public financing to reinforce the proprietary operational systems monopoly. Hence, the culture of FOSS found in Brazil a catalyst for its philosophy, and even Wired Magazine (http://www.wired.com/2004/11/linux-6/ accessed in November 28th, 2015) mentioned Brazil's Minister of Culture in 2003, Gilberto Gil, as an advocate of FOSS with the country being referred to as an 'Open Source Nation' (Freire *et al.*, 2007). The FOSS culture in Brazil is so strong that the International Free Software Forum for the last 16 years has taken place in Porto Alegre, Brazil (FISL - http://softwarelivre.org/fisl16, accessed January 16th, 2016), the same city where the first World Social Forum took place. The event unites people from all over the world interested in the theme.

Federal government macro discourse is usually in support of ICT4D events and programs, but in practice many initiatives either fail or undergo significant and non-disclosed transformations, partly due to changes in the political scene. I will give three main examples of such cases. First, in 2007 the National Observatory for Digital Inclusion (Electronic Government, 2016) was created with the purpose of mapping all public non-commercial internet usage places in Brazil (Mori and Assumpção, 2007). This initiative was discontinued, as the official website is not online anymore and there is no public information regarding the reasons. After an extensive online research, I found that the communication ministry developed an integrated monitoring system for all of its ICT4D initiatives (http://simmc.c3sl.ufpr.br/index.html, accessed January 16th, 2016 in Portuguese), which I am assuming is a continuation from the ONID initiative. Second, Telecentros.br (Brazilian Ministry of Communications, 2015), the biggest ICT program of

the federal government, became inactive in 2012 and the federal government now just manages the remaining internet centres, not offering opportunities for the creation of new ones. Third, in 2008 Brazilian's National Plan for Broadband (Brazilian Ministry of Communications, 2012) was launched with ambitious milestones, such as connecting over 40 million households to the internet by 2014. By the end of 2014 there was a hiatus with only 10 million households actually connected, partly due to poor management of the program and the partnerships with Brazilian Telecoms (Carta Capital, 2015).

To sum up, the Brazilian ICT4D scenario is very diverse. It is composed by government efforts, civil society organizations and activist movements, reflecting Ribeiro's (2005) view that there are different rhythms operating in the country concomitantly. The case studies pertaining to my research reflect this mosaic, bringing a variety of contexts together, as the partnerships are composed from government; big civil society organizations, smaller activist civil society organizations and the private sector (see Chapter 3, Section 3.3, p. 85). Moreover, my case studies are located in urban areas, which increase the complexity of the processes that are observed, due to the more chaotic nature of cities, but at the same time it leaves other factors out, such as lack of infrastructure, a problem usually found in more remote rural areas. Not having to worry about such aspects leaves more room to concentrate on the relationships between partners. In this light, the next section zooms out from the Brazilian context and focus back in ICT4D partnerships mechanisms, the core interest of this thesis.

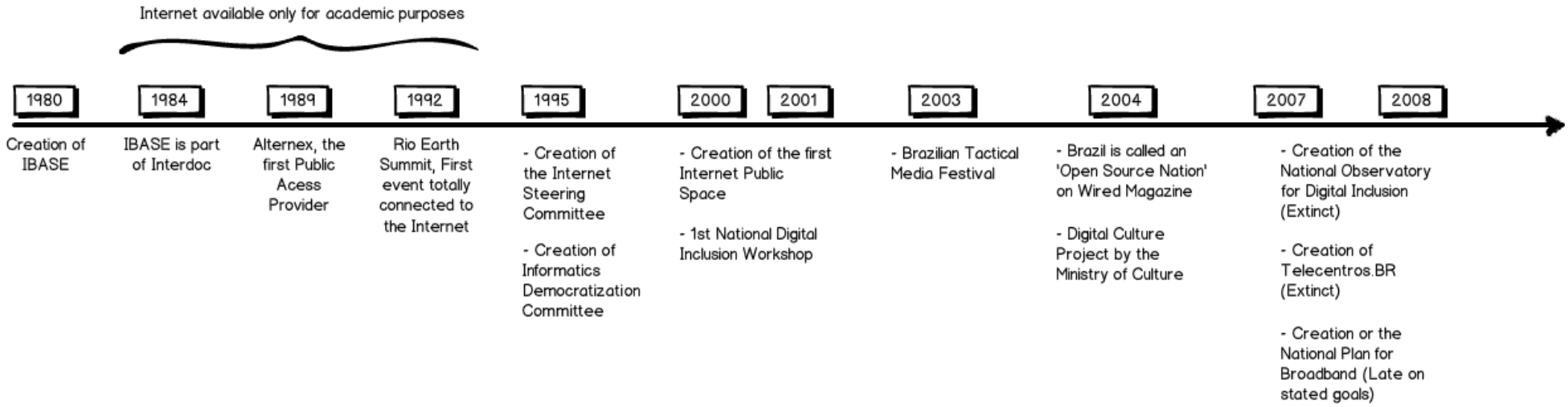

Figure 3: Brazil ICT4D Timeline, most important landmarks, assembled by author.

1.4 ICT4D partnerships

In order to pursue an effective collaborative environment grounded on stakeholders' interactions, it is first necessary to explore the usual mechanisms of ICT4D partnerships. Attempts to solve partnership challenges usually occur through the dissemination of ICT4D partnership best practices. Organizations from different sectors seek to engage in a variety of collaborative arrangements such as alliances, networks and consortia in the hope that the joining of competencies from public, private and the civil society sectors will lead to better development practices, promote policy changes and improved accountability of ICT4D initiatives than single sector approaches have previously done (Tennyson, 2003; Hardy *et al.,* 2005; Adam *et al.*, 2007). In this sense, multi-stakeholder partnerships (MSPs) have become a popular terminology in the international development scenario in the past decade by bringing together stakeholders from all sectors and not only from the public and private sector, as public-private partnerships (PPPs) do (GKP, 2003; Unwin *et al.*, 2011). Initiatives and reports of multi-stakeholder partnership facilitation and assessments of the advantages of such alliances are not difficult to find. Typical examples include the UN Global compact (http://www.unglobalcompact.org accessed November 27th, 2015); the Global Knowledge Partnership (http://gkpfoundation.org/ accessed January 16th, 2016); the Global Partnership for Education Initiative (http://www.globalpartnership.org/ accessed November 27th, 2015); and the United Nations Partnerships for Sustainable Development Goals Initiative (https://sustainabledevelopment.un.org/partnerships/ accessed November 27th, 2015).

It is possible to acquire a fair overview of shared consensus of indicators for the success of such partnerships. These include, for instance, clear agreement on desired outcomes and action plans; relevant knowledge of local context; committed leaders; investment in time building a partnership based on values of trust, transparency , ethics and mutual understanding; sustainability and assurance of needed resources and ICT technologies (GKP, 2003; Tennyson, 2003; Unwin *et al.*, 2011). However, the analysis of such indicators is made mostly at an institutionalized level rather than being based on empirical research (Martens, 2007; Draxler, 2008). This issue is further reinforced by Unwin *et al*. (2011), who argue that it is difficult to find ICT4D initiatives that actually

report on their partnership mechanisms. This research aims to analyse some of these indicators with the intention to contribute to the partnership debate with empirical evidence, also by assembling suggestions of useful guidelines for effective collaborative action (see Chapter 2, p.41 and Chapter 3, Section 3.2, p. 76).

In order to do the above, it is first necessary to define the concept of ICT4D partnerships within the scope of this work. There is no general accepted definition and the partnerships themselves usually do not discuss such concept (Unwin *et al*., 2011). In an effort to achieve a general consensus, there are a number of initiatives concerned uniquely with MSPs that have been working on the building of more formal definitions with the intention to introduce best-practice case studies in the field of partnerships. As an example, the Global Knowledge Partnership defined ICT4D multi-stakeholder partnerships as:

> 'alliances between parties drawn from government, business (*for-profit private sector*) and civil society that strategically aggregate the resources and competencies of each to resolve the key challenges of ICT as an enabler of sustainable development, and which are founded on principles of shared risk, costs and mutual benefit' (GKP, 2003, p.13, *my addition*).

It is important to take into account partners' contexts and how the partnership is designed, or otherwise the diversity of organizational cultures and interests can become a real challenge to effective collaboration. Moreover, as discussed by Unwin (2005), not only have ICTs become increasingly important in the development agenda in the past decades, but so too has the concept of partnerships, which, in turn, ICTs are supposed to foster. Unwin (2005:14) argues that we have to be careful with the diversity of meanings of the word 'partnership' to different 'partners'. Multi-stakeholder partnerships bring together institutions that each have their own organizational culture (Capra, 2002; Unwin, 2005) or, as stated by Draxler (2007) different aims and ways of working. As Unwin (2005:33) argues, '"Partnership", associated with other terms such as "multi-stakeholder" and "public-private", can be used to mean a pure contractual arrangement, a loose agreement among different parties to work together, a highly structured and governed set-up, or can merely be a term indicating an attitude of reciprocity in development programmes between donors and recipients'. As a result, stakeholders' understanding of partnership structures and processes such as responsibilities,

accountability, shared-risks/benefits and transparency also may vary. If mutual agreement on these issues is not worked upon, project implementation might become difficult (Figueroa *et al*., 2002).

It is because of this diversity of partnership arrangements that the task of finding general success factors becomes rather challenging. However, as Unwin *et al*. (2011) stated, these partnerships share the understanding that they are about relationships between different parties working towards a common goal. In this light, this research focuses on these relationships between the stakeholders within the case studies examined here. Moreover, reinforcing a particular pattern of ICT4D partnerships already observed by Unwin *(*2005) and later confirmed by Unwin *et al.* (2011), these initiatives do not necessarily follow or report on any specific partnership model and mechanisms; rather, they use the term partnership simply meaning that different organizations are working together in a single project.

My intention is to define the specific case study contexts and explore their communication processes more than to contribute to the debate of a general definition of multi-stakeholder partnerships (for more in-depth discussions, see Unwin, 2005; Draxler 2007; Martens, 2007; Adam *et al.*, 2007; Unwin, 2009). However, since there is a lack of widely agreed formal partnership definitions within the ICT4D initiatives I observed, I will employ a general typology that carries a wider consensus in the field of discussion (Unwin, 2005) for analytic purposes, as laid out in Table 1 below.

Type of Partner	**Example**
Public Sector	- Government institution
Private Section	- For-profit organization
Civil society	- Non-governmental institutions - community on demand side of the project
Research Institution	- University

Table 1: The general partnership typology that will be employed in this research, based on Unwin (2005)

Moreover, as multi-stakeholder partnerships can refer to a number of different arrangements, from more formalised structures to loose agreements (Unwin, 2005; Adam *et al.*, 2007), I will refer to them as social systems or networks instead of partnerships for two main reasons. First, calling them multi-stakeholder partnerships would imply that they should see themselves as such and this was not the case (see Chapter 3, Section 3.3, p. 85). Second, the theoretical framework for my thesis is built upon systemic and network approaches, which provide both a contextual and relationship perspective of the partnerships (see Chapter 2, p. 41).

1.4.1 ICT4D Project Management

It is not in the scope of this research to provide a detailed overview of ICT4D project management practices and methodologies. However, since this research tackles issues of social interaction mechanisms usually present in such initiatives, it becomes relevant to account for the project management principles employed on the projects that are observed here.

ICT4D projects are in many cases part of bigger initiatives or programs, related to an organization or government overall goals. In essence, they also entail the greater goal of contributing to higher goods, such as to help achieving a Millenium Development Goal (MDG) milestone. In this realm, the project management planning of these projects entail not only technical development milestones, but also that of a meaningful development, linked to people and society as a whole (Macapagal and Macasio, 2009). However, many of the bigger organizations belonging either to private or public sector make use of more traditional project management principles, and the local context in which such projects are implemented are not taken into consideration (see Section 1.2.1 above).

Management Practitioners are always pursuing more efficient project management practices. Within ICTs projects, many techniques were developed in order to assist such endeavour. More traditional approaches to project management have been contemplated with practices that promise to make project management more agile. Macapagal and Macasio (2009) assembled a set of differences that new agile principles brought to the more traditional project management practices, which turn it into a more iterative science, as shown in Table 2.

Agile Project Management Characteristics
Emphasis on the team that must work as a tightly integrated unit
Frequency of communication through daily meetings among team members to line up the day's work and determine dependencies
Short-term delivery of expected outputs or products ranging from one to two weeks
The use of open communication techniques and tools so all engaged in the project can express their views and have a quick response during the identification of requirements and implementation

Table 2: Agile Project Management differences from more traditional project management practices

Project management methodologies differ based on settings and partnerships arrangements. In the case of the pilot and in-depth Brazilian ICT4D case studies that are being portrayed here, traditional project management strategies are the rule, and the potential of ICTs to make the process more iterative is not harnessed (see Chapter 4, p. 125 for detailed project contexts). The short term case studies, on the other hand, are implemented by experienced project managers from bigger ICT companies in a volunteering fashion; these volunteers lend their knowledge regarding more modern project management techniques and make use of agile concepts, such as the minimum viable product concept (see for instance Chapter 4, Section 4.5, p.148) and all of the principles stated in Table 2 above are organically part of the project. These international programs of skills-based volunteering aim to transfer such knowledge to the beneficiaries of the programs they are working in (see Chapter 3, Section 3.4, p. 100) and they provided valuable insights regarding guidelines so that ICT4D projects can be more effective.

Regardless of the nature of the projects and the types of methodologies applied, it does seem that people, more than technology itself, are the ones that can harness the potential of more innovative practices on project management. On that note, the next section explores the case for effective collaboration among project stakeholders.

1.4.2 The case for effective collaboration

> 'Effective collaboration (…) depends on the relationships among participating members, which are negotiated on an ongoing basis throughout the life of the collaboration. Consequently, collaboration represents a complex set of ongoing communicative processes among individuals who act as members of both the collaboration and of the separate organizational hierarchies to which they are accountable.' (Hardy *et al.*, 2005:59)

This sub-section explores the need for ICT4D Initiatives to invest in collaborative learning processes. Partnerships for development are about collaboration and not competition. Thus, the focus is to improve such processes, so these organizations are able to leverage differences and aim for innovative and synergistic solutions that they could not otherwise achieve on their own (Hardy *et al.*, 2005). This process will be referred to as *effective collaboration* throughout this research. What usually happens is a lack of investment in the definition of the partnership and its mechanisms and the lack of such understanding can create difficulties in achieving the initiative's goals (see Section 1.4 above). Many argue that the more partners interact and share information, the greater is the likelihood that the partnership will succeed (Larsson *et al.*, 1998; Tennyson, 2003; Adam *et al.*, 2007; McManus and Tennyson, 2008). However, such endeavour takes a lot of effort and there is not always time to focus both on the quality of the partnership and delivering the initiative itself (Tennyson, 2003; Unwin *et al.*, 2011). This shows the necessity of creating an organizational culture that supports effective collaboration. However, as argued by Southern (2015), much of the collaboration learning processes are about building partnership strategies based solely in the exchanging of information, in a very basic concept of cooperation; she states:

> 'Not enough research and work has been done to understand the complexity of developing organizational cultures where collaboration is a pattern of action that is expected, facilitated by supporting structures and recognized as critical to organizational success and sustainability.' (Southern, 2015:34)

Moreover, the concerns addressed in this thesis can be divided into two overlapping realms. One is the organizational realm, which refers to the inter-organizational arrangements of the initiatives; the other is the individual realm, which refers to the team of individuals coming from these different organizations and is assembled to work

together in a particular ICT4D initiative. The latter will be the main focus of analysis and data collection throughout this research. The highly complex learning processes embedded and unfolding in these layers, both formally and informally, need to be explored from a situational context if we seek to understand what is hindering or facilitating the partnership (Larsson *et al.* , 1998). This is another challenge to be explored here: how to build a context-based collective identity of the partnership aimed at the initiative's common goals. Such challenge must take into account the difficulties of focusing both on the partnership mechanisms and the initiative itself, as well as to balance both respective organizational and individual layers.

Many scholars agree that the issues presented in this section are, above all, a communication challenge (Tennyson, 2003; Hardy et al., 2005; McManus and Tennyson, 2008; Southern, 2015). However, it is difficult to find research that addresses communication as the ultimate issue in effective partnering (Hardy *et al.*, 2005; Southern, 2015). My research builds on a theoretical framework that addresses issues of communication in ICT4D partnerships through a combination of a systemic approach and complex network theory perspectives (Chapter 2, p. 41), as both approaches have been concerned with issues of communication (See Chapter 2, Sections 2.2.1 and 2.2.2, p. 54).

1.5 Final observations

This chapter has outlined the main issues with which this research is concerned. It started by providing a context on mainstream development practices as processes that might generate some of the fundamental mechanisms hindering the implementation and sustainability of development initiatives. It then discussed the role of digital ICTs in such practices, either as potential catalysts or as tools that if not used with a critical view, might also hinder such processes. The subsequent section focused on Brazilian development more generally and then zoomed in into ICT4D practices in the country, where the case studies observed took place. The last section problematizes ICT4D partnerships as the main focus of my research as well as the need for establishing useful guidelines for effective collaborative action in such partnerships.

The next chapter introduces the conceptual framework from which the following main research questions are derived:

> *What are the relationships between network topologies and communication processes within Brazilian multi-stakeholder ICT4D initiatives, and why do they function as they do?*
>
> *What role do individual actions play in forwarding or hindering effective collaboration at the unfolding network interaction patterns of ICT4D initiatives?*

The collaborative framework that this research intends to suggest is aimed to be used within the reality of stakeholders involved. The focus is to assist with tools that develop people's reflective abilities upon some of the issues laid out so far, such as the tension among individual and organizational structures.

2 A Systemic approach to understanding network interaction patterns within ICT4D Initiatives

2.1 Introduction

The first chapter of this thesis outlined its context, first by providing an overview of mainstream development practices with an emphasis on the influence of digital ICTs; second, by providing an overview of the Brazilian context for such initiatives; and third, by summarising the multi-stakeholder character of ICT4D partnerships, emphasizing the importance of understanding collaboration among stakeholders. These social interactions are complex and many models that intend to describe them have been somewhat reductionist, as they have tried to simplify this complexity (Capra, 2002; Chambers, 2004). My earlier work suggested that reduced and simplified perspectives walked hand in hand with a stronger influence of the more structured partner on project processes (Scur, 2005). This chapter establishes a theoretical framework that addresses these issues and aims to provide the possibility for effective collaborative action in ICT4D partnerships through a combination of approaches that are concerned with the critical issue of communication among stakeholder (Sub-section 1.4.1, p. 36).

It is particularly difficult to analyse the social interactions of ICT4D partnerships, since technology increases the complex nature of the interactions. As Benkler (2006:17) argues, 'different technologies make different kinds of human action and interaction easier or harder to perform', and it is difficult to foresee the patterns of adoption of these technologies in the long run, especially if the variety of contexts coming together are taken into account. Capra (2002:165) reinforces such views, arguing that reductionism has at its behest the help of 'ever more sophisticated information and communication technologies, which have now created a profound conflict between biological time and computer time'. He goes on:

> '(…) new knowledge arises (…) from chaotic processes of emergence that take time. Being creative means being able to relax into uncertainty and confusion. In most organizations this is becoming increasingly difficult, because things move far too fast. People feel that they have hardly any time for quiet reflection, and since reflective consciousness is one of the defining characteristics of human nature, the results are profoundly dehumanizing' (Capra, 2002:165).

Decision-makers usually do not have the time or resources to focus on the whole, and they usually therefore concentrate on the economic perspective in the interests of revenue generation. However, if the objective is to envision sustainable well-being for all that is not based only on economic growth (Capra, 2002; Pamlin, 2002; Meadows *et al*., 2004), it becomes crucial to account for individuals' feelings and purposes. In this sense, technology can be seen as a mere instrument that can be used to harness or hinder objectives and purposes; it is the people who have the power to decide how to use technology. In this light, this research is built upon a systemic approach that focuses on the whole, the interaction of the parts and on long term views. This also permits an analysis of the multi-centric and multi-layered social networks formed by ICT4D partnerships. Its main concern, as Blenkler (2006:20) suggests, is 'with actual human beings in actual historical settings, not with representations of human beings abstracted from their settings'.

Section 2.2 explores the evolution of systems thinking and the systemic principles employed in this research. Sub-section 2.2.1 explores the debate of the systemic approach within ICT4D initiatives, and Sub-sections 2.2.2 and 2.2.3 discuss theoretical frameworks that assist in operationalizing this research's methodology, by helping to establish the system's boundaries. Sub-section 2.2.2 thus examines complex network theories and the use of network topology in understanding complex social phenomena; Sub-section 2.2.3 discusses the importance of multi-stakeholder perspectives in creating a common context and collective identity. Section 2.3 then explores the concept of network patterns as a way out of unpredictability. Sub-sections 2.3.1 and 2.3.2 detail such patterns in the social realm, focusing on communication patterns of social networks with clear and established behavioural rules. Section 2.3.3 introduces the emergent organizational character of social networks, such as newly conceived ICT4D partnerships, and the creative potential of such networks. The last section recalls the core questions that this research seeks to answer, which explore the possibilities of harnessing the potentials of networks and communication patterns seen in the previous sections through stakeholder individual actions, with the intent to foster effective collaborative action in ICT4D initiatives.

2.2 A systemic approach: interactions and context

'In modern science, dynamic interaction seems to be the central problem in every field of reality.' (Bertalannfy, 1977:125)

The history of systems thinking does not follow a linear path. The term has been used in many different disciplines with many different connotations that have meant that conflicting models have arisen (Checkland, 2000; Hammond, 2002; Jackson, 2003; Andrew and Petkov, 2003; Turpin, 2012). It is not possible here to provide a comprehensive overview of the evolution of systems thinking within the scope of this research due to such fragmentation. Rather, this section briefly synthesizes the most important landmarks in the evolution of the systems debate to provide the necessary understanding of the evolution of my particular theoretical framework.

This research intentionally examines ICT4D partnerships within a holistic perspective as diverse social networks that comprise systems of various orders that make them not as comprehensible when observed from a reductionist perspective (Chambers, 1997; Andrew and Petkov, 2003; Turpin, 2012). In classical science, phenomena are often reduced to elementary units and investigated independently from each other. One basic tension between traditional science and holistic approaches is thus between the parts and the whole. When observing phenomena through their isolated parts, the results are different from when the dynamic interactions of the parts are observed (Capra and Luisi, 2014). Von Bertalannfy (1977) suggested that classical science's Cartesian vision had not been satisfactory regarding technological advances in several disciplines, and as a result, several of those disciplines started focusing on the whole, instead of the isolated parts. They started to acknowledge that changes in one component of the system would inextricably affect others in various, often unpredictable ways (Bateson, 1979; Escobar, 1992; Chambers, 1997; Pamlin, 2002; Capra, 2002; Slater *et al*., 2003; Meadows *et al*., 2004). These included many branches of the social sciences such as Marxist, structuralist, ethnomethodology or critical theories, which focus on holistic and social rules of behaviour and underscored the central importance of language and communication (Turpin, 2012). Differences among such holistic approaches arise from the combination of factors that will build their respective conceptual frameworks. These might include the theoretical paradigms that they are built upon, the interpretations of

what is the whole and its components, the greater or lesser relevancy of these components, the perspectives from which the wholes are observed, and the focus or not on influence of the outside environment to this whole.

The next paragraphs explore the systemic approach in which this research's conceptual framework is built upon. A systemic approach does not offer any particular holistic conceptual framework, but rather exposes the need for careful assessment of theoretical premises, approaches and methodologies that are more appropriate to deal with the problem at hand (Checkland, 2000). In this light, I focus on a systemic approach for three main reasons: first and foremost, the possibility of acknowledging emerging interaction patterns on different systems (Bateson, 1979; Capra and Luisi, 2014); second, the valuable contributions that come from recent developments in systems thinking that focus on stakeholders' multiple perspectives; and third, the approach has not been sufficiently explored in the field of ICT4D initiatives (see Sub-section 2.2.1 below). The next paragraphs and sections assess the systemic theoretical premises that I find most appropriate for dealing with the problematic exposed so far and assist in the assembling of this research's methodology. Table 3 below summarizes general characteristics of the systemic approach embedded in this research so as to illustrate its underlying premises in opposition to a Cartesian approach, before going into an in-depth explanation of the systemic principles that will be used throughout.

From Cartesian Thinking	To Systemic Thinking
From the parts	to the whole
From objects	to relations
From measure	to mapping
From quantity	to quality
From structure	to processes
From objective science	to epistemic science
From Cartesian certainty	to approximate knowledge (i.e. via proxy measures)

Table 3: Adapted from Capra and Luisi (2014:113)

Von Bertalannfy (1977) assembled his General Systems Theory as several of these holistic models and approaches started to emerge across disciplines. His theory aimed to recognize the existence of general principles across systems, regardless of the type of system and its relation to other systems (Watson and Watson, 2011). However, as noted by Von Bertalannfy himself (1977:30), 'the methodological problem of systems theory consists in preparing itself to solve problems that, compared to the analytical and somatory problems of classic science, are of a more general nature'. As such, diverse interpretations and several different models emerged from the attempts to develop systemic conceptual frameworks and methodologies across different fields. Some of these concepts and models became particularly popular in the 1960s and 1970s, especially in the field of management sciences (Hammond, 1997). However, these models were usually based on hard systems theories, derived from engineering disciplines, in which systems were perceived as objective aspects of reality, independent of the observer, and therefore appropriate for solving well-defined technical and organisational problems. As such, this branch of systems theory was increasingly criticised for acting as mechanisms that promoted control over the systems where they were applied (Drover and Schragge, 1977; Gregory, 1980; Hammond, 1997). As argued by Hammond (1997:4):

> 'Systemic models came to be viewed with increasing skepticism with the emergence of postmodern critiques of totalizing schemes (…). Robert Lillianfeld's argument in The Rise of Systems Theory (1978) that the societal claims of the systems thinkers served only to justify the claims to power and prestige of the technocratic elite, is characteristic of more recent reactions to systems views among social scientists. Systems thinking has come to be associated with the highly rationalized technological and institutional systems of the late twentieth century, and the concept of system has become synonymous with control and totalization'.

However, the past two decades have seen an increase in literature discussing new interpretations of the basic premises of systems thinking. One example of these is the shift of focus from simplifying and synthesizing a system's processes to learning from and within these processes. Moreover, these new interpretations also fundamentally differ from those of the 1960s and 1970s, because of the new focus on multiple perspectives of the interactions and contexts of these systems (Bateson, 1979; Andrew and Petkov, 2003;Turpin, 2012; Capra and Luisi, 2014). In this light, this research's

systemic approach is first derived from notions developed by the second cybernetics generation of researchers in the mid-20th century. It begins by explaining the principles that will be directly used here such as *openness*, *recursiveness*, *feedback cycles*, *self-organization* and *emergence*. The first research generation was created by Wiener (1948) and focused on the emergence of stability and systemic equilibrium out of circular causality, namely retroaction (Von Bertalannfy, 1977). The second generation of cybernetics, however, focused on the *unpredictable emergence* of complex systems out of circular causality, which they named recursivity (Rasch and Wolfe, 2000). These included scholars from a wide range of disciplines: biologists such as Von Bertalannfy (1977), Maturana and Varela (1992); physicists and mathematicians such as Eigen (1971), Prigogine (1989) and Capra (2002); social scientists such as Bateson (1979) and Luhmann (1995); constructivists such as Von Foerster (2003); and philosophers such as Flusser (1999). Cybernetics was, in the first place, an attempt to define a science that would be able to study biological, mechanical and social systems under the same umbrella (Hayles, 1991) focusing especially on systems of control. However, according to the second generation, systems do not reach a final equilibrium or 'stability', but are rather ever-evolving unpredictable and complex. In other words, they are difficult to control. Hard systems approaches were seen as not being suitable to deal with soft and messy problems. Anthropologists Bateson and Mead (1973) constructed Figure 4 to contrast first and second-order cybernetics during an interview in 1973[3], so to exemplify this shift:

> '(. . .) essentially your ecosystem, your organism-plus-environment, is to be considered as a single circuit.' (Bateson, 1973)

[3] Interview with Bateson and Mead, *CoEvolution Quarterly*, June 1973. (http://www.oikos.org/forgod.htm, accessed in 22.04.2015)

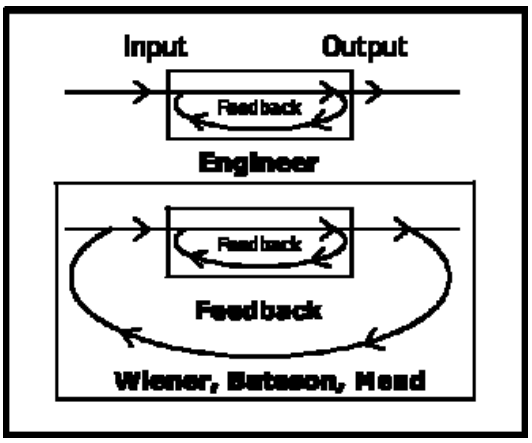

Figure 4: Bateson and Mead's depiction of the contrast between 1st and 2nd order cybernetics (1973)

This systemic perspective considers a system to be open, meaning that outside forces might trigger instability but they will not necessarily determine what will happen within the system, since that will depend also on many other (internal) elements, such as its development history, its initial openness to disturbances, its flows and feedbacks in its interconnections (Von Bertalannfy, 1977; Capra, 2002). What is predictable, though, is its recursive character: a recurrent emerging order out of instability, namely the systemic principle of self-organization. In this scenario, the system's configuration and components tend to evolve towards self-organization, but never reaches a final equilibrium, as there are constant disturbances both from the environment and from within. New system configurations will evolve through highly dynamic, chaotic, non-linear, subjective and ever-evolving learning processes (Bateson, 1979, Capra, 2002 and Meadow *et al*, 2004). For illustrative purposes, if a community radio project is implemented within a Brazilian native Indian tribe in the middle of the Amazon that has never seen a radio before, the members of the tribe will probably react to it in different ways. So will the people implementing the project. These processes will affect those individuals and they will leave their present status to become something else from that point on, and that will affect other members, and so on. The stakeholders of that project formed a new system; the tribe, as a system itself, suffered an outside disturbance; such disturbances do not dictate the changes that the system undergoes, but trigger them.

Open systems operate far from an equilibrium. Von Bertalannfy (1977) therefore recognized that classic principles of thermodynamics, which deal with closed systems in

equilibrium or close to equilibrium, were not appropriate to describe such open systems. Such hard systems thinking approach caused issues of over simplification (Drover and Schragge, 1977; Checkland, 2000). In the 1940s, there were no mathematical techniques to expand the laws of thermodynamics in that direction (Capra and Luisi, 2014). It was only in the 1970s, through the work of Prigogine (1989) and others in the field of complexity mathematics that this was feasible and from that, a newly found principle started to fascinate system theorists, namely the principle of self-organization. According to Capra and Luisi (2014), it is necessary to understand first the importance of patterns in order to understand the principle of self-organization. Systemic properties emerge from a series of ordered interactions, and such organizational pattern is inherent in all living systems. When an organism dies, it is because its patterns of interactions have died:

> 'Whenever we find living systems – organisms, parts of organisms or communities of organisms – we are able to observe that its components are arranged in a networked fashion. Whenever we look at life, we look at networks.' (Capra and Luisi, 2014:130)

A system's self-organization is an ever-evolving unpredictable process, 'a vast communication system' that will control the 'growth and differentiation' (Bateson, 1979:10) of that system by giving an on-going different form to it. It is not possible to control this process; hence, the importance of context learning (Bateson, 1979; Griffin et. al, 1998), because reality is not a given (See also Section 2.3.3, p. 67). Within this systemic perspective, the communication processes of these systems generate feedback cycles, another important systemic principle to this research. In the example of the Brazilian Indian tribe above, if the communication processes are active, the new information might spread non-linearly through the network and the community might self-organize by creating new behavioural rules that incorporate the new element inserted (Radio Technology). Figure 5 below illustrates how feedback cycles in systems lead to the notion of self-organization as a recurrent process (Capra, 2014; see also Section 2.3.3, p. 67).

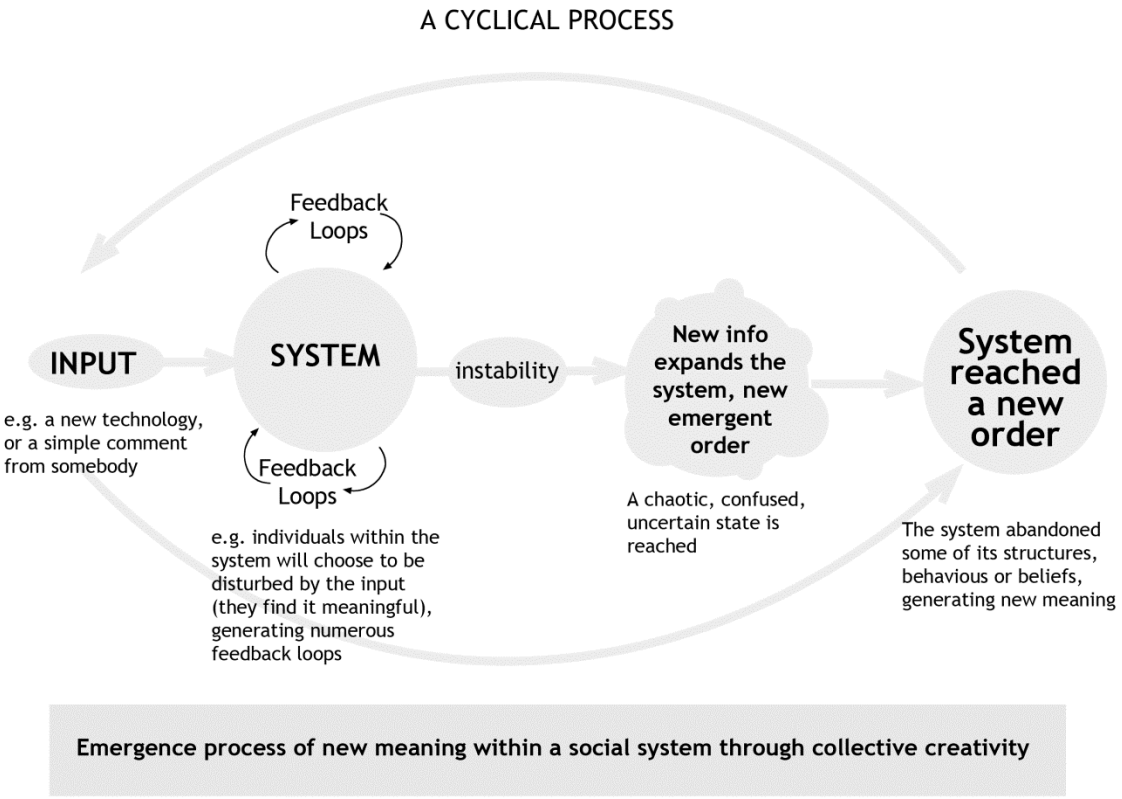

Figure 5: Based on Capra's (2002) description of a system's self-regulation (recursiveness) (Illustration by the author)

In short, the systemic approach to explore ICT4D initiatives collaboration patterns is an open one, focusing on the interaction of the parts through communication feedback cycles leading to a recursive self-organization of the systems (eg. The initiatives) observed. Such a holistic perspective is necessary, because 'scholars in all fields need to be able to situate their work in a world of tightly interlaced and "hybrid networks" (…) of human, technological, organic, and informational systems' (Rasch and Wolfe, 2000:10; see also von Bertalannfy, 1977; Latour, 1994; Kothari, 2005; Benkler, 2006; Capra and Luisi, 2014). ICT4D initiatives particularly reflect this world of hybrid networks because of the different contexts that come together in these partnerships.

This section has summarised the reasoning for choosing a systems thinking approach to address the issue of stakeholder collaboration of ICT4D Initiatives. Within this systemic approach, the objective of the research and the systems boundaries need to be well defined in order to detail which methodologies are most suited. Moreover, as systemic approaches are by nature methodologically pluralist and harder to measure, they do not enjoy great academic acceptance (Kapsali, 2011). In this light, the next section provides

an overview of the use of such approaches for ICT4D initiatives, and the subsequent sections provide the rationale that will assist academic rigour within this research.

2.2.1 A systemic view of ICT4D initiatives

> '(…) the systemic understanding of (…) social networks can contribute significantly to clarifying the dynamics of organizational learning.' (Capra, 2002:114)

This section delimits the systemic conceptual framework that will be employed to analyse the ICT4D initiatives that I studied, and it provides a short overview of implications for the methodology that is then further developed in Chapter 3 (p.76). To date, there has been rather little systemic approach-based ICT4D (Turpin and Alexander, 2014). Many of them reason that systemic approaches envision the complexity and uncertainty of ICT4D initiatives and allow for multiple perspectives to emerge (see for instance Andrew and Petkov, 2003; Gunawardena and Brown, 2007; Petkov *et al*., 2007; Kapsali, 2011; Turpin, 2012). Moreover, their focus is usually on the use of systemic approaches to help with managerial processes for achieving project outcomes (Turpin and Alexander, 2014) and they do not often seek general patterns among such initiatives, as it is the case of this particular research.

In my research, I expect to deliver on two main goals. The first is a conceptual one, which is to explore the communication feedback cycles in ICT4D initiatives by looking at the stakeholder interaction patterns (self-regulation) that emerge within the different systems. The second is a methodological, empirical and practical one, which is to suggest guidelines to ICT4D stakeholders that might assist them in the analysis of the whole and their own interactions with the objective to improve collaboration mechanisms. Managerial processes are part of, but not the only perspective, in my research. I am interested in collaboration and individuals' senses of purpose, as much as the project outcomes, delivery and sustainability. With such goals in mind, I explored the ways in which past research has been used and what could be applied to my own objectives and also contribute to the on-going debate.

Turpin and Alexander (2014) have given a comprehensive overview of the use of systemic approaches in ICT4D. They have searched over a thousand papers in

mainstream ICT4D publications, such as *Information Technology for Development*, *Information Technologies* and *International Development*, and the *Electronic Journal of Information Systems in Developing Countries* (EJISDC). Among these, a total of only nine papers referred directly to systemic approaches. According to their review, the use of systemic approaches in ICT4D is fragmented and 'it does not provide a clear foundation for future studies to build on' (2014:12).

Nevertheless, it was useful to examine this literature for lessons learned and to understand how I could better contribute to the debate of ICT4D and systemic approach-based research. A major concept previously advocated has been that ICT4D initiatives usually deal with messy contexts and not-well defined problems). As such, early systems approaches have not previously been seen as being appropriate, since they focused on well-structured problems, usually applied to project management theory (Andrew and Petkov, 2003; Gunawardena and Brown, 2007; Kapsali, 2011). Later development on systemic approaches focused on diverse groups of stakeholders and cultures and put emphasis on learning and accommodating stakeholder's interests (Turpin and Alexander, 2014). In order to accomplish this, it is necessary to define the conceptual systemic framework within this research in order to develop a rigorous methodological approach. The next paragraphs describe how I shape such a framework, by focusing on the relationships between stakeholders as well as individual's interests and actions. An ICT4D initiative involves highly complex systems, such as technological, social or physical. I focus on the social communication perspective as one of the aspects considered to be a main challenge of effective partnering that has not yet been sufficiently explored (see Chapter 1, Sub-section 1.4.1, p. 36). Other dimensions could have been examined, such as the technological one, but the focus here is specifically on the communication processes of the networks involved in the process of project evolution. As detailed next, these processes of information transfer among individual network nodes are considered the driving forces of the network's self-organization in my framework (Luhmann, 1995; Capra and Luisi, 2014).

One challenge posed by social systems lies in how to apply the concept of self-organization (see Section 2.2.1 above), once they exist both in the physical and social domain. Capra (2002) addresses this issue by looking at the communication processes of a given social system as mechanisms that will produce a shared system of beliefs, values

and knowledge (a common context of meaning), which is in turn sustained by multiple cycles of communication feedback. As such, the social system generates its own boundaries of meaning. This concept is similar to Luhmann's *Theory of Social Systems* (1995), largely influenced by the work of 2nd order cyberneticists such as biologists Maturana and Varela (1992), the physicist Prigogine (1989) and the constructivist von Foerster (2003), in which he looks at social systems from the social perspective only, and considers the communication processes of these systems as their feedback cycles.

It is crucial to account for the complex nature of human communication to complement this concept. This involves a continuous ordination of behaviours, and involves conceptual thinking as well as symbolic language to generate mental models. Mental models concern the capacity of the human consciousness to form and retain abstract images of material objects and events (Bateson, 1979; Larsson et al., 1998; Capra and Luisi, 2014). Accordingly, social systems will generate these contexts of meaning, but also behavioural rules and rigid social structures (see also Section 2.3.2 below).

> '(...) to be able to retain mental images allows us to choose among several alternatives, a capacity which is necessary for the formulation of values and social rules of behaviour.' (Capra and Luisi, 2014:368)

One of the main criticisms of such a systemic approach is that it does not offer a clear prediction path (Drover and Schragge, 1977; Von Bertalannfy, 1977; Bateson, 1979; Capra and Luisi, 2014) and problems of structural complexity arise, with an overlapping of systems and great difficulty in defining the boundaries of these super- and sub-imposed systems. This issue, though, can be addressed by analysing only when the context and the nature of the system's relationship are exposed. Systemic thinkers recognize various levels of complexity operating and the concept of contextualization helps to fill this gap (Bateson, 1979;; Capra and Luisi, 2014). Therefore, it is possible to define specific methodological principles that can be used by observing social systems from a perspective of a defined context (Keiding, 2011; Kapsali, 2011; Turpin, 2012).

> '(...) without context, words and actions have no meaning at all. This is true of all communication. That which tells the sea anemone how to grow and the amoeba what it should do next (...)' (Bateson, 1979:15)

In light of the above, this research complies with a systemic view of life in the social domain that comprises a fourfold structure, as proposed by Capra (2002). This structure derives first from the biological systemic view proposed by Maturana and Varela (1980). To them, three basic dimensions delimit a biological system: an organized structure, namely the system's *form*; the feedback cycles of interactions, namely the system's *processes*; and material embodiments, namely *matter,* which is generated in the process, changing the structure recursively. Capra (2002) adds to this model the social domain with a fourth dimension: the system's *meaning* (see Figure 6 below), which originates from human capacity of retaining abstract mental models. Capra (2002) states that the production of the system (matter), will not only be *material embodiments*, such as a written report regarding project outcomes or evaluation reports, but also *non-material embodiments*, such as ideas which are formed within the mind (*meaning*) which are a non-physical factor (Varela *et al.*, 1991).

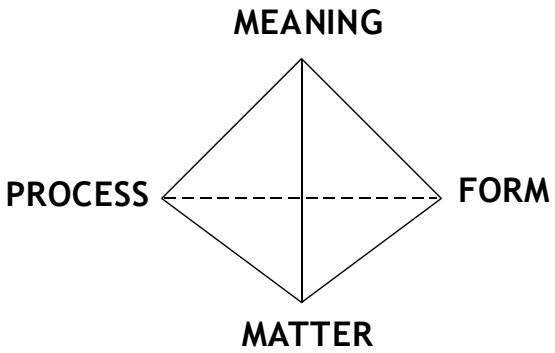

Figure 6: Capra's systemic understanding of life in the social domain (2002, p. 74)

This fourfold structure (see Figure 6 above) composes the three dimensions that will assist in establishing the boundaries of the ICT4D initiatives systems that will be observed. These dimensions are, respectively:

- *Network Structure*
- *Communication level*
- *Content: Knowledge production and exchange*

The first dimension, namely *Network structure*, corresponds to the *form* of the system. The second dimension, namely *Communication level,* corresponds to the processes which give the system its form. The last dimension, namely *Content: Knowledge production and exchange*, embeds the two last components of the fourfold structure of the systemic view of life in the social domain. It concerns both the subjective realm of *meaning* and production of physical *matter*, such as project documentation. These three dimensions are dissected into proxys that will provide the systemic thinking premise of approximate knowledge as opposed to the cartesian objectivity one (see Table 3 above; Capra and Luisi, 2014). These proxys are exposed in the next sections below (2.2.2 and 2.2.3) and detailed further in the methodological Chapter (p. 76).

The next section explores notions of complex network theory in order to address the first dimension, the *Network Structure*, with the objective of mapping the stakeholders' network of the ICT4D initiatives. In accordance with the systemic approach employed in this research, this mapping process was done in collaboration with key project stakeholders in the in-depth case studies (see also Sub-section 2.2.3, p. 58).

2.2.2 On the relevancy of network topology

> '(…) having a faithful drawing (*of the car*) (…) does not bring us any closer to understanding the processes that created the car in the first place. For that, we need to know how to build one just like the original. This is exactly what the various evolving network models aim to accomplish. They capture how networks are assembled by reproducing the steps followed by nature when it created its various complex systems. If we correctly model the network assembly, our final network should closely match the reality. Thus our goals have shifted from describing the topology to understanding the mechanisms that shape network evolution.' (Barabási, 2003:91)

A key characteristic of the systemic approach embedded in this research is the openness of the system, which brings structural complexity and boundary issues (Bertalannfy, 1977; Bateson, 1979; Capra and Luisi, 2014; see also Section 2.2.1 above). As such, its applications are of a complex and difficult nature, requiring much energy and time to be digested (Bertalannfy, 1977, Luhmann, 1995; Capra and Luisi, 2014). Previous ICT4D and systems thinking literature also acknowledge such difficulties (see Andrew and Petkov,

2003; Gunawardena and Brown, 2007; Petkov *et al*., 2007; Kapsali, 2011; Turpin, 2012; Turpin and Alexander, 2014).

Many scholars also argue that the world is increasingly functioning in a networked fashion as opposed to a hierarchical one, especially with the advance of information technologies (Castells, 1996; Benkler, 2006; Barabási, 2009). This is particularly so with ICT4D initiatives. Benkler (2006:18), for example, argues that the technical and economic characteristics of computer networks and information are the core of this shift to a networked society. Such shifts affect work dynamics and collaboration among people. For some, this is a great opportunity to forward individual efficacy and collective action (see for instance Mansells and Wehn, 1998 or Benkler, 2006) and it is one of the objectives of this research to analyse if this is indeed the case, through a systemic approach.

Social Network Analysis (SNA) has become well established in the social sciences since the 1980s, used especially in ICT project management, as a tool to map stakeholders at earlier stages of the project and define strengths for team formation in early phases of ICT projects (Borgatti et al., 2009; Mesicek and Svoboda, 2012). In ICT4D research, it is common to engage in the use of mapping tools in participatory action research (Chambers, 1997; Tacchi, 2003; Brunello, 2015). In my understanding of systems thinking, such participatory methodologies are considered systemic approaches that can be combined with other methodologies in order to assist research goals (see Chapter 3, Section 3.4, p. 100; Jackson, 2003). In SNA and development literature (especially ICT4D) network mapping is an analysis tool usually used to explain effective or ineffective team performance and collaboration (see for instance Figueroa *et al.*, 2002; Wang *et al.*, 2011; Mesicek and Svoboda; 2012). Moreover, SNA in the social sciences tends to focus on the individual, their position in the network and the consequences of this arrangement to him or her and the network as a whole. For instance, nodes with the same skills might perform differently depending on their relationships and position in the network (Borgatti *et al.,* 2009). Whereas in the physical sciences, recent development in complex network theory focuses on the emergency of general principles across network structures (Borgatti *et al.,* 2009; Barabási, 2013), these principles (see below) are being tested in a wide range of large complex networks, including social ones (Recuero, 2005; Barabási, 2010; Centola, 2015).

I maintain that the core of the social science approach to social network analysis is the particular configurations of the social systems portrayed (see Chapter 4, p. 125). However, I will embed some complex network principles in the analysis of my small social networks. There are two main conceptual similarities between complex network theory and the systemic approach in which I am interested. The first is the mapping of the whole, with a focus on the interaction (networks) or relationships (systems) of the parts. The second is the search for common patterns of these interactions/relationships (Bateson, 1979; Wassermann & Faust, 1994; Capra, 2002; Barabási, 2003; Recuero, 2005). According to Borgatti *et al.* (2009), there is a gap between social and physical sciences' regarding the use of network theory and my research intends to contribute to a debate where the two fields could bridge their respective approaches. Furthermore, the terminology used in this research must be defined more clearly, since network theory has been used in many different fields, particularly communications, mathematics, and physics, and in many different ways. Chapter 3 (see Sub-section 3.5.2, p.121) provides an in-depth account of how this approach was used practically in my research. In this section, I provide an overview of the terminology I will employ, so that the next sections of this chapter are clear and in accordance throughout.

Essentially, networks comprise *nodes* and *links*. Nodes are the basic elements that comprise a network, and links are the connections between these nodes (see Figure 7).

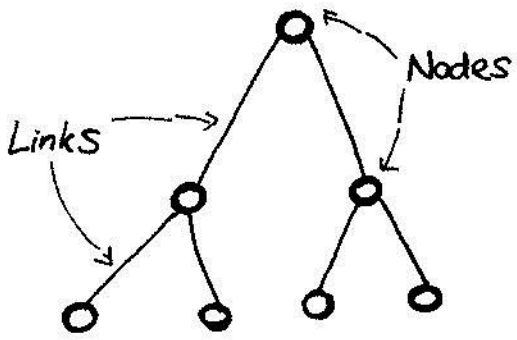

Figure 7: Depiction of a network and its components. (By author)

The first network models, such as the Erdos-Renyi Model (1959) introduced in the late 1950s, were randomly linked. In an Erdos-Renyi model, linking is random and dominated by averages; if a network was too complex to be understood in simpler terms, it would be described as a random network (Barabási, 2003). The thought that complex dynamic networks were fundamentally random dominated until the concept of network clustering emerged in the 1990s (Watts and Strogatz, 1998; Barabási, 2003). As many computational experiments showed, real world networks are not random. As the network grows, general properties start to emerge regardless of network size (Watts and Strogatz, 1998; Wang and Chen, 2003; Barabási, 2011). Barabási (2003) coined this type of complex network a *scale-free network*.

In opposition to random linking, scale-free topologies are characterized by the observation that nodes being added to the network tend to link to the more connected nodes, a network property called *preferential attachment*. As time passes and the network grows, this *clustering effect* causes highly connected *hubs* to emerge. Network hubs are one of the main features of the scale-free model. These high-degree nodes are usually older nodes in the network that have more time to acquire new links than newly added nodes. This is known as the *rich get richer* principle (Barabási, 2003; see Figure 8 below).

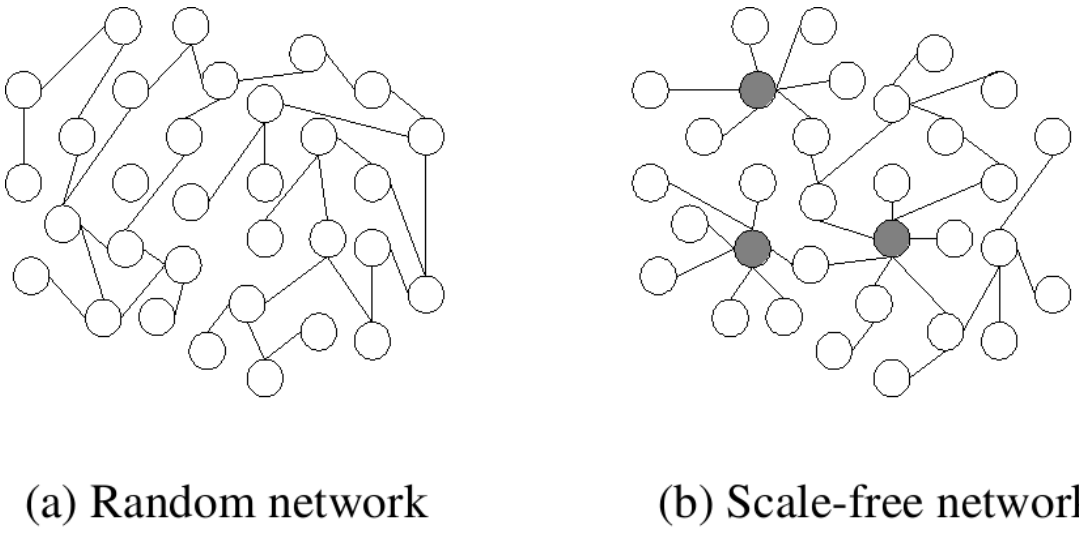

Figure 8: Comparison of (a) Random Network and (b) Scale-free network. The highlighted nodes are the emerging highly connected hubs. (Source: https://upload.wikimedia.org/wikipedia/commons/7/77/Scale-free_network_sample.png)

As Barabási (2003) argues, understanding some of the laws that govern such real world networks as well as how small changes in topology allow new possibilities to emerge, is crucial to understand the mechanisms that shape a network's evolution. Chapter 3 (p. 76) details the properties used, such as preferential attachment and the clustering effect. Chapter 4 (p. 125) provides a visualization of these network properties combined with the qualitative approaches used, offering insights regarding how the network structures might be affecting communication processes and vice-versa, two of the three dimensions of the systemic view of the ICT4D initiatives of this research.

Chapter 1 (Section 1.4, p. 33) has already highlighted some of the struggles facing ICT4D initiatives, and research using approaches similar to the ones assembled in my research are usually applied at the planning stages (Checkland, 2000; Kapsali, 2011), or the intervention phases of these projects (Checkland, 2000; Turpin and Alexander, 2014). Brazilian ICT4D initiatives follow the common path and engage very little in the planning of partnership mechanisms (Chapter 1, Sub-section 1.3.2, p. 28 and Chapter 3, Section 3.4, p. 100). As such, my focus is in harnessing the structures and communication processes already in place with the intention to create an on-going process for process adjustment. In order to create such on-going process, the next section explores the relevance of multi-stakeholder perspectives in this approach.

2.2.3 Multi-stakeholder perspectives

'(...) the world partly becomes - comes to be - how it is imagined.'
(Bateson; 1979:223)

Multi-stakeholder interpretation is a desired approach for gaining insights into complex socio-technical problems in many social science disciplines (Petkov *et al*., 2007). This is critical in the case of my research, since I explore insights for more effective collaborative action on mechanisms of ICT4D partnerships (see Chapter 1, Section 1.4, p. 33). A multiple perspective is accounted for in an open systemic approach, but this also raises complexity, as it raises boundary issues (Ulrich, 1989; Hammond, 1997; Capra, 2002; Alexander and Turpin, 2014). Following the systemic approach presented here and the focus on communication processes among individual stakeholders, the boundaries of the systems observed are formed through the meaning dimension of the fourfold

structure presented in Section 2.2.1 (p. 50). The building of such contextual meaning is reinforced through a pluralist approach that combines qualitative methodologies that account for a reality built by its actors borrowed from SNA (Barabási, 2003; Borgatti *et al*., 2009; Centola, 2015) and participatory and ethnographic research (Chambers, 1997; Tacchi, 2003). The methodologies are further detailed in Chapter 3 (Section 3.2, p. 76)

My research has two main goals with respect to multi-stakeholder perspectives. The first is to gather multiple perspectives so to understand the relationship between the network topologies and the communication processes within the initiatives and explore how certain behavioural patterns of the network's organizational structures emerge (Bateson, 1979; Giddens, 1990; Capra, 2002; Benkler, 2006; Lévy, 2009). The second is to share the multiple perspectives among stakeholders and pursue the development of a collective identity or knowledge towards the initiative common goals (Larsson *et al*. 1998; Hardy *et al.*, 2005; Southern, 2015). The next section explores the concept of *patterns* embedded both in systems thinking and SNA approaches as a way out of unpredictability.

2.3 Patterns: A resolution of unpredictability

> 'The mind, basically, is a pattern-seeking machine (…) we tend to seek patterns (…) and then we tell stories about them. I think we're pretty much conditioned to look for a pattern and to try to interpret it in terms of certain stories.'
> (Gould, 2000[4])

Strategies and predictive paths are involved in the planning of ICT4D initiatives so that desired outcomes can be ensured. Despite the existence of a number of methodologies and guidelines shaping the path of success for such initiatives (see Chapter 1, section 1.2, p. 18), there is sometimes a tension between stakeholders and institutions involved which might come from having different interests, agendas, organizational structures or culture. It is impossible to identify all of the variables that will influence a project's processes in advance. Even if it were possible to do so, their varying behaviour would still need to be taken into account (Centola, 2015). It is not possible to predict with certainty the occurrence of such events; what we can do is to predict their probability (Barabási, 2011; Capra and Luisi, 2014). Systems thinking and complex network scholars

[4] http://www.brainpickings.org/2013/09/10/stephen-jay-gould-2000-interview/, accessed in 22.04.2015)

agree that the emergence of patterns is a characteristic of complex systems especially at a large scale (von Bertalannfy, 1977; Bateson, 1979; Maturana and Varela, 1980; Barabási, 2010; Capra and Luisi, 2014). Figure 9 , for instance, illustrates network patterns found in phenomena of various natures.

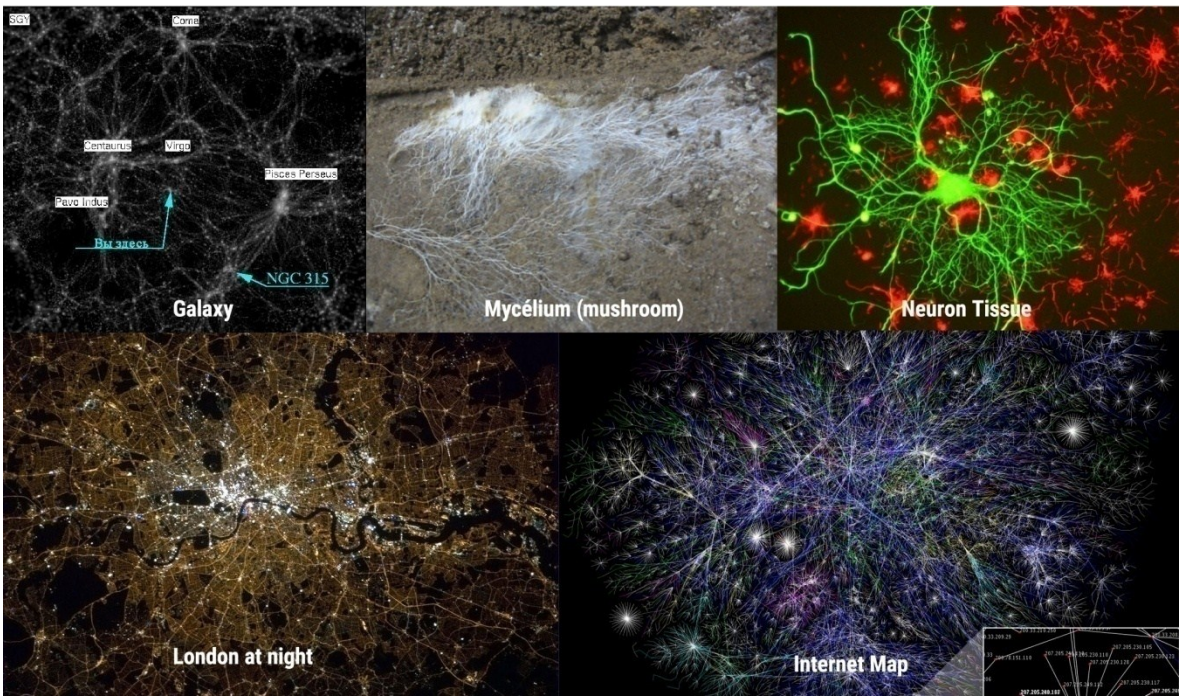

Figure 9: Example of network patterns found in phenomena of various natures (Assembled by author, source: Google)

With the above in mind, the systemic fourfold structure laid out in Section 2.2.1 (p. 50) generated the three dimensions that will serve as research parameters for the identification of common patterns among the different initiatives: the *network structure* (form), the *communication level* (processes) and *knowledge production and exchange* (matter and meaning). They are the starting point to predict certain behaviours in particular environments, thus learning from different experiences and adjusting project processes accordingly (Bateson, 1979; see Chapter 3, p. 76).

2.3.1 Finding patterns on social networks

An account of the changes and dynamics of complex social networks is still in the making, despite advances in research on complex network models in different fields such as disease spread and internet topology (Barabási, 2002). If the details of the depicted interactions could be collected (Recuero, 2005), this could make a difference in the analysis of the patterns to be looked upon in this research. As discussed in the

previous Chapter (p. 16), I am concerned in assessing learning processes that form mental models embedded in two overlapping realms: the organizational, and the individual. In order to do this, I am interested in exploring Bateson's systemic concept of logical typing (1979). He was interested in the formation of contexts of social networks through a dialectical mechanism between typologies (form) and classifications (processes) where one determines the other and vice-versa, thus creating what he called 'a zigzag ladder of dialectic between form and process' (Bateson, 1979:211).

As illustrated by Figure 10: Calibration and Feedback Ladder, adapted to this research (illustration by author), the procedure of inquiry is punctuated by an alternation of the feedback cycles between the *form* and the analysis of the *processes* shaping the form. *Form* relates here to the *Structure of the Network* dimension; and *processes* embed both the *Communication level* and *Knowledge Production and Exchange* dimensions.

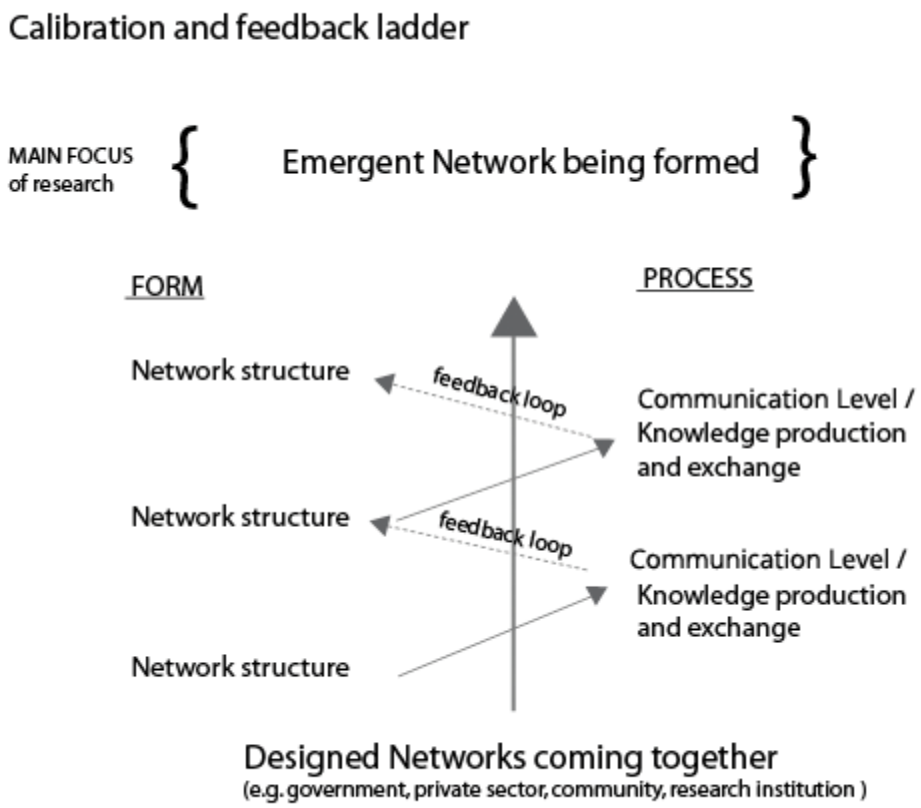

Figure 10: Calibration and Feedback Ladder, adapted to this research (illustration by author)

He discusses two types of change in systems: one happening at the collective level, such as genetic changes happening from one generation to another, and the other change at an individual level, which he calls somatic change, in which being, learning and thinking are part of it. Barabási (2003) reinforces this view, by attesting that at an individual level, it is almost impossible to predict our actions; as a group, on the other hand, we tend to follow strict patterns (see Sub-section 2.3.2 below), because linking is never random in real world networks (see Sub-section 2.2.2 above). To illustrate this, in an organization such as the government of the State of São Paulo in Brazil (a stakeholder in one of my case studies), the population level is the institution (collective level) as a whole, and the staff members are the individuals. The changes happening at both levels are stochastic in nature (Bateson, 1979; Barabási, 2003; Capra and Luisi, 2014). This means that to the individual, the changes s/he will accept to undergo will come through learning of the random events that affect the person, through his/her ability of self-correction (within a learning act) and s/he will selectively choose what will make a difference, according to his/her history. The government institution at the collective level will also be affected by random events, but as a more rigid structure, with clearer organizational rules compared to the individual level, it will undergo different changes. When change does occur, some individuals will be detached and others will be incorporated according to this new state:

> 'What has survival value for the individual may be lethal for the population or for the society. What is good for a short time (the symptomatic cure) may be addictive or lethal over long time.' (Bateson, 1979:160)

In an attempt to solve the above conundrum, Bateson (1979) created a calibration and feedback ladder depiction. This procedure of inquiry is punctuated by an alternation between the study of the form and the description of the processes shaping the form. The objective was to achieve qualitative analytical rigour, by minimizing errors in logical typing from one level to another. In other words, Bateson is observing and classifying the feedback loops (interactions) of the systems he observed. According to the systemic view proposed in Section 2.2.1 (p.50), the first dimension corresponds to the form; the second and third dimensions correspond to communication processes, and knowledge exchange respectively. Drawing from this approach, I will iterate between them with stakeholders with the purpose of generating critical feedback cycles on the systemic view of the ICT4D

initiatives they are part of, so as to acknowledge differences in logical typing. Section 3.2 in Chapter 3 (p. 76) explores this method practically, and below I summarize a glimpse of the research proxys that are detailed in that Chapter.

The starting point in establishing the contexts of the ICT4D initiatives observed will be to map stakeholders both at the organizational and individual levels. This concerns the first dimension of the systemic view of ICT4D initiatives, namely the form or structure of the systems. The research proxys that will compose the systemic network dimension are divided in two: *Definition of Partners* and *Network Cohesion*. The proxy *Definition of Partners* is divided further into three proxys: *Type of Partners*, *Partners as Organizations* and *Partners as Individuals* and are detailed further in the methodological chapter (see Section 3.2.1, p. 78).

The second systemic dimension, *Communication Level*, assists in analysing the level of on-going dialogue shaping the values and behavioural rules that bound the networks (Capra, 2002; Figueroa *et al.*, 2002).Research proxys were defined so to assist in the definition of particular patterns usually found on ICT4D initiatives regarding this dimension. These were drawn from relevant literature concerning the value of communication for social change and good practices for ICT4D partnerships, and include *Expressions of Shared Understanding* and *Patterns of Behaviour*. The first is about measuring the level of consensus within the group; and the second concerns the mental models that are present, created or brought upon by the stakeholders through *communication processes* and *meaning* generated (Bateson, 1979; Capra, 2002; Barabási, 2011; Centola, 2015). They are further detailed on the methodological chapter (see Section 3.2.2, p.80).

The last dimension embeds two processes of the fourfold structure of the systemic view of life in the social domain established in Section 2.2 (p. 43) and depicted by Figure 6. It concerns both the subjective realm of *meaning* and production of physical *matter*, such as project documentation. This dimension acknowledges the mental models that trigger the patterns of behaviour identified at the *Communication Level* dimension. The three main proxys for *Content: Knowledge Production and Exchange*, drawn from literature in the field concerning the value of the formation of a collective sense of purpose among stakeholders and project documentation processes, namely *expressions of individual and shared interests*, *monitoring and evaluation processes* and *sense of collective identity* are

detailed further on Section 3.2.3, p.82. For systematization purposes, the networks in my research are pre-categorized drawing on literature in the field as follows: the networks will be considered either to have an *emergent character*, in the sense that their structures are not so well defined, or a more *designed character*, in which rules of behaviour and relationships of power are more consolidated than the former. The next two sections explore the differences between these two types of networks respectively.

2.3.2 On the stability of designed networks

Complex social networks are dynamic and change over time, but it is possible to acknowledge the emergence of certain behavioural patterns, especially at collective or organizational levels. These patterns provide important insight for their comprehension (Thacker, 2002a, Recuero, 2005; Barabási, 2010; Centola, 2015). For instance, social networks present intrinsic behaviour patterns that forward control from one system to another (Habermas, 1987; Chomsky, 1997; Capra, 2002), such as clusters of trust, a socially constructed nature of subjectivity or a reduction of complexity via social consensus (Giddens, 1990). Such control patterns are present in many ICT4D multi-stakeholder partnerships (Chambers, 1997; Tacchi, 2003; Scur, 2005).

Giddens (1990) reinforces this by arguing that it is because of individuals' trust on the systems that they exist as they are. According to him, mechanisms of trust are established based on the faith that these systems will work as they are supposed to, for they are formed out of a type of knowledge about which the layperson is ignorant. Giddens calls them 'disembedding mechanisms'. Accordingly, it is easier to predict behavioural rules at more collective and organizational levels (Bateson, 1979; Capra, 2002; Barabási, 2010). On the other hand, at an individual level, it is more difficult to observe the emergence of common patterns. As Bateson argues (1979:45), it 'matters which individual acted as the nucleus for a change (…) It is precisely this that makes history unpredictable in the future'.

Following the above, this section focuses on the collective and organizational level of systems, in which rules of behaviours and social norms are clearer. In my research, I join Gidden's (1990) concept of a systems' disembbeding mechanism to Bateson's view of logical typing, explored in the previous section. This is in the sense that the typologies

(forms) and classifications (processes) of the systems are usually dominated by social systems with more consolidated social norms, which are required to provide enough integrity to the system so to support the dynamics of behavioural diffusion (Centola, 2015). Such processes also relate to semiotic ideas of representation and the concepts of mental images and collective identity (see Section 2.3.1 above). The dialectical process of logical typing is a tool that facilitates the observation of the lifting out of social norms, behavioural rules or relationships of power from one system to another set of systems (Gidden's disembedding mechanisms). In this sense, Giddens' calls these more consolidated systems as 'expert systems', which impose their logical typing onto other systems, thus creating very clear power relationships. The more clear the relationships of power of a social system, the more designed and stable these networks are (Capra, 2002). By reconfiguring structures (Giddens, 1990), designed networks are helping to shape the mental images social networks create to configure their living experiences (Capra, 2002), as illustrated by Figure 11 below.

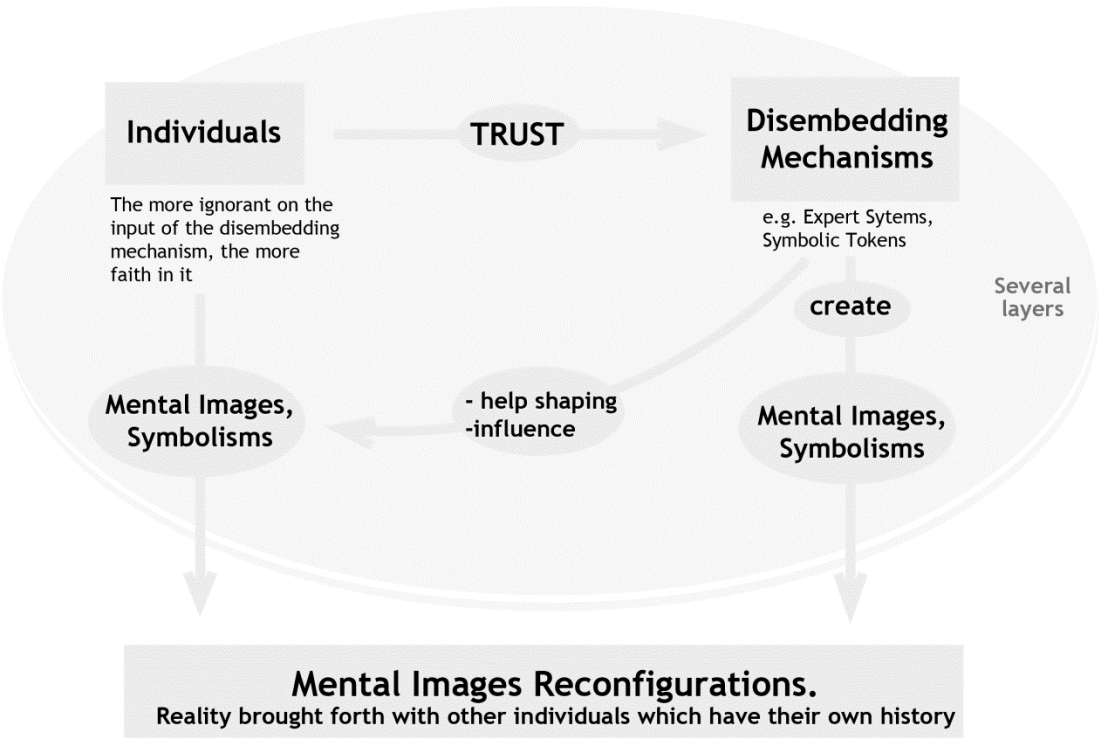

Figure 11: Loop of mental images reconfiguration based on notions from Bateson, 1979; Giddens, 1990 and Capra, 2002 (Illustration by Author).

The above is not an uncommon communication pattern found in ICT4D initiatives, which are usually directed by a 'profound faith in the powers of technology, the workings of a free market, the growth of the economy as the solution to all problems, even the problems created by growth' (Meadows *et al.*, 2004: 203). Institutions and communities where ICT4D projects are implemented generally do not question sufficiently critically project concepts and the implications of a new technology being inserted into already existing media networks within the community. In my previous research (Scur, 2005), the local institutional sphere (local experts, school principals, hospital directors) presented a rather critical view, while local community members presented a rather blind faith in the system. I attributed these, to the levels of knowledge and interests in those contexts. Nevertheless, nobody was ready to criticize the project formally (all had something to say), even though the outsider institutions presented themselves as open to criticism (see Scur, 2005). The institution implementing the initiative represents the designed network (the disembedding mechanism) as it dictated norms and retained greater knowledge when compared to other stakeholders. This has shaped much of the mental imagery in which stakeholders of this initiative based their actions. However, all spheres – at an individual level - had something to say about what should change in order for the project to succeed, but they did not (Scur, 2005). The challenge seems to direct such collective identity processes into more collaborative and mutual learning practices.

In short, designed networks are planned purposely to entail clear formal structures and social norms, connected by clear lines of communication, coordination and control which in turn facilitate decision-making (Jackson, 2003; Capra and Luisi, 2014). These processes in turn shape much of an individual's mental images, by being re-embedded in local contexts, either 'supporting or undermining them'(Giddens, 1990:80). The next section explores the core characteristic of the systemic approach of this research as illustrated in Figure 5 above, resembling the emergency of new meaning generated through collective creativity.

2.3.3 On the creativity of emergent networks

> '(...) there is the whole realm of creativity, art, learning, and evolution, in which the ongoing processes of change feed on random. The essence of epigenesis is predictable repetition; the essence of learning and evolution is exploration and change. (Bateson; 1979:49)'

> 'If you have an apple and I have an apple and we exchange these apples then you and I will still each have one apple. But if you have an idea and I have an idea and we exchange these ideas, then each of us will have two ideas.' (Charles F. Brannan, 1944)

Self-organization is one of the key principles of the systemic approach used in my research (see Section 2.2 above) According to the principle of self-organization, the system relates to the environment structurally, through recurring interactions, and each of these interactions releases structural changes to the system. In other words, form and processes influence each other recurrently (Bateson, 1979; Maturana e Varela, 1992; Checkland, 2000; Capra, 2002, Johnson, 2003 and see also Section 2.2, p. 43). There are limits and facilitations that select what will be learned both from within the individual and from its environment (Bateson, 1979). In other words, the structure and organization of a network work as triggers for how new information is incorporated. The more open the system is to such inputs, the more creative it is considered to be (Hammond, 1997; Checkland, 2000; Capra, 2002). One of the objectives of this research is thus to observe how the structure and organization of the ICT4D initiatives are affecting learning processes and vice-versa, assisted by Bateson's methodology of the calibration and feedback ladder of logical typing (see Sub-sections 2.3.1 and 2.3.2 above). In order to do this, the common context among the nodes of the networks (stakeholders), which communication processes recurrently shape, delimit the structures (boundaries) of the networks observed.

The emergent character of a network shapes itself contextually by accommodating new inputs at a higher rate than designed networks do. An emergent network presents highly diverse patterns of social relations and little consolidation, making it more difficult for the diffusion of common social norms, practices and beliefs (Centola, 2015). In this sense, all the ICT4D initiatives observed in this research are considered emergent networks relatively to the very same institutions that compose these networks.

Moreover, what happens within people's individual minds will also shape what happens outside them, within each specifically social network. This means that views about a particular event are never just the physical event (the 'thing-in-itself'), but rather, an idea or a representation of the event. In essence, these are the points of view of different individuals, socially constructed through each person's own history. Another way of saying this is that mental models are how individuals perceive the world and the more contextual shaping processes occur, the more creative the system is considered to be. However, this creativity also has a price, in that it will contain arbitrary characteristics. It will carry along greater distortions of logical typing (Bateson, 1979), or chaos:

> 'Every image is a complex of many -levelled coding and mapping' (Bateson 1979:206)

Within a social network, every new piece of information entering the system is not perceived as it is (the thing-in-itself); rather, it is perceived through the communication processes that will shape context, classification of contexts, and meaning within that particular system. These processes come both from internal and external relations (Bateson, 1979).

> 'Every evolutionary step is an addition of information to an already existing system. Because this is so, the combinations, harmonies, and discords between successive pieces and layers of information will present many problems of survival and determine many directions of change.' (Bateson, 1979:22)

Also, new technology, when introduced in a community's network, tends to carry a greater tension because of the contrast of being different from everything else already established (Ostrower, 1984). As such, it is even more difficult to 'predict' consequences; what one can do, is be aware that change is intrinsic to cultural evolution and seek to acknowledge the systemic patterns. As Giddens (1990:38) puts it, 'social practices are routinely altered in the light of on-going discoveries which feed into them'. These practices are, in turn, the learning processes within the system (Bateson, 1979; Checkland, 2000) or, in other words, their creative and emergent side.

From this angle, it is necessary to consider the ambiguity/diversity of contexts of meanings formed in the different social networks that at some point will connect in a

particular ICT4D initiative. This will assist in establishing patterns of the particular networks analysed. This subjective, non-material aspect is one of the most complex processes structured (Ostrower, 1984; Capra, 2002) of which one has no complete knowledge. Therefore, one should not homogenize and quantify people, in order 'to facilitate' processes (Chambers, 1997), but rather, be aware that they are diverse, vivid and creative beings, constructing realities within the systems they belong to.

Having in mind that both designed and emergent networks come together in ICT4D initiatives, and the initiative itself is an emergent network, one of the challenges of this research is to explore communication processes among stakeholders in order to acknowledge unfolding network interaction patterns that might forward or undermine effective collaborative action, as discussed in Chapter 1 (Hardy *et. al*, 2005; Southern, 2015; see also Sub-section 1.4.2, p.38). Benkler (2006:33) argues that 'emergent patterns of cooperation and sharing, but also of simple coordinated coexistence, are beginning to take on an ever-larger role in how we produce meaning – information knowledge, and culture – in the networked information economy'. The last section of this chapter therefore explores insights on how one might seek for balance between networks with the two configurations laid out so far and recalls the main questions this research seeks to answer.

2.4 Designed and emergent networks: Finding a balance

> Is it possible to achieve '(...) an appropriate synchrony or harmony between rigor and imagination?' (Bateson, 1979:242)

> 'In every human organization there is a tension between its designed structures, which embody relationships of power, and its emergent structures, which represent the organization's aliveness and creativity. As Margaret Wheatly puts it "The difficulties in organizations are manifestations of life asserting itself against the powers of control." Skilful managers understand the interdependence between design and emergence. They know that in today's turbulent business environment, their challenge is to find the right balance between the creativity of emergence and the stability of design'. (Capra, 2002:121)

This chapter has explored the overall systemic approach and theoretical concepts embedded in this research. The key issues with which it is concerned are the complexities of social interactions and avoiding reductionism and over-simplification of processes within ICT4D partnerships. The previous two sections provided an account of the features of *designed* and *emergent* social networks by drawing on their communication processes, which is the main aspect explored here. Many philosophers and sociologists have established notions of systems of social control (see for instance Marx and Engels, 1884; Durkheim, 1947; Foucault, 1977; Habermas, 1987; Giddens, 1990; Chomsky, 1997) and this research acknowledges this (see Sub-section 2.3.2 above). In this light, it addresses the tension among existing control processes and creative processes of ICT4D initiatives, with a specific focus on the role individuals might play in influencing these processes according to their own contexts and interests
This research seeks then, to understand how both of these concomitant processes contribute and interact with the overall process of evolution of an initiative's project processes. As many scholars emphasize (Bateson, 1979; Prigogine, 1989; Recuero, 2005; Barabási, 2010; Capra and Luisi, 2014), the emergence of new structural patterns is a constant characteristic of social systems. Following the discussion in Chapter 1 (Sub-section 1.4.2, p.38) and in Sub-section 2.2.1 (p.50), the focus is on communication processes with the objective to analyse contexts of learning through the system's self-organization processes together with key stakeholders. The ultimate goal is to explore useful guidelines for effective collaborative action among them, which favours the advantages of both the emergent and designed social networks involved.

Centola (2015) found in his studies of complex social network theory, that consolidated environments (designed networks) are needed in order to create overlapping systems that will facilitate social diffusion. In this scenario, collaboration among stakeholders might be easier to achieve. He also found that little consolidation (emergent networks) might hinder the initiation of a collective action, as it prevents the creation of coherent groups with coordinated interests that would lead to such collective action. However, he also argues that too much consolidation 'might limit the growth of a movement by restricting the initially interested groups to segregated regions of the social network, preventing them from mobilizing broad support for their cause' (2015:1331). Checkland (2000), a soft systems thinker with vast experience of the approach within action research, suggests what I understand as a possible way out of this, by identifying and managing emergent behaviour, maintaining the concern for impact on total system, even when changes are only in part of the system. Moreover, in opposition to the idea of control perpetrated by hard systems (see Section 2.2 above), the objective is not to control the system anymore, but rather, to achieve balance and discover what levels of flexibility are useful (Kapsali, 2011).

To sum up, this research analyses the communication processes of social networks formed among stakeholders of ICT4D initiatives in Brazil through a soft systems thinking perspective which embeds a pluralist methodological approach using complex network theory methodologies and qualitative tools such as Participant Observation, Focus Group Discussions and Individual Semi-Structured interviews (see Chapter 3, Section 3.4, p. 100).

The following aspects will be explored based on a fourfold structure of the systemic view of life in the social domain (as discussed on Section 2.2.1, p. 50 and detailed in Chapter 3, Section 3.2, p.76). The fourfold structure composes the following three dimensions:

a) *Network structure*

   This aspect refers to the *form* component of the fourfold structure, which is composed by the nodes of the network (project stakeholders), connected through communication links, namely, aspect (b) below.

b) *Communication level*

This aspect refers to the network's communication *processes* that give the form or flow of the network, namely, aspect (a) above.

c) *Content: Knowledge production and exchange*

This dimension comprises both components of meaning and matter of the fourfold structure. It refers to boundaries of meaning prior to and generated during the dialectical process between (a) and (b), as well as physical content generated, such as project documentation.

In the light of the literature reviewed in this chapter, this research embeds the following five premises:

1. Communication is the core process that gives a social network its form (structure), through the construction of meaning (Luhmann, 1995; Capra, 2002; see Section 2.2.1);

2. Therefore, in varying degrees, an individual recognizes him/herself as a node of a specific network when typologies (the process of naming things) formed in that particular network have a meaning to him/herself. This process is facilitated further through participatory approaches (see Sub-section 2.2.3). Examples include:

    - An external agent such as a hardware expert installing a computer network (as in 'my role in this network is to install this computer network);

    - A local worker interested in raising health issues through the new technology (as in 'my role is to understand how to use this computer network so I can produce and pass on knowledge through this new media'); and

    - A project coordinator who has to evaluate the outcomes of such a project ('my role is to analyze the outcomes of this project so to report to donors the success / failure of this initiative');

3. To varying degrees, these participants are interconnected as partners in the same initiative composing the same social network in a time-bound scale (see Sub-section 2.2.2).

4. At the beginning, the process of coming together is chaotic (emergent); communication is, then, the process required to construct the consensus (meaning) necessary that will form the boundaries of this new emergent social network, which is, in turn, part of a greater network or networks, which are themselves more designed or emergent (see Section 2.3); and

5. These communication processes create the recurrent self-organization of such networks, a key principle of the systemic approach supporting this research's conceptual framework.

The understanding and definitions of the aspects and premises above will depend on the consensus of the participants within this research. The core issue will be to analyze how the communication processes (b above) shape the balance between being a creative and open emergent social network or a stable designed social network (a above) and how this influences project outcomes or production/exchange of new knowledge (c above). Figure 12 below summarizes the systemic approach laid out so far, that will support this research's understanding of network interaction patterns within ICT4D initiatives.

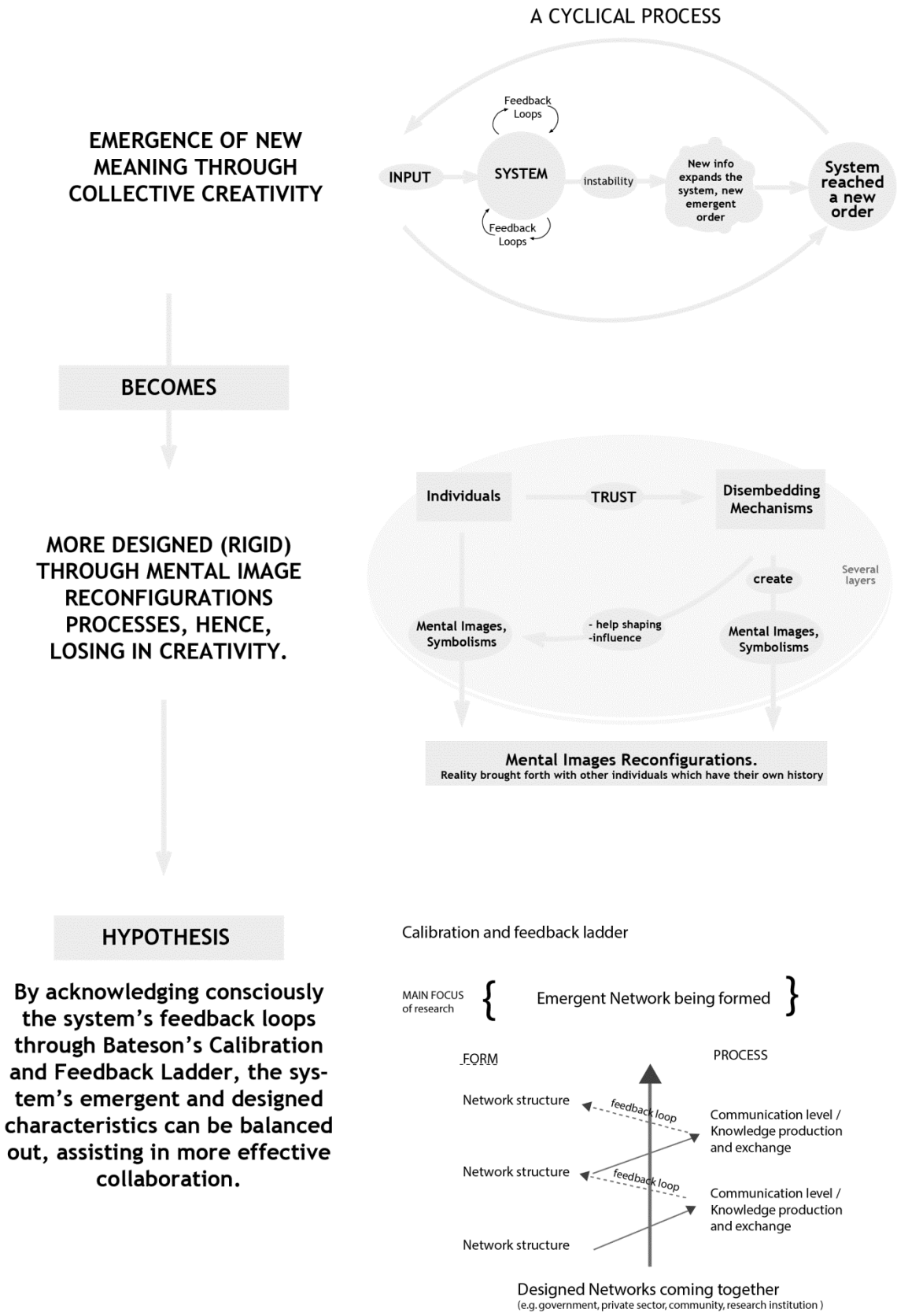

Figure 12: A systemic approach to understanding network interaction patterns within ICT4D Initiatives.

The goal is also to attest if the systemic dimensions (*Network Structure*, *Communication Level* and *Content: Knowledge Production and Exchange*) as well as the analytical lenses drawn above for the systemic view of the ICT4D initiatives are indeed mechanisms that can be considered for the analysis of social networks both at individual and collective levels and how they influence the cohesion of the system, forwarding effective collaborative action. It is important to stress that the systemic dimensions are not separate entities from each other, but processes that happen simultaneously and influence one another.

As a reminder, these are the main research questions this research intends to answer:

> *What are the relationships between network topologies and communication processes within Brazilian multi-stakeholder ICT4D initiatives, and why do they function as they do?*
>
> *What role do individual actions play in forwarding or hindering effective collaboration at the unfolding network interaction patterns of ICT4D initiatives?*

The next chapter details the methodological framework of this research. First, it indicates the process of inquiry in the light of Bateson's (1979) feedback and calibration ladder supported by proxys derived from the aspects of the systemic view of life in the social domain, namely (a), (b) and (c) above. It then introduces the rationale for sampling and the case studies, followed by an account of the specific methods used and the process of analysis. Chapter 4 then provides an account of the context of the case studies along with the visualization of the organizational and individual networks and an initial network analysis. Chapter 5 analyses the case studies further in the light of the first research question, searching for patterns among the initiatives regarding network topology and communication processes. Chapter 6 than draws on the conclusions of Chapter 5 and analyses the case studies in the light of the second research question. Chapter 7 concludes with the main contributions of the present work and suggests a set of useful guidelines that can assist in generating effective collaborative action.

3 Methodological framework

3.1 Introduction

As outlined in the previous two chapters, this research examines communication processes within social networks formed between stakeholders involved in ICT4D initiatives through a conceptual systemic approach as outlined in Chapter 2 (p.41). It focuses on the dialogue among partners and their interpretations of project processes through a pluralist approach that combines qualitative methodologies borrowing tools from complex network theories (Barabási, 2002; Centola, 2015) and participatory action research (Chambers, 1997; Checkland, 2000; Tacchi, 2003).This chapter describes how I operationalized the three dimensions of this research's systemic view in order to collect data. Proxys were drawn from literature that explores these three dimensions, namely the *Network Structure,* regarding the system's form; the *Communication level,* regarding the system's dialogue processes as systemic feedback cycles; and the *Content: Knowledge production and exchange,* regarding matter and new meaning generated in the process.

The first section describes my rationale for the conceptual design of the methodology, and the second section explores the methodologies used in order to generate empirical evidence to respond to the issues discussed in Chapter 2. The third section of the chapter justifies the choices for sampling as well as giving a short overview of each case study and the type and amount of data collected. The final section describes the analytical procedures adopted, and reflections on limitations and ethical issues are made throughout.

3.2 Conceptual design

The three dimensions of *Network Structure*, *Communication Level* and *Content: Knowledge Production/Exchange* are integral parts of single systems interacting through a recursive process (see Chapter 2, p. 41). These highly complex and dynamic social systems are a fundamental challenge for the analysis (Bateson, 1979; Thacker 2004a; Recuero, 2005; Barabási, 2011). Most complex network models will produce 'photographs' of the networks at a given time in space and as such it is difficult to

measure relationships and behavioural formation qualitatively (Recuero, 2005; Barabási, 2011; Centola, 2015).

To address the above, the three systemic dimensions are observed through a dialectical mechanism and not as isolated entities. I explore the system's context formation through Bateson's concept of logical typing (1979; see Chapter 2, Section 2.3.1, p. 60) by using his depiction of a calibration and feedback ladder for the observation of the system's structure and meaning formation. As a reminder, Figure 13 depicts the procedure of inquiry is punctuated by an alternation of the feedback cycles between the *form* and the analysis of the *processes* shaping the form. *Form* relates here to the *Structure of the Network* dimension; and *processes* embed both the *Communication level* and *Knowledge Production and Exchange* dimensions.

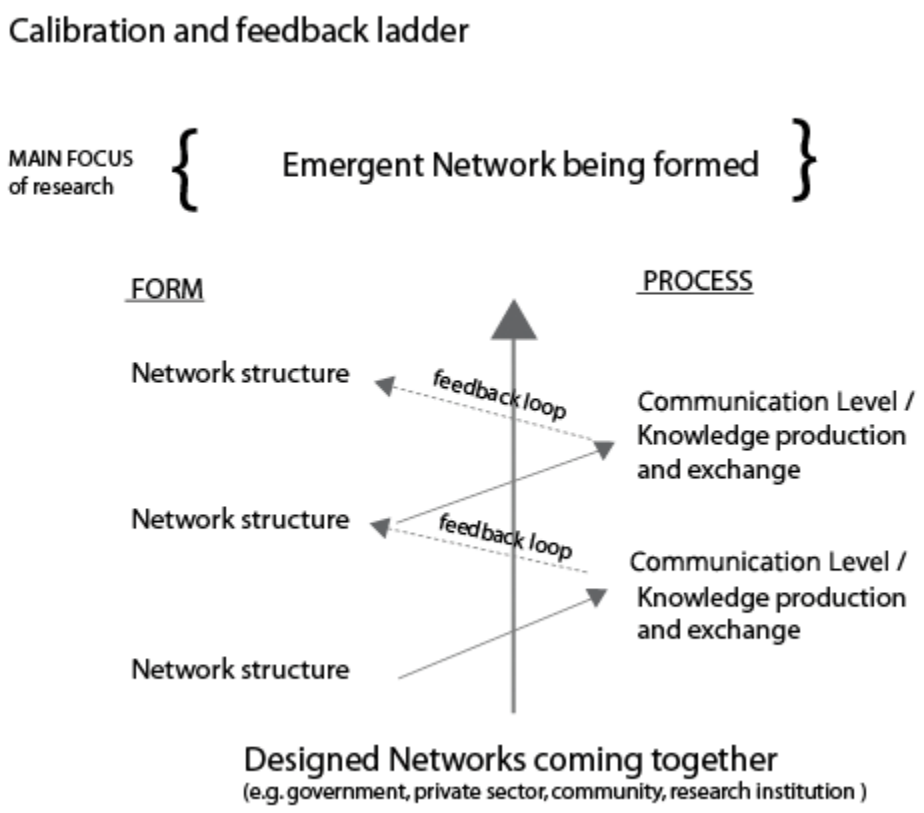

Figure 13: Calibration and Feedback Ladder, adapted to this research (illustration by author)

The three dimensions were divided into proxys drawn from relevant literature concerned with social change, ICT4D partnerships, organizational learning and collaboration. These include, for instance, the *Integrated Model of Communication for Social Change* (Figueroa *et al.*, 2002),*The Partnering Toolbook* (Tennyson, 2003*),* the framework for ICT4D Partnership assembled by Unwin *et al.* (2005) for the *UNESCO Publications for the World Summit on the Information Society* and *Talking the Walk: A Communication Manual for Partnership Practitioners* (McManus and Tennyson, 2008).The proxys do not reflect each one of the works studied, but were compiled and adapted according to the purposes of the methodology assembled in this chapter. The next three sections explore the proxys for each dimension in turn.

3.2.1 Structure of the network

Proxys composing the Network Structure dimension are divided in two: *Definition of Partners* and *Network Cohesion*. The proxy *Definition of Partners* is divided further into three proxys: *Type of Partners*, *Partners as Organizations* and *Partners as Individuals* (see Table 4). Inter-organizational dynamics are distinct from individual ones (Bateson, 1979; Clark, 2006), and it is important to visualise both the relationships between partners as organizations and as individuals in order to gain insight of collective and individual layers of the ICT4D initiatives' social networks (Hardy et al., 2005; Centola, 2015). These two realms might show great differences among their respective mental models and logical typing processes (Bateson, 1979; Capra, 2002; Clark, 2006; see also Chapter 2, Section 2.3, p. 59). This in turn, increases the tension between them. As an example, if the board of directors of an organization decides to run a collective layoff, this might be considered good for the financial health of the whole institution, but it will not have the same effect at the individual level.

	Network Structure
Definition of partners	▪ *Types of partners* ▪ *Partners as organizations* ▪ *Partners as individuals*
Network Cohesion	

Table 4: Network Structure' Proxys (Assembled by author)

The proxy *Types of Partner* (Figueroa *et. al*, 2002; Unwin, 2005; Draxler, 2008; Martens, 2007) assists in defining specific organizational cultures involved in the particular contexts observed. Previous Chapters (p. 16 and p.41) discussed the influence of specific organizational cultures on project processes. This knowledge assists in assessing specific patterns of the social systems studied. For working purposes, I employ the following general classification (Table 5) that carries a wide consensus in the field (Unwin, 2005).

Type of Partner	Example
Public Sector	- Government institution
Private Sector	- For-profit organizations - Multinational organizations
Civil society	- Non-governmental institutions - Community on demand side of the project - Volunteers - End Users
Mixed Capital[5]	- IT Government Companies
Research Institution	- Universities

Table 5: Organizational stakeholder classification (Assembled by author)

The proxys *Partners as organizations* and *Partner as individuals* assist in the quantification of the number of nodes of the network visualizations of the ICT4D initiatives. The stakeholders identified in the proxy *Partner as Individuals* took part in focus-group discussions and semi-structured interviews and generated a substantial part of the qualitative data in this research (see Sections 3.3 and 3.5).

The next step was to measure the network's cohesion to establish how well connected the nodes were. The greater the number of connected links, the more cohesive a network is considered to be. This is a favourable element for collaboration at first sight, as it means there is more communication flowing (Barabási, 2003; Figueroa *et al.*, 2002). Data collected regarding network cohesion was synthesized and entered into a SNA software for visualization and analysis of the cohesion and information flows of the

[5]Mixed Capital in the case of Brazil, is a closed partnership where the government has major participation (more than 50% of the stocks). There are a couple of Mixed Capital enterprises in some of the case studies observed.

networks (see Section 3.5.1, p.112).The next section discusses the *Communication level* dimension. This dimension concerns one of processes that provide the social networks with their form.

3.2.2 Communication level

This dimension assists in analysing the level of on-going dialogue shaping the values and behavioural rules that bound the networks (Capra, 2002; Figueroa *et al.*, 2002). This concerns the second dimension of the systemic view of ICT4D initiatives, namely the communication processes shaping the network's form (see section above). Many argue that the more communication and iterations among stakeholders, the more understanding of one another's view there is and thus the likelihood of collaboration is greater (Larsson *et al.*, 1998; Checkland, 2000; Figueroa *et al*., 2002; Tennyson, 2003; Adam *et al.*, 2007; Hardy *et al.*, 2005; Southern, 2015).Communication is, then, the mechanism that balances the interests of individuals within a group. This systemic dimension assists in the recognition of the leading social patterns of the different case studies. Table 6: Proxys of Communication Level among stakeholders of the case studies shows proxys for *Communication Level,* drawn from relevant literature concerning the value of communication for social change and good practices for ICT4D partnerships, include *Expressions of Shared Understanding* and *Patterns of Behaviour*.

Communication level	
Expressions of shared understanding	▪ *View of project goals* ▪ *View of one's responsibilities* ▪ *Shared benefits and Risks* ▪ *Perceived constraints* ▪ *Project unintended outcomes*
Patterns of behaviour	▪ *Relationships of power* ▪ *Identification of social norms* ▪ *Collective Capacity*

Table 6: Proxys of Communication Level among stakeholders of the case studies

Expressions of shared understanding between stakeholders (Chambers, 1997; Capra, 2002; Figueroa *et al*, 2002) assist in measuring the level of consensus within the group. This proxy was analysed through a sub-set of five proxys drawn, namely *view of project goals*, *view of one's responsibilities*, *shared benefits and risks*, *project constraints* and *project unintended outcomes*.

The *View of project goals* proxy clarifies how individuals perceive project intended outcomes. This proxy helps stakeholders in acknowledging different points of view. The *View of one's Responsibilities* proxy clarifies if stakeholders are aware of each other's roles during project implementation and in which ways the configuration identified was influencing project processes. *Shared Benefits and Risks* clarifies what stakeholders identify as shared benefits or risks of the project and why. Objectives were to attest if measures were taken to identify project beneficiaries and include them in the planning process, so as to adjust project goals to meet the demand side's needs more accurately and to acknowledge if there were mechanisms for stakeholders of different hierarchical levels to communicate their interests. The goal was to unravel the mechanisms used by stakeholders to express themselves at the different structural levels of the network in which they were inserted. *Perceived constraints* concern the identification of elements that hinder project processes by stakeholders. This might include issues such as funding donors imposing deadlines or lack of resources. It was also observed if such issues were a common sense among the group or acknowledged by only a few people, as well as if anything was done to address such issues, in case they existed The *Project unintended outcomes* sub-proxy clarifies what stakeholders see as unforeseen outcomes regarding the project already in process, as well as what they agreed upon. The *Network Structure* dimension (see above) together with the sub-set of five proxys for *Expressions of Shared Understanding* provide input for the visualization of the networks and how stakeholders saw themselves and others within the context of the projects in which they were inserted.

The next proxy is *Patterns of behaviour* and it concerns the mental models that are present, created or brought upon by the stakeholders through *communication processes* and *meaning* generated (Bateson, 1979; Capra, 2002; Barabási, 2011; Centola, 2015; see

also Chapter 2, Section 2.3, p. 59 and Sub-section 3.2.3 below).This proxy was analysed through a sub-set of three proxys, namely *relationships of power, identification of social norms* and *collective capacity. Relationships of power* (Chambers, 1997; Figueroa *et al.*, 2002) concern issues of hierarchy, roles, trust and self-awareness in the relationships of the networks observed. Such relationships bring control and stability to the network (Capra, 2002; Jackson, 2003; Centola, 2015; also see Chapter 2, Section 2.3, p.59). Moreover, different roles and levels of expertise also assist in the formation of relationships of power throughout project evolution. The more carefully designed a network is, the more stable and controlled it is. This means that more hierarchical relationships of power will bring stability to the network (Jackson, 2003; Scur, 2005). However, creativity might be hindered if the network is too consolidated regarding social norms (Capra, 2002; Centola, 2015). Thus, *Identification of social norms* (Figueroa *et al.*, 2002; Centola, 2015) analyses the rules and behaviours accepted in the context of the network. *Collective capacity (*Figueroa *et al.*, 2002*)* concerned shared beliefs within the group to achieve the goals and desired tasks they agreed upon.

The proxys above assist in identifying the presence or absence of characteristics that are considered as catalysts for the creation of an environment that favours effective collaborative action as suggested by existing research in the fields of management, communication for social change and ICT4D partnerships (see for instance Larsson *et al.*, 1998; Checkland, 2000; Figueroa *et al*., 2002; Tennyson, 2003; Adam *et al.*, 2007; Hardy *et al.*, 2005; Southern, 2015).

3.2.3 Content: Knowledge production and exchange

The last dimension embeds two processes of the fourfold structure of the systemic view of life in the social domain established in the previous chapter (see Section 2.2, p. 43). It concerns both the subjective realm of *meaning* and production of physical *matter*, such as project documentation. This dimension is of crucial importance, as it seals the boundaries of the systems observed in this research through the contexts formed by the meanings generated through the processes described in the section above. While *patterns of behaviour* are identified through the proxy *communication level*, this dimension acknowledges the mental models that trigger such patterns of behaviour. Table 7: Content: Knowledge Production and Exchange shows the three main indicators

for *Content: Knowledge Production and Exchange*, drawn from literature in the field concerning the value of the formation of a collective sense of purpose among stakeholders and project documentation processes, namely *expressions of individual and shared interests*, *monitoring and evaluation processes* and *sense of collective identity*.

Content: Knowledge Production and Exchange
Expressions of individual and shared interests
Monitoring and Evaluation Processes
Sense of Collective Identity

Table 7: Content: Knowledge Production and Exchange Proxy

Expression of Individual and shared interests(Figueroa et al, 2002; Unwin, 2005) acknowledges what are the interests of individual stakeholders regarding the project and also what are shared interests among these stakeholders. The intention of this proxy is to explore the level of noise among people's personal interests and a project's overall stated goals. The proxy *Monitoring and Evaluation Processes* (Capra, 2002; Jackson, 2003) refers to new information circulating among stakeholders about the project, documentation processes and project assessment. *Sense of Collective Identity* refers to the mental models that are shared among stakeholders that are translated into a collective sense of meaning and of purpose within the particular ICT4D initiatives where these stakeholders are inserted in (Checkland, 2000; Figueroa et al, 2002; Hardy et al., 2005; Southern, 2015; Centola, 2015). Table 8 shows all proxys of the three dimensions summarized, for overview purposes.

Network Structure	
Definition of partners	▪ *Types of partners* ▪ *Partners as organizations* ▪ *Partners as individuals*
Network Cohesion	
Communication level	
Expressions of shared understanding	▪ *View of project goals* ▪ *View of one's responsibilities* ▪ *Shared benefits / Risks* ▪ *Project constraints* ▪ *Project unintended outcomes*
Patterns of behaviour	▪ *Relationships of power* ▪ *Identification of social norms* ▪ *Collective Capacity*
Content: Knowledge Production and Exchange	
Expressions of individual and shared interests	
Monitoring and Evaluation Processes	
Sense of Collective Identity	

Table 8: Proxys for the three dimensions of a systemic view observed in this research

The set of proxys laid out above are all elements of an operational framework that aims to establish the boundaries of the systems observed and to recognize patterns among them for a comparative analysis where possible. These proxys are explored through Bateson's (1979) calibration and feedback ladder in which the procedure of inquiry is punctuated by a dialectical observation of dimensions above (see Figure 13 above). The next section explores the methods used for creating the empirical evidence derived from these proxys.

3.3 Methods for creating empirical evidence

3.3.1 Justification of choice

While quantitative methods tend to reframe complex realities into standard categories through generalization and simplification (Chambers, 1997; see also Chapter 1, Section 1.2.1, p. 18), qualitative assessments tend to provide more in-depth understanding about the subject and its contexts drawn from smaller samples (Debus, 1986). This research's conceptual framework entails a methodological challenge because it involves multi-stakeholder perspectives with the intention to start a process of enquiry and learning, rather than just data gathering (Chamber, 1997; Checkland, 1999; Andrew and Petkov, 2003; Gunawardena and Brown, 2007; Lennie *et al.*, 2015). My goal is to allow for a diverse environment to emerge, where stakeholders feel eager to analyse critically the process and identify failures as well as correct them when possible. In this sense, this research falls into the qualitative category of action research, although not as formally defined as in Checkland's (2000) or Tacchi's (2003) research.

The past two decades have seen an increase in literature discussing new interpretations of the basic premises of systems thinking (Hammond, 1997; Checkland, 2000; Jackson, 2003). One example of these is the shift of focus from simplifying and synthesizing a system's processes to learning from and within these processes (Checkland, 2000). Moreover, these new interpretations also fundamentally differ from those of the 1960s and 1970s, because of the new focus on multiple perspectives of the interactions and contexts of these systems (Bateson, 1979; Andrew and Petkov, 2003;Turpin, 2012; Capra and Luisi, 2014). For example, two main approaches being developed within this new perspective are soft systems and critical systems thinking. In soft systems thinking, the world is taken to be complex, confusing and messy with diverse perspectives. Soft systems thinking accepts that multiple perceptions of reality exist, and one needs to find a way of accommodating such views. Critical systems thinking was developed to cater for the evaluation of the strengths and weaknesses of the various systems approaches, and to think through the relations between the different methodologies (Andrew and Petkov, 2003).

Checkland (2000) has led the creation of soft systems methodologies (SSMs) applied to action research in the field of management and information systems for over 30 years. SSMs are usually employed for identification and action towards messy problems through the multiple perspectives of stakeholders (Jackson, 2003; Andrew and Petkov, 2003; Turpin, 2012). Many systems thinkers advocate the use of critical systems thinking as a result of the pluralism of methodologies and techniques that were developed over the years within SSM (Checkland, 2000; Jackson, 2003). According to a critical systems thinking approach, methods should be decided after stakeholders have defined together what the problem to be addressed is. After closing the boundary gap of agreeing on the problem to be addressed, then a set of methodologies is chosen, with an emphasis on learning and the systemic view of the problem. ICT4D research employs a fragmented set of such techniques in action research programs designed as project interventions (see for instance Andrew and Petkov, 2003; Gunawardena and Brown, 2007; Turpin, 2012; Turpin and Alexander, 2014). As my research does not have a direct interventionist role in the ICT4D initiatives observed, this made it difficult to decide what methods to use based on past systemic approaches and ICT4D related research.

Checkland (2000) also emphasizes the great complexity of SSM and the need for experienced researchers in choosing, structuring and conducting the techniques. Such techniques take time to learn and applied, so this is one of the reasons why it was not applied to this specific research. Also, SSM-led research is usually conducted by a team of researchers due to this complexity, rather than by individual researchers (see Andrew and Petkov, 2003; Petkov *et al.*, 2007; Gunawardena and Brown, 2007; Turpin et al., 2009; Kapsali, 2011). As an individual researcher, I used three main factors to help me decide on what methodological tools to apply: first, my past research methodology experience; second, the systemic theoretical premises of this research; and third, this research's main questions. Thus, I chose qualitative participatory research methods used in my previous research (Scur, 2005) maintaining the focus on multistakeholder perspectives, the interaction of the whole and its parts and stakeholder communication and collaboration. The methods were chosen after careful assessment of the premises around the systemic approach (see Chapter 2, p. 41), ensuring that they provide the rich perspective and learning inquiry process desired. Also, as an aspiring participatory

endeavour, simpler tools were required in the field, as it will be illustrated in the subsequent analytical chapters.

In order to acquire a rich perspective of the situational contexts observed, it is important to embrace both subjective/social and formal/rational approaches (Turpin and Alexander, 2014). Thus, the primary methods used for data collection were participant observation, focus-group discussions and individual semi-structured interviews (Jorgensen, 1989; Stewart and Shamdasani, 1990; Wengraf, 2001; Guest *et al.*, 2013). Document analysis was used as a secondary method to acknowledge the formal contexts of the partnerships. The goal was to obtain insights on structure, patterns of behaviour and generation of content of these social networks, as depicted by the proxys of the three dimensions of the systemic view embedded here (see Section 3.2 above), rather than making generalizations about them (Chambers, 1997; Baxter and Eyles, 1997). By using this variety of qualitative methods I was able to triangulate data from different sources and compare collective and individual levels of interpretation of meanings in each of the networks studied.

Qualitative approaches often require that the samples observed share the same set of meanings in order to achieve research rigour (Debus, 1986; Checkland, 2000). However, at times, different clusters of the same network showed different interpretations or different interests regarding the same issues (Pinch and Bijker, 1984). Acknowledging this with participants while doing research was not only an attempt to start a process of mutual understanding (Checkland, 2000; Figueroa *et al.*, 2002; Hardy *et al.*, 2005; Southern, 2015; Chapter 2, p. 41 and Section 3.2.2 above), but also an effort to establish data analysis rigour within each case study. My views evolved according to participants' interpretations and consensus building. There were no payments or rewards for participants; they all participated voluntarily in this research. The next sections explore the methods used in more detail.

3.3.2 Participant observation

> 'According to Niklas Luhmann, the key phrase regarding interaction systems is "der Wahrnehmung des Wahrgenommenwerdens"(Luhmann, 2002a, p.56). It might be translated as "perception of being perceived" and underlines that participating in interaction is tightly intertwined with mutual experiences of being perceived.' (Keiding, 2011: 107)

Jorgensen (1989) provides a detailed rationale for the use of participant observation as a methodology. Some of these features are appropriate to the aims explored in this research (see Table 9 below). For instance, participant observation is concerned with human meaning and interaction from the perspective of stakeholders of the situation; this is a link with the multiple perspectives required in this research. It also provides logic of inquiry that is open-ended and flexible and this is a link with the soft systems thinking. Participant observation was my main method of inquiry and the only method present in all of the case studies.

Participant Observation Features
Special interest in human meaning and interaction as viewed from the perspective of people who are insiders or members of particular situations and settings
Location in the here and now of everyday life situations and settings as the foundation of inquiry and method
A form of theory and theorizing stressing interpretation and understanding of human existence
A logic and process of inquiry that is open-ended, flexible, opportunistic, and requires constant redefinitions of what is problematic, based on facts gathered in concrete settings of human existence;
An in-depth, qualitative, case study approach and design
The performance of a participant role or roles that involves establishing and maintaining relationships with natives in the field
The use of direct observation along with other methods of gathering information

Table 9: Participant observation basic features (Jorgensen, 1989)

I acknowledge the systemic dimensions of *Network Structure*, *Communication Level* and *Content: Knowledge Production and Exchange* as my 'context markers' (Bateson, 1979) or my reference set (Pile, 1991) for the social networks studied. These provided some structure before going into the field (Jorgensen, 1989; Guest *et al.*, 2013), which helped later with data analysis. Moreover, as the dynamic and recursive processes of the systemic dimensions happen simultaneously, they were observed simultaneously

through the calibration and feedback ladder approach (Figure 13, p. 77). Bateson (1979) used this artifice to reduce the complexity of the relations he observed. The more I moved around the network clusters, the more I reduced errors in logical typing from one cluster to another. The proxys assisted in reducing complexity by classifying specific patterns of behaviour, such as certain types of relationships of power or social norms.

As an observer, I was in a danger of expecting certain patterns to emerge, according to my prior constructions of the observed (Keiding, 2011). However, participant observation is never neutral, as it is always a construction of a reality put forth through observer and observed (Bateson, 1991; Pile, 1991; Luhmann, 1995; Keiding, 2011). As such, the referencing of the observed was not let only to the observer (Pile, 1991), but constructed together with participants. Table 10 summarizes some of the principles that were used in building such realities (Cassel, 1981; Jorgensen, 1989; Eyles and Baxter, 1997; Guest *et al.*, 2013).

Participant Observation construction of reality checklist
Getting into the location of whatever aspect of the human experience you wish to study
Building rapport with the participants
Spending enough time interacting to get the needed data
Detailing power relations between observer and observed
The control of the setting where research takes place
The control of the research context - how the interaction is designed and defined
The direction of research interaction: whether it flows primarily in one direction or two

Table 10: Participant Observation construction of reality checklist, assembled by author (adapted from Cassel, 1981; Jorgensen, 1989; Eyles and Baxter, 1997; Guest et al., 2013)

My level of involvement in each case study is acknowledged by observing each of the features in Table 10 above. While my performance as a researcher was that of an active participation in the in-depth case studies, it was that of a passive participation in the short-term case studies, meaning that I was more observing than participating in these. During the in-depth case studies, observation was persistent, which provided depth and it was also prolonged, which provided scope (Pile, 1991; Guest *et al.*, 2013). Persistent observation allowed me to focus on the most relevant facts for my research which I

wrote every day my diary. The fact that I was a part-time researcher and I remained in the field for over a year at the in-depth case studies allowed for a prolonged observation that brought to surface what were multiple influences as well as important contextual factors. Table 11 summarizes the set of categories observed while in the field.

Things to note
Verbal behaviour and interactions
Physical behaviour and gestures
Stakeholder's personal space
People who stand out

Table 11: Things to note, assembled by author (adapted from Guest et al., 2013)

My field notes took form through recursive observation, drawing on the pre-conceived structures of my mind and my expectations of future interpretations (Keiding, 2011). As a participant observer, I was always involved in the production of meaning and it was a matter of acknowledging some principles and being transparent in each case on how much this was. As such, I always presented myself as an observer-researcher to participants (Pile, 1991; Keiding 2011; Guest *et al.*, 2013). Moreover, data was collected with a variety of resources I had available and Table 12 assembles these types of data collection.

Types of data collection
Observation notes (diary) / audio / video
Casual Conversations / Informal Interviews
Semi-structured Interviews (see Section 3.3.4 below)
Personal account on self-reference (Ethnoshots, see Appendix III, p. 304)

Table 12: Types of data collection (assembled by author)

As in other holistic approaches, soft systems thinking embraces the claim that there is no objective knowledge anymore, but instead 'everything said, is said by someone' (Maturana and Varela, 1992:135) and the world is brought forth through observer/observed interaction (Bateson, 1979; Rasch and Wolfe, 2000; Chambers, 1997; Slater *et al*., 2004; Capra and Luisi, 2014). A systemic perspective also involves the self; there is no isolated system being looked at, but the observer is part of the observed, through the consideration of a 'relativization of observation' perspective (Rasch and Wolfe, 2000:12).

> '(…) questioning how things are done - an essential component of self-reflection - allows qualitative research to demonstrate the relevance of the single case (credibility) and to move beyond it (transferability) with a degree of certainty (dependability and confirmability)' (Baxter and Eyles, 1997:520)

I kept a monthly research diary regarding my own motivations, biases, interests and reflections while in the field (see Table 12 above and Appendix III, p. 304), with the objective to acquire the greatest level of understanding of the emergence of my subjective understanding that was possible in such a context. I acknowledge how these feelings affected my interpretations of the data throughout the analytical chapters. It is important for me that anyone who reads through my analysis also develops an understanding of how I situated myself in that moment (Baxter and Eyles, 1997).

My field research history was full of ups and downs. These certainly affected my views along the process and required research design adjustments (see Sub-section 3.5.2, p.121). The process was a learning curve for me as a researcher, especially in the in-depth case studies, where my role was clearer to participants and I had to accommodate their understandings regarding this role (Cassel, 1981). There were cases where I edged into the danger of 'going native', as I had pushed it too far:

> 'He (the project coordinator) said I made a major confusion (with the volunteers). He wants to discuss with the technological training complex coordinator what my role actually is. The boys (volunteers) showed up at the Marist Educators Congress after I asked them if they were going to go. They cut off school for that and were not on the bus list, crowding up the vehicle! I just asked them that because I heard the "empowering speech" of the technological training complex coordinator regarding their role and responsibilities as educators (rather than mere students). I did not tell them "to go to the congress".'

(*Diary notes, Redes Livres, October, 2012)*

I had constantly to remind some participants that I was there to conduct research, not as a friend or part of the group. In one of the case studies one of the volunteers asked me to be the project leader. It turned out that my relationship with the participants at every level of the networks influenced findings and these issues are discussed further in the analytical chapters as an essential part of my research (Rose, 1997). To help this particularly subjective endeavour of reflexivity, the monthly 'ethnoshots' reports each of which reported on the same set of questions and issues (see Appendix III for the structure, p. 304) assisted me in being conscious of my own process in becoming a researcher:

> '(...) neither the researcher nor the researched remains unchanged though the research encounters (...) both negotiate their knowledges through it.'(Rose, 1991:317)

The reality I have constructed in this research was therefore both a reality brought through me and by the meanings produced in each of the social networks that I studied. While trying to keep a balance between being an insider and an outsider, I was also intervening in critical thinking of some project processes (See also Sections 3.3.3 and 3.3.4 below).

3.3.3 Focus group discussions

There are three main common uses of focus group discussions (Stewart and Shamdasani, 1990): first, to obtain general information around my topics of interest, namely the proxys established on Section 3.2 above; second, to learn how participants talk about this issues; and third, to stimulate stakeholder's critical thinking regarding project processes. I conducted focus group discussions that allowed for flexibility and adaptation according to the input of participants (Debus, 1987). First, I assembled a topic guide with a list of the issues that I would cover during discussion, so as to provide a clear agenda (see Appendix I, p 291). Table 13 lists the aspects taken into account regarding the creation of the topic guide (Debus, 1987; Stewart and Shamdasani, 1990). The focus group discussions format was composed in three parts, adapted from the *AED's Handbook for excellence in focus group research* (1987). First, there was a warm

up section, where I explained the purpose of the focus group and procedures; second, the discussion section supported by the topic guide; third, a closing section with final remarks and follow-up statements.

Aspects to consider for topic guide
Flexibility to stay in course and cover all the objectives of the focus group. Pursue new issues IF they are relevant to research
Not to cover too many issues, avoid 'how many' and 'how often' questions
Sequence of questions: general to specific, because key issues will emerge naturally and allow for a framework of the moderator

Table 13: Aspects to consider for topic guide (adapted from Debus, 1987; Stewart and Shamdasani, 1990).

My focus group discussions were exploratory since the purpose was to stimulate respondents' thinking on specific topics (Debus, 1987; Stewart and Shamdasani, 1990). A non-directive moderating approach was employed, by making use of open-ended questions as this allowed participant' own interpretations to emerge with minimum influence from me. This style of questioning is the most used in focus group discussions, opposed to directive moderating approaches, used when the objective of focus group is more narrowly defined (Debus, 1987). Ideally, the focus groups should not be composed of too many people, so everybody can speak equally and time was not too restricted. The objective is to maximize group expression, so I envisioned using groups of 7-10 people. However, in some cases, there were groups with more than 20 people, such as an entire student batch. All focus group discussions lasted an average of 1h30min, being separated in blocks of 45 minutes with a 10 minute break and they always took place at the case studies venues.

Figure 14: DEPROTEC focus group discussion with representatives from all network clusters. The purpose was to discuss project goals (12.06.2012)

For the longer-term case studies, I had initially envisioned one focus group per week for each interest group identified in the *Network Structure* dimension (final users, project coordinators, donors) and a minimum of two focus-group discussions with representatives of all interest groups throughout the period of field research. The intended purpose was to diminish misinterpretations, reach consensus about the issues discussed and increase mutual understanding. The focus group discussions with all representatives were the most important, since there are several variables to be taken into account such as the level of expertise, cultural differences or relationships of power (Stewart and Shamdasani, 1990). More than one focus group discussion was necessary depending on the diversity of interest groups. Some focus-group discussions were conducted with these different interest groups separately, and when possible, a last focus group discussion was scheduled to reach a final consensus among the entire set of stakeholders, as was the case of in-depth case study DEPROTEC. The networks generated were observed with the goal of comparing how the network structure might have changed through time, influenced by on-going communication patterns and

knowledge production and exchange among stakeholders. During the pilot and in-depth case studies, data were constructed in their final form interactively through focus group discussions and interviews with participants. For the short-term case studies, data were collected only through participant observation and document analysis.

Figure 15: DEPROTEC Focus Group Discussion with representatives from the cluster of coordinators only. The purpose was to build the network of stakeholders together (26.06.2012).

It was especially through focus-group discussions with representatives of different interest groups that the level of consensus among different stakeholders was identified. Different participants exposed their opinions regarding the project they were involved with, in an attempt to bring to the surface principles that, to them, indicated success/failure of the project's evolution. The focus-group discussions conducted during project evolution were an effort to bring stakeholders together in viewing critically these very same communication processes and thus seeking a general consensus. The intention was to diminish the error in logical typing through these discussions (Bateson, 1979; see also Chapter 2, Sections 2.2 and 2.3, p.43)

3.3.4 Semi-structured interviews

The individual interviews done throughout this research were semi-structured and open-ended, and they maintained a common structure relating to the research aims while allowing for changes depending on the flow of conversation with the interviewee (Wengraf, 2001). Such type of questioning allows the formation of new contexts, since there are no anticipated responses (Clark, 2006).Interviews were triangulated along with the other methods used, by bringing individuals perspectives into context formation, along with the group perspectives from focus groups and my own from participant observation.

The elaboration of interview questions used in my research (see Appendix II, p.296) followed Tom Wengraf´s (2001) proposed structure. In this, the interview questions should be generated from the theory (academic) questions (Section 3.2 above, p. 76), which in turn come from the central research questions (see Chapter 2, Section 2.4, p.70). Wengraf (2001) recommends not using theoretical questions directly because interviewees might not understand academic questions, so the researcher has to come up with interview questions, thinking of the background of the interviewees, which translates the theory questions (Wengraf, 2001). In my case, my research questions are based on the proxys that I unfolded from the three systemic dimensions: *Network Structure*, *Communication Level* and *Content: Knowledge Production and Exchange* (see Section 3.2 above, p. 76).

The interview questions I generated are straightforward (see Appendix II, p.296) such as 'Who would you say are key individuals acting in this project' (in *Network Structure / Partners as Individuals*) or 'Who has access to the action plan' (In *Communication Level / Expressions of Shared Understanding*).However, there were cases of adjustments while in the field, because of the need to ensure that respondents understood all of the questions. As an example, during an in-depth case study, when asked about the type of network they saw themselves inserted in, some participants did not comprehend what I meant by 'hierarchical' or 'flat' and I saw the need to rephrase the question when it was directed to students or volunteers: 'Do you have the freedom to go and talk to the main coordinators if you feel you have some suggestions, questions or adjustments you would like to make?'. From this point on, I made sure to check with members if they

understood my expressions and explained what I was trying to achieve and asked for their agreement on the terms I was using throughout the study (Baxter and Eyles, 1997).

My intention was, whenever possible, to interview every active individual stakeholder identified in the in-depth case studies, so as to acquire a broad view of participant's perspectives regarding the same issues. I managed to do that, and in some cases I interviewed the same person more than once, at different times, to see how their views changed over time about the processes. Informal conversations also served this purpose. One of the objectives of recurring interviews was to check if participants were indeed increasingly thinking about the processes of the communication they were inserted in, as well as to check for consistency of responses. Focus group discussions served to reinforce my understanding of the network, but the individual interviews provided an even deeper understanding if individuals were critically thinking about the research issues. Chapter 4 explores in more depth each social network and describes the individuals who took part in the research, so as to provide a feeling for whom the respondents were (Bayles and Eyles, 1997).

Case Study	Number of Formal Individual Interviews	Number of People Interviewed more than once
Pilot Metaprojeto	5	0
Long-term DEPROTEC	21	3
Long-term Redes Livres	25	2

Table 14: Breakdown of Individual Interviews by case study

For me, as the listener, it was a period of great learning; learning to listen. I have the tendency to talk a lot and I caught myself talking too much as I conducted the interviews from time to time, especially at the beginning of my process as an interviewer. It took me a couple of interviews, of listening to myself and noting where I was failing. I had to improve my conversational skills, and most importantly, exercise my listening; not being judgemental; being empathetic towards all the very different people I was interviewing and also keeping the path open for people to share their thoughts with me (Pile, 1991;

Longhurst, 2010). Individual semi-structured interviews provide standardisation and also the flexibility to address issues according to the respondents' views (Baxter and Eyles, 1997). However, the difference in points of view was, at times, overwhelming; sometimes I felt I wanted just to tell everyone what I knew and 'fix' things for them, forgetting that my only job was to listen, and link the 'responses and meanings to a broad body of knowledge' (Pile, 1991:464).

I scheduled my interviews in advance with stakeholders and I always gave them freedom to choose where they would like to be interviewed. Some were interviewed during their break in the cafeteria or out in the sun, while others preferred to be interviewed in their work place, be it in their office if they had one, or the community radio station, or the computer lab. The interviews were recorded on my phone; I always made sure to ask permission and made it clear that the interview was confidential, although most of the times stakeholders would say they did not mind if it was not. After asking for permission to record and make such observations, I explained what my research was about and why I needed their views. The interviews usually took the form of conversations and if the interviewee was eager to develop one or other subject from the list of questions I had, I let her/him carry on if it was relevant to the focus of my study. I also took notes while interviewing as well, to remember later, when transcribing what struck me the most on a particular interview.

During the in-depth case studies, I was a white girl who owned a car and has lived abroad; I was certainly different. I often felt more as a threat to people who were placed higher in the hierarchy than I was to the students or volunteers. At the Redes Livres, for example, I developed such a sense of trust among the volunteers that I was even tagged in a Facebook Post as Athena, a character of the 12 golden Knights of the Zodiac anime cartoon. Athena is the Goddess of wisdom, of defensive war, strategy; justice and hope in the anime (see Figure 16).

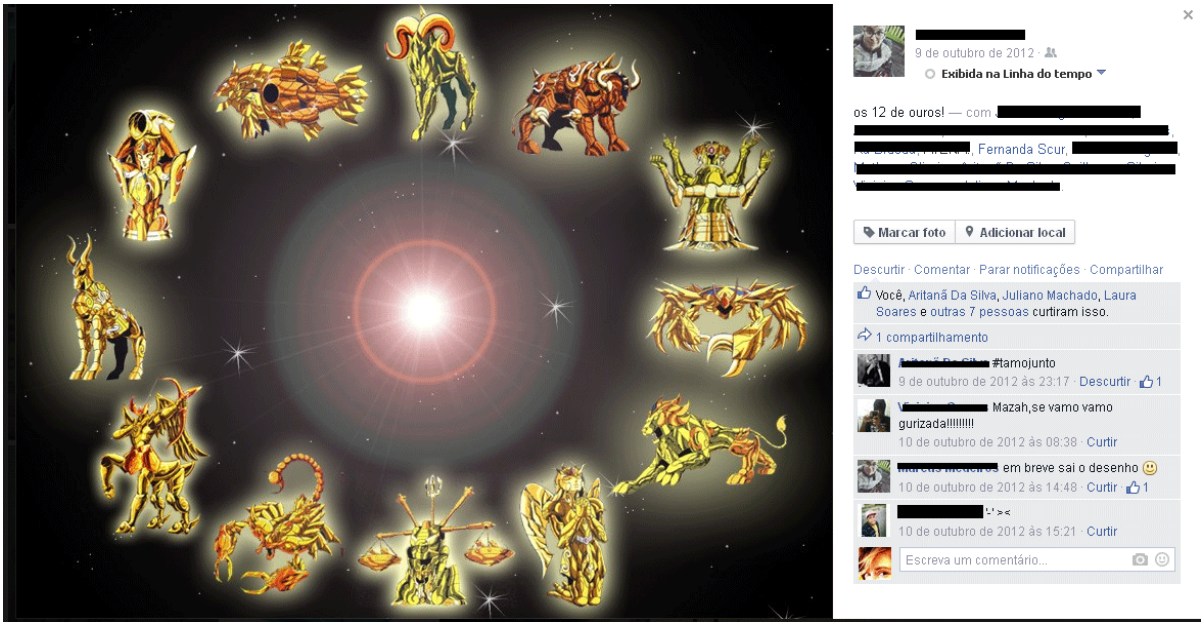

Figure 16: Facebook post from one of Redes Livres Volunteers, where I am depicted as Athena (the light in the middle, a character of the '12 Golden Knights of the Zodiac'

Through informal conversations, students came to me for life advice and sometimes to complain about their superiors. It was difficult dealing with such situations. The sort of relationship I had with the respondents is acknowledged throughout – if closer or not, and if any relevant issue happened around our relationship- so that it is transparent why some quotations were chosen in favour of others and how our relationship or my presentation might have affected how certain respondents reacted in some interviews. It was a constant state of vigilance for me, alternating with observation of the object to help to account for the ways I have constructed such contexts (Baxter and Eyles, 1997; Keiding, 2011).

As a Brazilian Portuguese speaker, I had no issues regarding language. I could freely engage with research participants, often having direct communication with them in a very colloquial fashion. Within this thesis, the Portuguese translation to English has been done literally, so as to keep the mood of the conversation, not adjusted to grammatically correct English. I will always be referred by my initials in italic, *FS* (Fernanda Scur) and interviewees are referred to by role and the number they were assigned when mapping the networks also in italic, such as *Educator 3*. After the quotation, there is the method used, the name of the case study and date. All citations will have the original version as a footnote. Here is an example:

FS: Was there something on the planning to involve the demand side?

Educator 3: I did not participate in the planning ... from what I understand it was done in quite a rush (...) there are several things we are adjusting (...)

(*Individual Interview, DEPROTEC, 22.07.2012*)[6]

3.3.5 Document analysis

According to Bowen (2009), document analysis is a systematic procedure for reviewing printed and electronic materials. In the case of this specific research, document analysis was used as a secondary method with the goal to gain initial knowledge on the formalized contexts of the partnership arrangements, as well as of formally stated project goals. The documents analysed included contractual agreements, previously available statistical data, Memoranda of Understanding, institutional websites and project scopes. These are pointed when present throughout Section 3.4 on sampling below.

3.4 Sampling

3.4.1 Justification of choice

The case studies were chosen because they all share two main features in which I am interested. First, they are located in urban areas with a high population density. Second, they all have a core focus on ICT for social and community development. The main reason I prioritize urban areas is because these are more chaotic and the systemic imbalance tends to be greater (Capra and Luisi, 2014). They were chosen through a non-probability convenience sampling method and a criticism of such technique is that they are not suited for generalization. However, I have no interest in generalizing. Thus, I also chose these case studies for features that they actually do not share in common, which supports one of the core interests of this research. Their diverse features provide different network dynamics to be analysed in the light of the same systemic framework

[6]Original:
FS: 'Foi feito algo na parte de planejamento pra envolver o lado da demanda'
Educador 3: 'Eu nao participei do planejamento...pelo que eu entendi foi feito na correria (...) tem varias coisas que ate estamos ajustando (...)'

and proxys (see p. 76). They differ in their partnership arrangements, types of organizational partners and duration.

The duration of field observation varied depending on the opportunities that I was given to undertake periods of participant observation, which influenced the methods used for data collection in each case study. Thus, I classified the case studies into three groups according to their duration, as this feature has implications for network formation and should be carefully considered when analysing the data. The first case study was pilot field research and it was observed for 6 months; two case studies fall into the in-depth category as they were observed for one year and a half and one year, respectively; the last three projects fall into the short-term category and were observed for three months each. The pilot and in-depth case studies involved key stakeholders heavily in the research and the short-term case studies involved predominantly direct observation. Table 15 describes the initial systemic features of each case study. Table 16 provides an overview of the characteristics of each initiative concerning issues of duration, focus, types of partner and arrangements and the research methods used in each.

Pilot Field research (1 initiative)	Older initiative, more established context and networks.
In Depth Field research (2 initiative)	New initiatives, long-term duration, context still emerging, but within greater and more established context and networks
Short Term Field research (3 initiatives)	New initiatives, short-term duration, private sector expertise, highly emergent context and networks

Table 15: Fieldwork categories according to duration (assembled by author)

Analysis of the communication flow of projects with a sectoral focus on social/community development, with distinct partnership arrangements						
	Pilot Fieldwork	**In-depth Fieldwork**		**Short-term Fieldwork**		
Project	**Metaprojeto**	**Redes Livres**	**DEPROTEC**	**IBM Smarter Cities Challenge – Porto Alegre**	**SAP Social Sabbatical – Fala Porto Alegre Service**	**SAP Social Sabbatical – 4th District Resurgence**
Local	São Paulo, SP, Brazil	Porto Alegre, RS, Brazil	Porto Alegre, RS, Brazil	Porto Alegre, RS, Brazil	Porto Alegre, RS, Brazil	Porto Alegre, RS, Brazil
Duration	6 months (2010)	17 months (2011/2012)	9 months (2012)	3 months (2013)	3 months (2013)	3 months (2013)
Specific Focus	Digital Literacy	Content Access	Digital Literacy	Public Service Improvement	Public Service Improvement	Community development
Stakeholders						
Type 1 – Public Sector	YES - State Government - - University -	YES - Federal Government -	YES - Federal Government -	YES - City Government -	YES - City Government -	YES - City Government -
Type 2 – Private Sector	NO	YES - Educational / Philanthropic Institution -	YES - Educational / Philanthropic Institution -	YES - Multinational Company -	YES - Multinational Company -	YES - Multinational Company -
Type 3 – Civil Society	YES - End User (Community) -	YES - NGO - - Volunteer (Individual Citizen) - - End-User (Community) -	YES - End User (Community) -	YES - NGO - - End-User (Community) -	YES - NGO - - End-User (Community) -	YES - NGO - - End-User (Community) -
Type of Agreement	Tight	Loose	Tight	Somewhat Formal	Somewhat Formal	Loose
Funding	From Public Sector	No	From Public Sector	From Private Sector	From Private Sector	From Private Sector
Research Methods used	Participant Observation Focus Group Discussion Semi-structured Individual Interviews	Participant Observation Focus Group Discussion Semi-structured Individual Interviews	Participant Observation Focus Group Discussion Semi-structured Individual Interviews	Participant Observation Follow-up interviews	Participant Observation Follow-up interviews	Participant Observation Follow-up interviews

Table 16: Case Studies main features (assembled by author)

The pilot study gave valuable insights regarding the methodological structure of my research. It was difficult to gather stakeholders from the different clusters together as initially intended. Methods such as focus group discussions require energy and time (Jorgensen, 1989; Petkov *et al*., 2007; Guest et al., 2013) and if these are not previously planned and embraced, it may cause undesired disturbances to the project mechanisms already in place. Also, perceptions gathered from individuals in the focus group discussions and some perceptions from the same individuals at individual interviews differed. There was insufficient time to iterate enough in order to achieve a consensus. In the pilot, it was not possible to start a process; just to gather data (Chambers, 1997). The main methodological adjustments included the opportunity that this gave to improve my interview skills and data collection optimization. I had originally planned to collect data regarding *Network Structure* and *Communication Level* at different moments and realized this could be done simultaneously during my interviews and focus group discussions, which I did in the subsequent in-depth case studies.

The short term case studies, although differing especially on time regarding the previous case studies, did provide much insight for assembling a systemic model of useful guidelines for effective collaborative action. The communication feedback cycles happened at a much higher frequency and as such, they were much more dynamic regarding outputs, and characteristics that were forwarding collaborative action were easier to observe in this cases (see Chapter 5, Section 5.4, p.207), thus assisting in the modelling of the systemic methodology I propose at the concluding chapter of this thesis (Figure 73 on Chapter 7, Sub-section 7.4, p. 273; see also Checkland, 2000).

The next sections introduce each case study very briefly along with an account on the field research agenda where applicable and an overview of the data collected in each case. At this stage, it is also worth noting that a distinct advantage of undertaking my research on a part-time basis was that it enabled me to spend much longer undertaking field work than would be normal for a PhD, and I was therefore fortunate to be able to examine some of the changes in network configuration over time.

3.4.2 Case study 1: Pilot Metaprojeto

Metaprojeto (http://www.acessasp.sp.gov.br/metaprojeto/accessed February, 2nd 2016, in Portuguese) is part of a large ICT4D initiative in the State of São Paulo, the Acessa São Paulo program (http://www.acessasp.sp.gov.br/accessed February, 2nd 2016, in Portuguese). Metaprojeto functions as a free workshop space in the areas of computer maintenance/reconditioning and IT development. The prime purpose of my pilot research was to test my methodology, thereby enable me to make necessary adjustments for the subsequent case studies. I conducted data collection regarding the *Network Structure* dimensionin full and the other two elements (*Communication Level* and *Content: Knowledge Production and Exchange*) partly, due to time and methodological constraints (see Chapter 4, Sub-section 4.2.2, p. 128). This case study lasted 6 months during the first half of 2010, as part of a formal research agreement between me and the research institution Escola do Futuro (School of Future, http://futuro.usp.br/accessed February, 2nd 2016, in Portuguese). I was based in Porto Alegre, Rio Grande do Sul and travelled for a week every month to São Paulo from February to June 2010. Table 17 provides the research agenda and Table 18 lists the methods used to collect data.

Metaprojeto research agenda	
1st In loco visit (São Paulo)	08.03 – 12.03.2010
Period in Porto Alegre, partial analysis	13.03 – 21.03.2010
2nd In loco visit	22.03 – 26.03.2010
Period in Porto Alegre, partial analysis	27.03 – 11.04.2010
3rd In loco visit	12.04 – 16.04.2010
Period in Porto Alegre, partial analysis	17.04 – 02.05.2010
4th In loco visit	03.05 – 07.05.2010
Remaining Period (final analysis and writing)	08.05 – 31.07.2010

Table 17: Metaprojeto research agenda

Methods	Source	Amount
Participant Observation	Research Diary	5000 words
	Ethnoshots	6 documents, average 2500 words each
	Pictures	25
	Videos	1
Focus Group Discussion	Audio Recordings/Transcripts	1
Individual Semi-Structured Interviews	Audio Recordings/Transcripts	5 (1h30min duration interviews)
Document Analysis	Different types of documents	Ponline statistical data (digital survey with Acessa SP users) and previous reports from School do Futuro.

Table 18: Data Collected for Case Study 1: Pilot Fieldwork Metaprojeto

3.4.3 Case study 2: In-depth Redes Livres

Redes Livres (Free Networks) is an initiative situated within CESMAR (Social Marist Center, http://socialmarista.org.br/cesmar accessed February, 2nd 2016, in Portuguese). It is situated in the neighbourhood with the lowest human development index of the city of Porto Alegre in South Brazil. Redes Livres' main goal was to resemble a digital village, providing free connectivity for communication and information exchange through a free intranet with a wireless signal using a mesh protocol. I observed Redes Livres from its inception for a year and a half, from August 2011 until December 2012, through an informal agreement. I visited the initiative twice a week, apart from the periods when the social centre was closed, in January and February. Table 19 provides the research agenda and Table 20 lists the methods used to collect data.

Redes Livres research agenda		
1st phase • Identification of the initial network structures of both individual and organization levels; • Application of questionnaires and conduction of focus group discussions regarding *Network Structure* and *Communication level*	In-loco visits twice a week	15.08 – 22.12.2011
Recess **Summer Vacation at CESMAR**		23.12.2011 – 01.03.2012
2nd phase • Re-assessment of *Network Structure* after my initial intervention • Application of questionnaires and conductions of focus groups regarding *Communication level* and *Knowledge Exchange*	In-loco visits twice a week	02.03 – 31.07.2012

Table 19: Redes Livres field research agenda

Methods	**Source**	**Amount**
Participant Observation	Research Diary Ethnoshots Pictures Videos	25000 words 6 documents, average 2500 words each 50 3
Focus Group Discussion	Audio Recordings/Transcripts	6 (1h30min long average)
Individual Semi-Structured Interviews	Audio Recordings/Transcripts	25 (1h long average)
Document Analysis	Different types of documents	1 Project Documentation Wiki (intranet), Websites, Facebook Group

Table 20: Data Collected for Case Study 2: In-depth Redes Livres

3.4.4 Case study 3: In-depth: DEPROTEC

DEPROTEC (Development of Technological Projects) was an initiative also situated at CESMAR. The initiative took place from March 2012 through March 2013, in the form of a modular course for students of the community in the areas of software, electronics and communication. Its main objective was to provide young people with training in the

area of ICTs. I was a participant observer in DEPROTEC as a researcher in the project, through a formal agreement from March to September 2012 and through an informal agreement from November to December 2012. I visited the initiative 2-3 times a week. Table 21 provides the research agenda and Table 22 lists the methods used to collect data.

DEPROTEC research agenda		
• **Identification of the initial *Network Structure* of both individual and organization levels** • **application of questionnaires and conduction of focus group discussions regarding *Network Structure* and *Communication level*** • **Participant Observation regarding *Network Structure*, *Communication level* and *Knowledge Exchange***	In-loco visits twice a week	15.04 – 22.12.2012

Table 21: DEPROTEC Field Research Agenda

Methods	**Source**	**Amount**
Participant Observation	Research Diary Ethnoshots Pictures Videos	15000 words 3 documents, average 2500 words each 60 2
Focus Group Discussion	Audio Recordings/Transcripts	6 (1h30min long average)
Individual Semi-Structured Interviews	Audio Recordings/Transcripts	21 (1h long average)
Surveys	Statistical Surveys	41 (number of students taking part on the project)
Document Analysis	Different types of documents	Marist Technological Training Complex Term of Reference, DEPROTEC agreements, Meeting reports, Websites

Table 22: Data Collected for Case Study 3: In-depth DEPROTEC

3.4.5 Case study 4: Short term IBM Smarter Cities

This case study's main stakeholders are the city of Porto Alegre and IBM. The city of Porto Alegre, located in the state of Rio Grande do Sul, South Brazil, was awarded the IBM Smarter Cities Challenge (http://smartercitieschallenge.org/city_Porto_Alegre.html, accessed February, 2nd 2016). The IBM Smarter Cities Challenge consists of a donation of expertise by IBM Executives to a specific demand of the city. In the case of Porto Alegre, the project revolved around transforming Porto Alegre into a more cognitive city ('a smarter city', as coined by IBM). I engaged in this initiative as a program manager, through the logistics partner, the American NGO PYXERA Global (http://www.pyxeraglobal.org accessed February, 2nd 2016). Overall, my tasks included selecting the organizations that receive the corporate volunteers; assisting these organizations to elaborate scopes of work specifying the areas in which they need help; once volunteers were on the ground, my tasks ranged from logistical issues to conflict management among stakeholders. In short, my main role was to ensure that the program ran smoothly. After the projects were over, PYXERA Global applied both short-term and long-term impact online surveys, which were also used as data for my research (see Table 23 below).

The project lasted three months, between the preparation of the scope of work and in-loco arrival of consultants for the period of a month, in March 2013. My research agenda consisted of participant observation throughout the project life-cycle, since there was no formal agreement yet for me to conduct research. It was agreed with the IBM foundation that I could use this initiative as a short-term case study in my research after the project was over. Table 23 lists the methods used to collect data.

Methods	Source	Amount
Participant Observation	Research Diary Pictures	2000 words 25
Document Analysis	Different types of documents	Memorandum of Understanding, Project Scope of work, Deliverables, Websites
Post-Project Online Surveys	internet	26 Short and Long-term Impact Surveys with project stakeholders

Table 23: Data Collected for Case Study 4: Closure Fieldwork IBM Smarter

3.4.6 Case study 5: Short term SAP Social Sabbatical – Fala 156

The SAP Corporate Social Responsibility division offers SAP employees the opportunity to take a sabbatical month, working as volunteers in a program called SAP Social Sabbatical (http://global.sap.com/corporate-en/news.epx?PressID=19248 accessed February, 2nd 2016). This program, similar to the IBM Smarter Cities challenge, is also coordinated in Brazil by PYXERA Global and I acted as a program manager. This case study's main stakeholders were Porto Alegre's Local Governance Secretariat and SAP. The objective of the project was to optimize the processes of Porto Alegre's public service hotline, Fala 165 (Speak up 156).

There were two phases to this project. The first phase lasted three months, between the preparation of scope of work and in-loco arrival of consultants for the period of a month during October 2013. The second phase had the same structure and occurred in April, 2014. My research agenda consisted of participant observation throughout the project life-cycle, since once again there was no formal agreement yet to conduct research. It was subsequently agreed with SAP that I could use this initiative as a short-term case study in my research. Table 24 lists the methods used to collect data.

Methods	Source	Amount
Participant Observation	Research Diary	3000 words
	Pictures	50
Document Analysis	Different types of documents	Memorandum of Understanding, Project Scope or work, Deliverables, Websites
Post-Project Online Surveys	internet	16 Short and Long-term Impact Surveys with project stakeholders

Table 24: Data Collected for Case Study 5: Short-term SAP Social Sabbatical Fala 156

3.4.7 Case study 6: Short term SAP Social Sabbatical – 4th district

The last short-term case study observed was the SAP Social Sabbatical Porto Alegre 4th district. The project configuration was the same as the short-term Fala 156 (see section above). This case study's main stakeholders were the 4th District movement, an organized civil society movement designed to revitalize an industrial neighbourhood of Porto Alegre (https://4distrito.wordpress.com/accessed February, 2nd 2016, in Portuguese) and SAP. The objective of the project was to help the movement develop a

strategic plan of action in the first phase, and then the design of a collaborative platform to solve urban problems in the second phase.

The first phase once again lasted three months, between preparation of scope of work and in-loco arrival of consultants for the period of a month during October, 2013. The second phase had the same structure and occurred during April, 2014. My research agenda again consisted of participant observation throughout the project life-cycle, since there was no formal agreement yet to conduct research. Subsequently, as with Fala 156, it was agreed with SAP that I could use this initiative as a short-term case study in my research. Table 25 lists the methods used to collect data.

Methods	Source	Amount
Participant Observation	Research Diary Pictures	3000 words 20
Document Analysis	Different types of documents	Memorandum of Understanding, Project Scope of work, Deliverables, Websites
Post-Project Online Surveys	internet	16 Short and Long-term Impact Surveys with project stakeholders

Table 25: Data Collected for Case Study 5: Short-term SAP Social Sabbatical 4th District

The above provided a brief description of each one of the case studies observed during this research. Chapter 4 (p. 125) is dedicated to establishing the contexts of each initiative in detail, since context is a core issue within the systemic approach suggested (p.43).

3.5 Data analysis

It is important to describe the procedures of data analysis as much as it is to describe those of data collection (see Section 3.3 above), in order to make explicit my rationale for the path developed in the subsequent analytical chapters. The overall conceptual design reviewed in Section 3.2 (p. 76) remained the same throughout my research. However, the weight initially put on the systemic dimensions (*Network Structure*, *Communication Level* and *Content: Knowledge Production and Exchange*) had to be adjusted according to the initial findings drawn from my pilot field research (Murray and Overton, 2003).

I intended to revisit the visualization of the *Network Structure* at focus group discussions. However, I found that it was very difficult to bring stakeholders from different clusters together. When I did manage to do this, the changes in *Network Structure* were so little that the effort and time spent was not worth it. I decided then to increase my focus on the *Communication Level* and *Content: Knowledge Production and Exchange* dimensions. During my in-depth fieldwork I also let go of the' ideal 'scenario' of bringing every identified key stakeholder together in focus group discussions (Chapter 2, p. 41 and Section 3.2 p. 76). Instead, I settled for focus group discussions with separate clusters within the networks, such as a focus group discussion with directors and main coordinators and then with educators and then with students. However, when I managed to conduct a focus group discussion with representatives of all clusters, issues were discussed at the level I expected (see Chapter 5, Sections 5.2 and 5.3, p.182). Unfortunately, it was not feasible to schedule such focus group discussions more frequently. People's agendas were too different and it was not possible to bring them all together.

The proxys detailed in Section 3.2 (p. 76) were used to encode data for analysis. The first sub-section below explores in detail the features of social network visualization I engaged with, giving an account of the justification of choice for the software used to generate the visualizations and my rationale on how I used the software. The second sub-section describes the procedures for data transcription and the justification of choice for the software used for data encoding and analysis (Crang, 1997).

3.5.1 Social network visualization and analysis

The data from focus group discussions, individual interviews and participant observation techniques regarding *Network Structure* assisted in generating the visualization of the social networks observed in the case studies. The visualization of the networks did not just offer a purely descriptive network map (*Network Structure*), but also assisted with an initial understanding of the information flows (*Communication Level*). Social Network Analysis (SNA) assisted in identifying the systemic dimensions of this research (see the discussion on Chapter 2, Sub-section 2.2.2, p.54).The case studies were observed in terms of their organizational structure from a network perspective, primarily focusing on nodes and the interaction of the nodes (Wassermann & Faust, 1994, Barabási, 2002; Recuero, 2005, Centola, 2015). SNA is used here as a diagnostic tool for identifying and analysing the flows of information and showing them to the participants subsequently for focus group discussions. The initial maps generated acted as visual material and as a starting point for discussion, helping to improve these flows within the emergent context, rather than seeking to create new ones (Clark, 2006). The social network visualizations (see Chapter 4, p. 125) entailed the main purpose of identifying key stakeholders within the context observed (Clark, 2006).

During my pilot field research (2010), I began researching the types of tools available, with the intention to find the most suitable one for my purposes. As Huisman and Duijin (2011) noted, it is very difficult to assemble a list of every SNA tool available, as there are many and the list constantly needs revising. However, they assembled a comprehensible comparison amongst a diversity of tools available, first based on the software list of the *International Network for Social Network Analysis* (INSNA, 2016) and in the second revision of their review they used the list assembled in Wikipedia (2011). At the time I did my pilot research, I used their list in order to choose the most relevant software. I was looking for a tool that had already been widely evaluated and was well known, such as UCINET (2016), Pajek (2016) or NetMiner (2016). The aspects they reviewed comprised data format (type of data, input format, and ways of indicating missing value codes for network relations), functionality (visualizations options, what kind of analysis it can perform) and finally the amount of support available (availability of the program, presence of online help, manuals).

I also spoke with colleagues in the field, who had been working with such tools, as well as looking at the review presented by Huisman and Duijin (2003), searching on websites such as the INSNA or Wikipedia's list and network mapping manuals such as the one assembled by Clark (2006). PAJEK stood out as the preferred choice for most, but it is less user-friendly and suited for researchers with more advanced programming skills. Ucinet would have been a safer choice, but it is commercial and I had already opted for commercial software for the qualitative data analysis (see below, p. 121) so could not afford another. As I could count on colleagues who had been working with PAJEK for quite a long time, I chose to use that software at first. Back in 2003, PAJEK was also ranking high in most of the aspects reviewed by Huisman and Duijin (2003), such as functionality, support and user-friendliness.

However, I was not happy with the user-friendliness aspect of the software. In 2014 I took a SNA online course from the University of Michigan (https://www.coursera.org/ , accessed February 6th, 2016) and found out about GEPHI (2016), which is a free and open source network visualization software available for any operational system. It is thought to be one of the most advanced of the open source options (Butler, 2015) and it is much superior in terms of usability and graphic generation. I do not know why GEPHI does not appear in Huisman and Duijin's (2011) revised list, but speaking to colleagues in the field, I found out that most of them were now also using GEPHI instead of PAJEK at that point. As the course I took gave me a good overview of the possibilities of SNA using GEPHI and I felt most comfortable with the software, I decided to re-generate all of the networks I had done so far with PAJEK using GEPHI instead and I used GEPHI for all of the new ones. The main stakeholders both at an organizational and an individual level were identified from data collected and matrices were built in order to create the visualizations using GEPHI. These network visualizations represent the *Network Structure* systemic dimension (see Section 3.2) and are depicted in Chapter 4 (p.125)

SNA has been used in many different fields, particularly communications, mathematics, and physics, and in many different ways. Network science has its origin in the field of mathematics, where it is most commonly called a graph. However in the field of social network analysis, the systems studied are always called networks. Networks are composed of nodes (or vertices) and links (or edges), as illustrated by Figure 17 below.

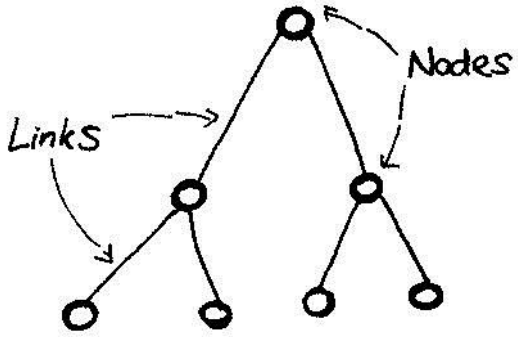

Figure 17: Depiction of a network and its components. (Author's Illustration)

Network nodes (vertices) are represented in my maps by different colours and shapes. An example of a node attribute is its role in the project. *Network Links (relationships/edges)* are the connections between the nodes of the network. They show the different relationships between them and can be determined, for instance, as information source (information flows of the network), dialogue level (contact with different nodes) or knowledge production and exchange (flow of ideas among nodes). It is also possible to give numerical values to these relationships, and thus the strength of the ties is measured by quantitative data.

My GEPHI input files were created using variables that helped to determine visually the amount of communication between the network nodes. During the qualitative assessments, I asked participants how many times they talked to specific stakeholders in a certain period of time. By assigning numerical values to the relationships generated through focus-group discussions and interviews, I was able to define the strength of the link from one node to the other (Barabási, 2002; Clark, 2006).The thicker the line, the more communication there is (see Table 26 below):

Link Weight	**Communication Level of pilot and in-depth case studies**	**Communication Level of short-term case studies**
Thin (2)	Weak **– equal or less than once every six months**	Weak **–once a month or less**
Medium (4)	Little **– once a month**	Little **– twice a month**
Medium Thick (6)	Good **– Once a week**	Good **– Once a week**
Thicker (8)	High **- Everyday**	High **- Everyday**

Table 26: Values for the strength of the edges in network visualization according to data collected (Assembled by me)

For illustrative purposes, Figure 18 shows the table of links with their respective weights for one of the networks studied:

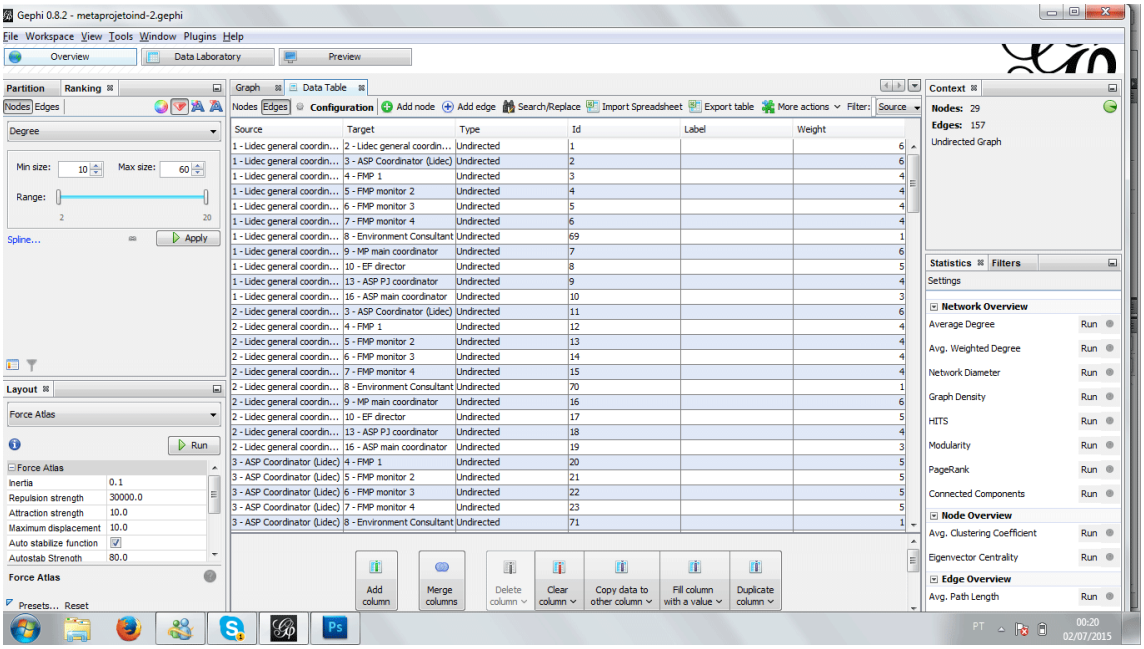

Figure 18: Screenshot of table of links in SNA Software GEPHI

Besides the link strength, I also assigned colours to the different organizational sectors as shown in Table 27 to facilitate visualization when taking the networks back to stakeholders:

Type of Partner	Example	Color
Public Sector	• Government institution	(pink)
Private Sector	• For-profit organizations • Multinational organizations	(green)
Civil society	• Non-governmental institutions • Community on demand side of the project • Volunteers • End Users	(salmon)
Mixed Capital[7]	• IT Government Companies	(light green)
Research Institution	• Universities	(pale yellow)

Table 27: General typology employed in this research (based on Unwin, 2005)

[7] Mixed Capital in the case of Brazil, is a closed partnership where the government has major participation (more than 50% of the stocks). There are a couple of Mixed Capital enterprises in some of the case studies.

After inserting both data matrices of nodes and links with information regarding the strength of the links between nodes and also the type of sector each node belonged to (see Figure 18 above), I was able to start exploring the visualization of the networks. At first, the nodes in the network are positioned randomly by the software. The first essential operation is to run an algorithm better to shape the network. GEPHI offers different energy algorithms for visualization of the networks once data has been entered. Most of these algorithms follow the principle of attracting nodes that are linked to each other and pushing apart nodes that are not linked. For this purpose I used Force-Atlas, the most used algorithm in GEPHI (See Figure 19 and Figure 20):

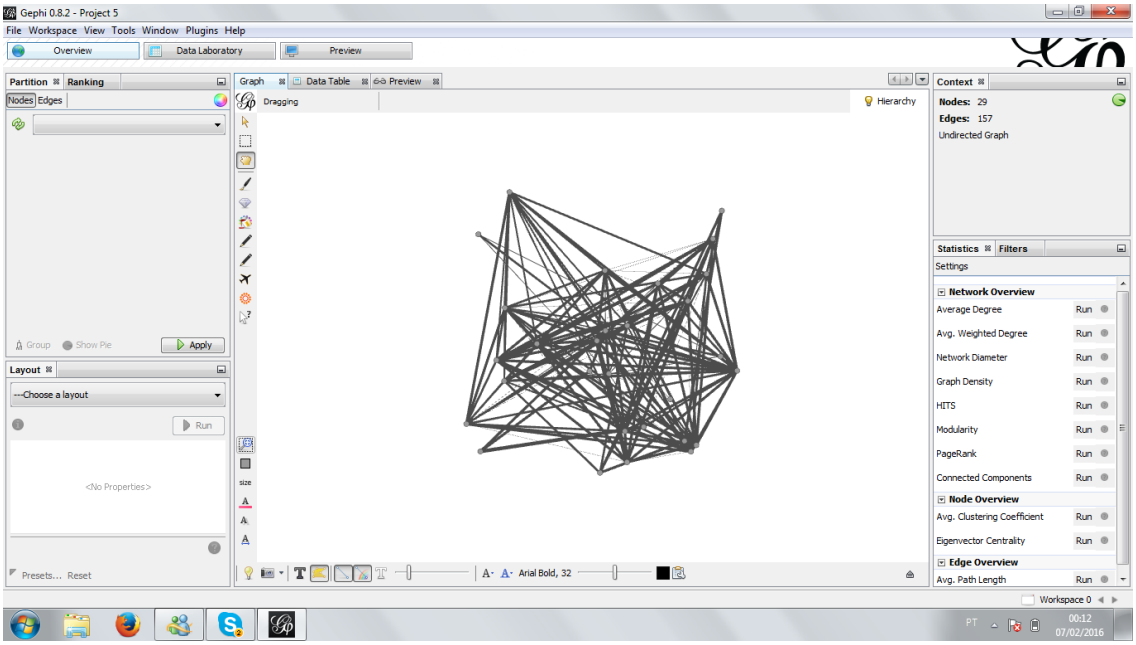

Figure 19: Screenshot of GEPHI / Graph view before using algorithm Force Atlas

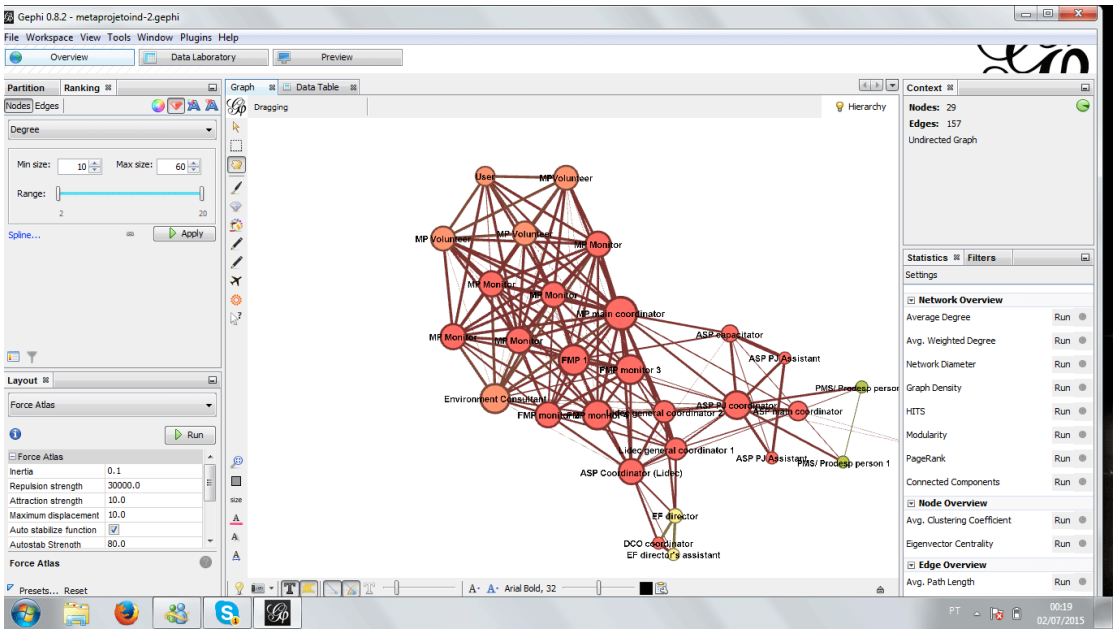

Figure 20: Screenshot of GEPHI / Graph view after using algorithm Force Atlas

The size of the nodes represents their degree in the network, namely how well connected they are. The bigger the node, the more links it has. In the example above, the most connected nodes form a cluster in the network while less connected nodes are placed further apart by the algorithm. GEPHI also offers a data preview section, where one can better layout the networks. Figure 21 is an example of a finalized network generated with GEPHI to illustrate how they are presented in Chapter 4, (p.125).

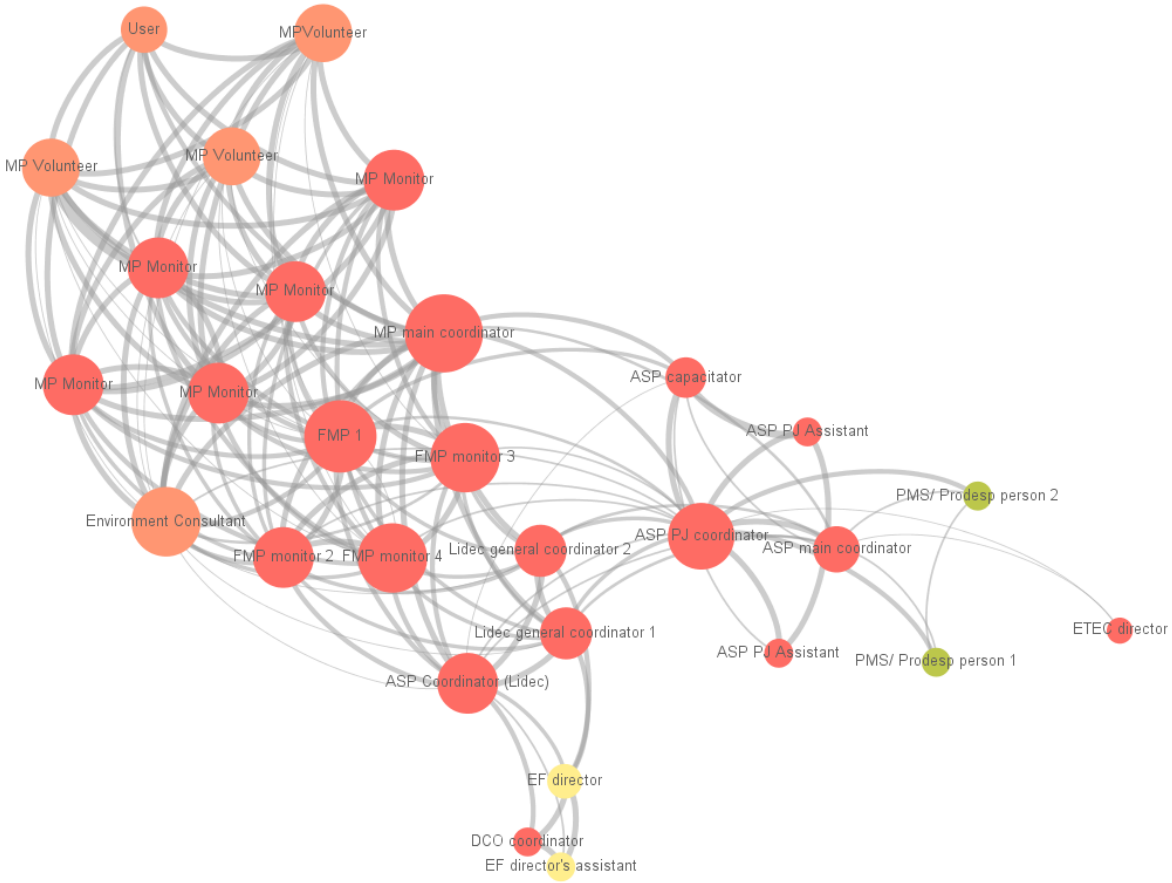

Figure 21: Example of a finalized social network generated with SNA software GEPHI

At the in-depth case studies, the visualization of these networks came about not only through participant observation, but also from the inputs of key individual stakeholders. They provided views that helped to generate the visualised networks, helping to limit the boundaries of the networks to be studied. However, for the short-term projects, they were not formally discussed with interviewees and these networks only represent my own views. I generated the datasets for the network visualization in all of the case studies, and in so doing I had to make some individual decisions when analyzing the data, based on my own reflections and participant observation. As an example, stakeholders at higher hierarchic levels would name every organization they thought to be involved in the process even though formally they were not part of the partnership, and stakeholders from lower levels had never heard of these partners:

> *Project manager:* '(...) this whole space belongs to the Sports Secretariat.'
> *FS:* 'Is this considered to be a partner?'
> *Project coordinator:* 'A hidden partner!! I never met anyone from the Sports Secretariat' [8]
>
> (*Focus Group Discussion, Metaprojeto, 15.04.2010*)

In this instance, I added the partner to the network matrix, because the individual stakeholders acknowledged them as such. However, since it was not an active partner, it appears further from all network nodes and a light connection to the person that mentioned it, as adjusted by GEPHI's Force Atlas algorithm (see Chapter 4, Section 4.2.3, p.130). Moreover**:**

> *FS:* '(...) so I will place Maddog over here with Brother Pedro (...) '
> *Volunteer 8*: 'Our new partner (...)'[9]
>
> *(Focus Group Discussion, Redes Livres, 28.10.2011)*

In the focus group discussion above, project volunteers wanted me to include Jon 'Maddog' Hall, the founder of the Linux Foundation (Linux Magazine, 2016), because they met him personally at a Free Open Source Software, as a partner. Maddog is an enthusiast of their project, but not an actual stakeholder. As the group was very excited about this, I kept him as part of the network, although I was not convinced myself that he should be. His real involvement is shown in terms of the amount of communication he had with the volunteers. As the case reported above, Maddog ended up as more remote node in comparison to those nodes actively engaged in the project, as shown in Figure 22.

8 Original:
Coordenador principal: '(...) o espaco aqui todo é da secretaria do esporte.'
FS: 'É um parceiro também né?
Coordenador de projeto: 'Um parceiro Oculto! Por exemplo, eu nunca tive contato com ninguém do esporte'

9 Original:
FS: '(...) Então vou colocar o Maddog aqui junto do Irmão Pedro.(...)'
Voluntário 8: 'Nosso novo parceiro (...)'

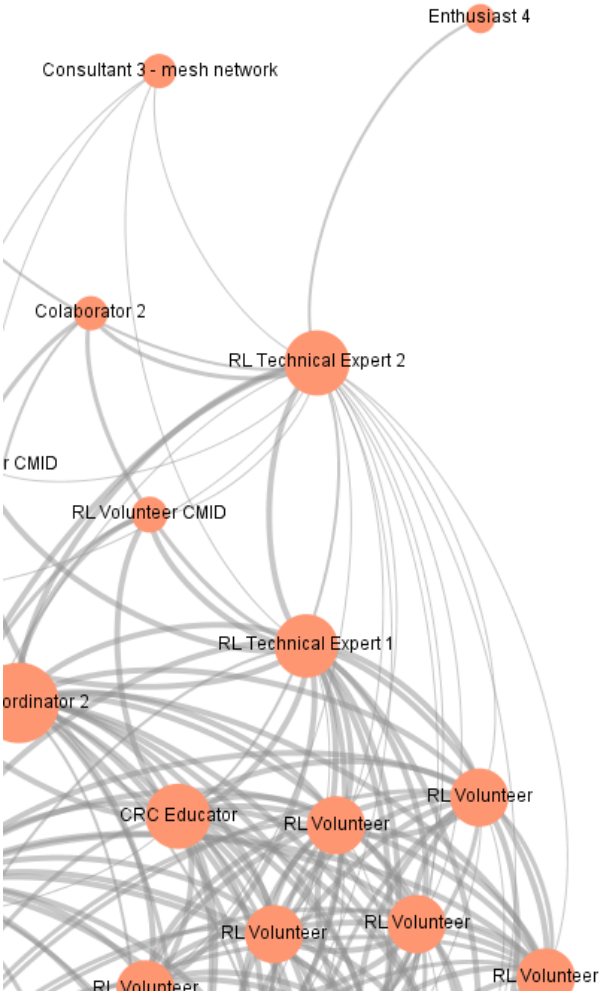

Figure 22: Redes Livres Individual Network zoomed in to show Maddog (Enthusiast 4)'s distance from the cluster of volunteers

Such decisions were made according to methodological definitions as discussed in Section 3.3 (p. 85), as much as this is a participatory endeavour. Otherwise it is not possible to achieve the necessary research rigour (Pinch and Bijker, 1984). The networks generated are born from my perception, but the intention is to be as truthful to individual inputs as possible. Some respondents might have had different opinions as was observed in the focus-groups discussions, but the overall purpose was to try to achieve consensus about the networks generated. The initial definition I made for the types of organizational stakeholders changed at times, according to participants' inputs and this was accounted for whenever it occurred. For instance, in one of the focus-group discussions, stakeholders were puzzled about how to classify São Paulo University (USP). USP is a government university and the question was whether we should classify it as public sector or as a research institution. According to my initial classification, the institution within USP responsible for coordinating Metaprojeto would be a research

institution. However, for the majority of individuals involved in Metaprojeto, they classified it as public sector, since USP belongs to the State:

> *Project Coordinator*: 'Well, I see School of Future as public sector, belonging to USP (University of São Paulo). But I don't know how this is so (...) because School of Future works by receiving projects (...) so for me, this is a bit foggy, this thing of (...) the government being a client from School of Future (...) they are both public sector (...)'
>
> *FS:* 'So you classify the School as public sector, not as a research institution?'
>
> *Project Coordinator:* 'No, not as a research institution'
>
> *FS:* 'Public sector means government, right?'
>
> *Project Coordinator*: 'Yes. So, USP is a government institution. School of future is within a government institution, which receives money from the state government, which in turn also maintains USP to develop a certain type of work. I am in this second line of the public sector that develops this work.'
>
> *(Individual Interview, Metaprojeto, 13.04.2011)*

The next section explores the analysis of data collected through participant observation, focus group discussions and semi-structured interviews.

3.5.2 Qualitative data encoding and analysis

Section 3.3 (p.85) described the methods used for data collection, and in this section I detail how I transcribed and encoded the data collected for analysis. After data collection, the raw data I was left with were research diaries about things that happened in the field, notes on my development as a researcher and thoughts around my pre-findings, 70 hours of recorded interviews and focus group discussions, photographs, documents regarding project agreements, websites, e-mails and Facebook groups. Table 28 below assembles the qualitative data collected among all case studies.

Methods	Source	Amount
Participant Observation	Research Diary	53,000 words
	Ethnoshots	18 documents (45,000 words total)
	Pictures	135
	Videos	6
Focus Group Discussion	Audio Recordings transcribed	13 (19h30min total)
Individual Semi-Structured Interviews	Audio Recordings transcribed	51 (51 hours total)

Table 28: Compilation of all qualitative data collected

I transcribed all of my interviews and group discussions by myself; this was a very time-consuming task (Conradson, 2005). The transcription files had the configuration shown in Table 29 below.

Line	Speaker	Notes	Text	More Notes
1	Me	Notes regarding my behaviour	(Actual Transcription)	Any extra observation
2	Interviewee	Notes regarding the Interviewees behaviour	(Actual Transcription)	Any extra observation

Table 29: Transcription File Template

My transcriptions reflected exactly what the interviewees and I said, along with notes around both our behaviours. The reason for this was because I was interested in how they were making sense of the process they were engaged in. Not only was what they were actually saying important, but their tone of voice, hesitations as well as my actions were commented on, so I also could reflect on how I could have been influencing their answers (Crang, 1997; Guest *et al.*, 2013). The focus group discussions followed the same structure for transcription, but at some points not with such level of details. Some of the focus group discussions had a great number of people talking at the same time, so I did my best to grasp everyone's lines. The notes I made during the focus group discussions were particulalry valuable in reminding me what was the context at the time, which made the transcription easier.

Once I had all my raw data in written form, the next stage was to encode it. I used qualitative analysis software for data encoding and generation of reports accordingly.

Such types of software help to speed up the process of coding and sorting through the materials needed for analysis (Crang, 1997). I chose to use the commercial software Hyperresearch (2016) for the coding and fetching of qualitative data (Figure 23). I had previosuly used Hyperresearch and so I was acquainted with its features, thus saving time in the overall analysis. Moreover, Hyperresearch is very flexible and offers many useful features for assisting in the analysis of qualitative data. For illustrative purposes, Figure 23 shows the box with the different sources of my raw data; then a box with all the research proxys/codes (as detailed in Section 3.2) and the bigger box shows one of the source materials and the coding that I did on that particular excerpt.

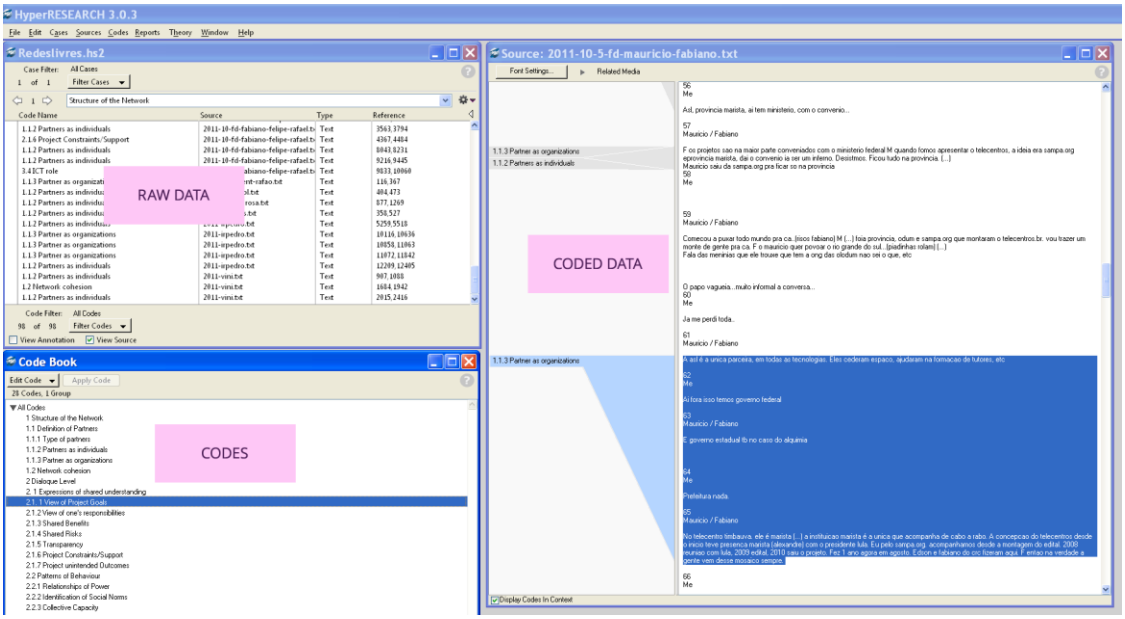

Figure 23: Hyperresearch screenshot

From the process above, I was able to fetch reports on each specific code. For instance, I could generate a report on '*View on project goals*' proxy, containing all of the raw data I had coded which such an proxy. These results provided me with connections and patterns through my raw material (Crang, 1997), which, together with my notes regarding the contexts on each of the interviews and focus group discussions, I could then analyse with some rigour. The six case studies can be cross-compared regarding the systemic dimensions detailed in this research provided their specific contexts are considered. The research's analysis occurred in those terms, as will be seen in the subsequent chapters.

3.6 Final observations

This chapter described my rationale to operationalize the three dimensions of my research's systemic view in order to collect data, namely *Network Structure, Communication level and Content: Knowledge production and exchange*. It has shown how proxys were drawn from literature in the fields of communication for social change, ICT4D partnerships, collaboration and stakeholder management. These proxys assist in the acknowledgment of the presence or absence of characteristics that are considered as catalysts for the creation of an environment that favours effective collaborative action. Furthermore, the chapter detailed a qualitative approach that combines methodologies borrowed from participatory action research and complex network theories which in turn comply with the soft systems thinking approach of this research. The qualitative framework assembled supports the intention to start a process of enquiry and learning, rather than just data gathering. Moreover, the diverse features of the case studies presented in the sampling section provide different network dynamics to be analysed in the light of the same systemic framework and proxys, a core interest of this research. The last section of this chapter described the procedures for data analysis in order to make explicit my rationale for the structure of the subsequent analytical chapters.

The next chapter provides a detailed account of each of the case studies so to provide a deep understanding of their context, a key concept in this research. It also presents the network visualizations generated and analyses issues of network cohesion and the initial patterns identified across the different contexts observed. The chapter ends with an account on why the initiatives presented certain patterns and why issues of stability or creativity of such networks could be forwarding or hindering effective collaborative action. This provides the ground for Chapter 5 (p.181) to answer this research's first main question:

> *What are the relationships between network topologies and communication processes within Brazilian multi-stakeholder ICT4D initiatives, and why do they function as they do?*

4 Network visualization: Establishing the context

4.1 Introduction

This chapter focuses on the first dimension of this research, namely the *Network Structure*. It provides the context of the case studies and describes their respective organizational and individual networks. For the pilot and in-depth case studies I was able to create the network topologies with input from all of the stakeholder's multiple perspectives. Multiple perspectives raise complexity because of the different views and mental models about the same processes (Checkland, 2000; Capra, 2002; Kapsali, 2011), but comparing these views ensured that a consensus around the network topologies was built. The short term case studies networks solely depict my views, because I did not have sufficient time to undertake all of the interviews necessary and I therefore collected information only through participant observation techniques with no direct input from the stakeholders.

The objective of this chapter is first to establish the contexts of each case study, and the first sections of this chapter are therefore of a descriptive nature. The initial depiction of the networks provides an overview of characteristics such as the most active nodes, key-decision makers and how they are positioned in the network (Luhmman, 1995; Capra, 2002; Barabási, 2009; Centola, 2015). The knowledge gathered from these visualizations was fed back to stakeholders in the in-depth case studies in order to provide them with information around the structures in which they were inserted. The purpose of this was to stimulate a dialectical learning mechanism alternating form and processes to stakeholders within these systems (Bateson, 1979), so as to provide them with a more critical view of the existent communication feedback cycles (see Chapter 2, Section 2.2, p.43).

The next sections are divided by case study. Each section establishes the case study's context by describing the projects and their stated goals, methodological constraints that were relevant regarding data collection, and the last sub-section presents the organizational and individual networks. After the situational contexts and networks have been presented, Section 4.8 compares the networks, exploring initial differences and similarities between them. Section 4.9 explores methodological adjustments that were made while in the field.

4.2 Pilot Metaprojeto

4.2.1 Context

Metaprojeto (http://www.acessasp.sp.gov.br/metaprojeto/ accessed February, 6th 2016, in Portuguese) is part of a much larger ICT4D initiative in the State of São Paulo, the Acessa São Paulo Program (AcessaSP, http://www.acessasp.sp.gov.br/, accessed February, 6th 2016, in Portuguese). Metaprojeto is a workshop space that offers courses free of charge in the areas of computer maintenance and reconditioning, and IT development. This initiative was launched in April 2008 and it is situated at the State Technical College (ETEC) building. ETEC in turn is situated at Parque da Juventude (Youth Park), which was built in 2002 where the former Carandiru Penitentiary Complex[10] used to stand (see Figure 24).

Figure 24: Parque da Juventude Complex. The building to the right is the State Technical College (ETEC). The Acessa SP Program occupies a whole floor, where Metaprojeto is also situated (Source: https://static.panoramio.com.storage.googleapis.com/photos/1920x1280/66864208.jpg).

10 For more information: http://en.wikipedia.org/wiki/Carandiru_Penitentiary

In order fully to understand Metaprojeto, it is important to say a little bit more about the larger AcessaSP context. AcessaSP is one of the largest ICT4D projects in Brazil, maintaining public spaces with free access to the internet since 2000. By 2016, it had 850 telecenters serving 600 municipalities. Metaprojeto is embeded within Rede de Projetos (Projects Network, http://rede.acessasp.sp.gov.br/, accessed February, 6th 2016, in Portuguese), an initiative that belongs to the AcessaSP Program. Rede de Projetos' goal is to promote and create a network of community led projects involving ICTs.

One of Metaprojeto's goals is to serve as a pilot for Rede de Projetos. Metaprojeto managers and educators create workshops that are tested and then replicated in other initiatives within Rede de Projetos. Other objectives include workshops for computer reconditioning, mantainance and assembling, basic computing principles through profissionalization and interaction with digital technology and the creation of a collaborative network with other projects within Parque da Juventude focusing on youth.

Figure 25: Workshop: Introduction to internet at Metaprojeto, photo by author (April 2010)

Figure 26: Technology experimentation space at Metaprojeto, photo by author (April 2010)

There are no official statistics for Metaprojeto. The people attending the workshops vary in age and gender greatly and most of them live live nearby, according to an educator in an informal conversation (13.03.2010). During the workshops teenagers can be seen alongside elderly people, learning how to assemble a computer together.

> '(...) People start off a little shy but soon they are already engaging with each other and if there are language barriers, that is soon overcome.'[11]
>
> *(Interview with Metaprojeto Educator, 15.05.2010)*

4.2.2 Methodological constraints

There were three main constraints in conduct field work in Metaprojeto. The first was a difficult communication process before the actual start of data collection. The field work was meant to start in January 2010, but January and February is summertime in Brazil and processes are usually slower during this time of the year. This is because many

[11] Original: '(...) As pessoas começam meio tímidas, mas logo elesjá interagem um com o outro e se há barreiras nas linguagens, isso logo é superado.'

people take vacation at this time, especially at Universities. I had many enquiries that would help me prepare and optimize my time during fieldwork, such as 'What are the potential projects that fit my research purposes?'; 'Who will be the main people I will be communicating with?', 'May I start communicating with them beforehand?' These were, however, never answered and my first visit to São Paulo happened only in March, because the people who would be in charge of supporting me were not there before that. I therefore had to apply a shortened version of the methodology due to these time constraints and focused on two dimensions: *Network Structure* and *Communication Level*.

The second constraint was the difficulties in gathering data due to bureaucratic and political reasons. This reinforces the view that it is not unusual for more institutionalized systems to superimpose their processes (Chambers, 1997; Capra, 2002; Unwin, 2005; Barabási, 2009; Centola, 2015). I also experienced great care regarding approval to conduct research because the year of 2010 was an election year and AcessaSP is a government led project.

> '(...) I am working on the presentation for AcessaSP's main manager in order to get approval to conduct research and a series of e-mails go back and forth between me and my coordinator to revise the document. She sends me a map of the institutional relations so I understand how the process works, since I am worried with the timeframe, giving the whole bureaucracy I am going through.
>
> *(Notes from my diary - Pre-in loco visit period, 12.03 – 21.03)*

The third constraint concerned differences in interpretations regarding what is a proper process to conduct research within the context of AcessaSP. As mentioned by the research coordinator:

> 'AcessaSP, since its inception, has gained much complexity and therefore one looses in degrees of freedom'
>
> (*Informal conversation, Metaprojeto, 22.03.2010*)

However, at the meeting (24.03.2010) when my proposal was presented, the AcessaSP manager approved it with no further comments and the local coordinator at Parque da Juventude revealed later in an interview:

'Why didn't you come direct to us, it didn't have to be so formal'

(*Individual Interview, Metaprojeto, 12.04.2010*)

The above process reinforces the view that people perceive the same events differently according to their own history and the context in which they are inserted (Bateson, 1979; Checkland, 2000; see Chapter 2, p. 41). What seemed to be logical for one stakeholder, such as writing a very formal proposal, was not reflected by the other. I always had to adapt my research to the possibilities available.

4.2.3 Organizational and individual networks

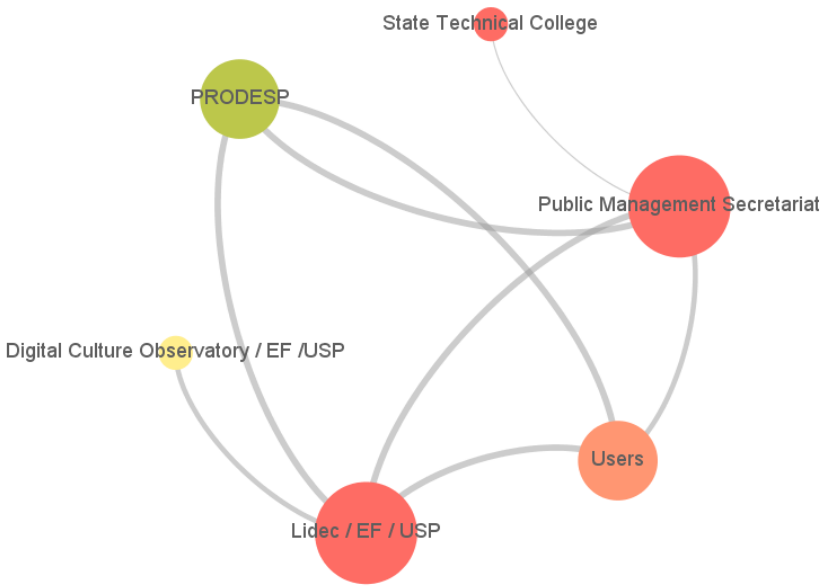

Figure 27: Social Network of Metaprojeto organizational stakeholders generated with SNA software Gephi.

There are three main organizations involved in the implementation of AcessaSP and Metaprojeto. These are the higher degree nodes depicted in the network above. The first is the Public Management Secretariat of São Paulo (http://www.gestaopublica.sp.gov.br/, accessed February, 6th 2016, in Portuguese) which coordinates the entire program. The second is São Paulo's Data Processing Company, PRODESP (http://www.prodesp.sp.gov.br/, accessed February, 6th 2016, in Portuguese). PRODESP manages AcessaSP in partnership along with the third higher

degree node depicted in the network, the Research Support Center for New Technologies applied to Education, LIDEC a.k.a Escola do Futuro (EF, Future School, http://futuro.usp.br/, accessed February, 6th 2016). EF is situated within the State University of São Paulo, USP. All these partners belong to the public sector (pink), apart from PRODESP which is a mixed capital company (green).

Moreover, Escola do Futuro (Public Sector), PRODESP (Mixed Capital) and Users (Civil Society) are part of the most cohesive cluster, meaning they engage more often with each other, as shown by the thicker links. The Public Management Secretariat, despite being highly connected, does not engage as much with end users as indicated by the thinner line that connects them. The smaller degree nodes are organizations not directly involved in Metaprojeto. The State Technical College (Public Sector) is where Metaprojeto is located and according to participants the project would not happen without them, even if it does not contribute directly to project process and outcomes. The Digital Culture Observatory is depicted as a stakeholder linked to Escola do Futuro because it does not contribute directly to Metaprojeto, although it is conducting research on the project through my intervention. The individual network of Metaprojeto demanded greater iteration of stakeholders in order to achieve consensus regarding the structure of the network:

> *EF Coordinator*: '(...) excuse me (...) I would do it a little different. May I?'
> *Metaprojeto Coordinator*: '(...) my network would be a little different (...) I am learning from yours (...), OK, I agree (...)'
> *PRODESP Coordinator*: '(...) No, the (AcessaSP main manager) I think is more over here, because he knows about the contract, he is closer (...)'
> *Metaprojeto Coordinator:* '(…) No, it's like this, in my perception you are closer from the project as well, you and (AcessaSP main manager) are closer to me. It's my perception, right.'
> *AcessaSP main manager*: '(...) Well, actually is more the other way around (...) this is more over here (…)'
> *EF Coordinator*: '(...) But then you will change everything!!!![12]
>
> *(Excerpts from Focus Group Discussion, Metaprojeto, 15.04.2010*)

12 Original:
EF Coordinator: '(...) dá licença (...) eu faria um pouco diferente, posso?'
Metaprojeto Coordinator: '(...) A minha estrutura seria montada um pouco diferente(...) Eu tô aprendendo a tua (...) mas beleza, eu concordo.'
PRODESP Coordinator: '(...) Não, o (*coordenador principal*) acho que tá mais pra cá mesmo porque ele sabe do contrato, ele tá mais próximo (...) '
Metaprojeto Coordinator: '(...) Não, mas assim, na minha visão mais próximo do projeto tb...você e o (*coordenador principal*) tão mais proximos de mim. É uma percepção minha, né.'
AcessaSP main manager: '(...) É, na verdade é mais o contrário...aqui tá mais pra lá'
EF Coordinator: '(...) Aí cê vai começar e vai mudar tudo!!!'

Figure 28 below illustrates the process of generation of the individual network during the focus group discussions. Three different networks were co-generated. Participants had different views of who was closer to whom and were more concerned in understanding the different views more than in achieving consensus on one final network structure. Participant observation and individual interviews assisted further in assembling of the final network of individuals for Metaprojeto (see Figure 29).

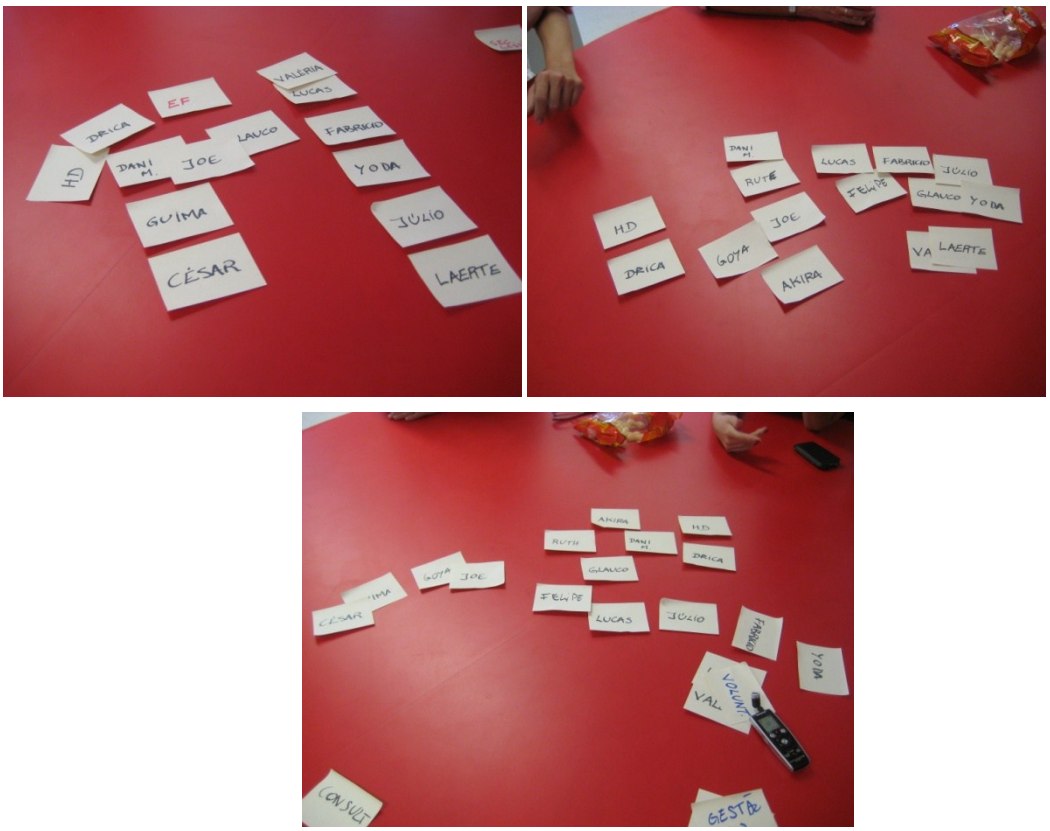

Figure 28: Three networks put together by the participants of the focus group discussion of 15.04.2010.

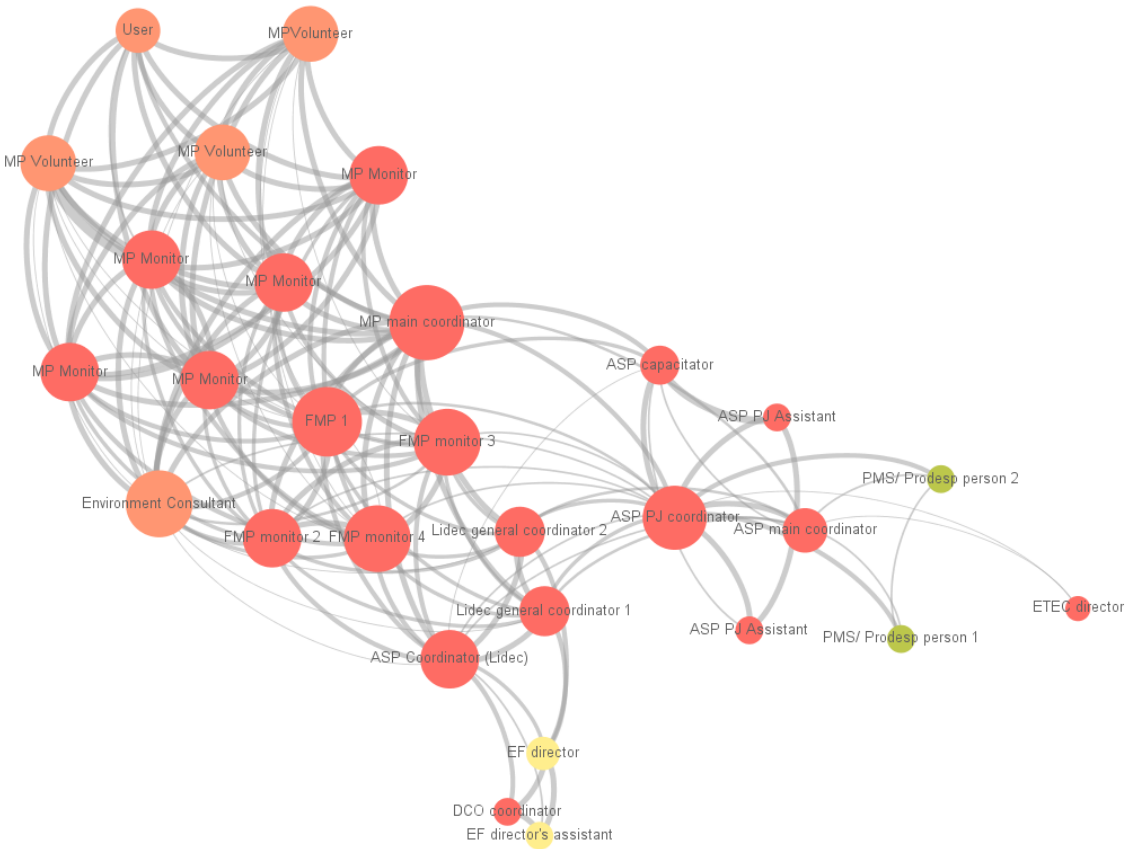

Figure 29: Social Network of Metaprojeto individual stakeholders generated with SNA software GEPHI

Figure 29 shows the network generated with 29 individuals, with varying degrees of involvement with the initiative, who were cited by different participants. The majority of stakeholders belong to the public sector (Pink). The clustering and property of complex scale-free networks is visible in this network (Barabási, 2003; Wang and Chen, 2003). The main large cluster represents the nodes that are involved on a daily basis with the initiative, and particularly the educators and the volunteers. The highest degree node is the coordinator of AcessaSP EF. This node can be considered a connector within this context as it has the highest centrality within the network. This means that this coordinator is connected to all clusters and is a crucial decision-maker. Removing this node could compromise the network's robustness (Barabási, 2003).

Network visualization assisted in the identification of structural patterns and the qualitative approach assisted in gaining insights on the patterns of communication between stakeholders. For instance, AcessaSP EF's coordinator is depicted as the highest

degree node and it is a crucial decision-maker, but data collected from interviews and focus group discussions showed that the quality of the communication between this node and Metaprojeto's most active nodes was not satisfactory (Chapter 5, p. 181).

4.3 In-depth Redes Livres

4.3.1 Context

Redes Livres (Free Networks) is an initiative implemented in the city of Porto Alegre, South Brazil, in the neighbourhood with the lowest human development index of the city, Mario Quintana. It is a project that took place within the Marist Technological Training Complex (Social Marista, 2015), situated at the Social Marist Center, CESMAR (http://socialmarista.org.br/cesmar/, accessed February 6th, 2016, in Portuguese).

Figure 30: Mario Quintana Neighbourhood (Source: http://zh.clicrbs.com.br/rs/noticias/noticia/2014/11/moradores-do-mario-quintana-vivem-sob-toque-de-recolher-em-porto-alegre-4641003.html)

Figure 31: CESMAR main entrance (Source: http://websmed.portoalegre.rs.gov.br/escolas/timbauva/HISTORICO%20PRONTO.htm)

Figure 32: Broader view of the CESMAR complex (Source: https://www.youtube.com/watch?v=FmoKBbVenfo)

Figure 33: Front view of the Marist Technological Training Complex, situated within the CESMAR Complex, house of the Redes Livres Initiative *(Source: https://anacarolinapontolivre.wordpress.com/tag/uergs-de-guaiba-para-o-mundo-do-recondicionamento-de-computadores-cesmarpoa/)*

The Marists Brothers are a Catholic civil society organisation in Rio Grande do Sul (http://www.maristbr.com/ , accessed February 6th, 2016, in Portuguese) have been great supporters of ICT4D Initiatives as they believe in the social development potential entailed in ICTs. The South Brazilian branch of the biggest federal initiative regarding ICT4D, the Telecentros.br (http://www.mc.gov.br/telecentros, accessed February 6th, 2016, in Portuguese) was under their coordination at the time I conducted my research. Along with Telecentros.br, the Social Marist Center (CESMAR) was home to two other federal initiatives: the Computer Recondicioning Center (CRC) and the Alquimia Project, focused on the recycling of seized illegal gambling machines. Because of the convergence of all these projects, CESMAR has become the home of the Marist Tecnological Training Complex. This facilitated the emergency of other smaller projects, including the Redes Livres Initiative. The Complex was created in 2006, with the mission

to provide vocational training opportunities particularly in the area of ICTs for local youth in situation of social vulnerability[13].

Redes Livres was established in 2011 and was led in a volunteering fashion, through a loose agreement among the Technological Training Complex and volunteers who were former students of other courses situated at the complex. Redes Livres' main goal was to resemble a digital village, providing free connectivity for communication and information exchange through a free intranet with a wireless signal using a mesh protocol. In a computer network that employs a mesh protocol, computers do not depend on a single central node for connectivity. Instead, each computer becomes a potential connectitivy provider (see Figure 34). In other words, there is no need for a centralized infrastructure, which makes the implementation of connectivity projects in poorer areas more affordable.[14]

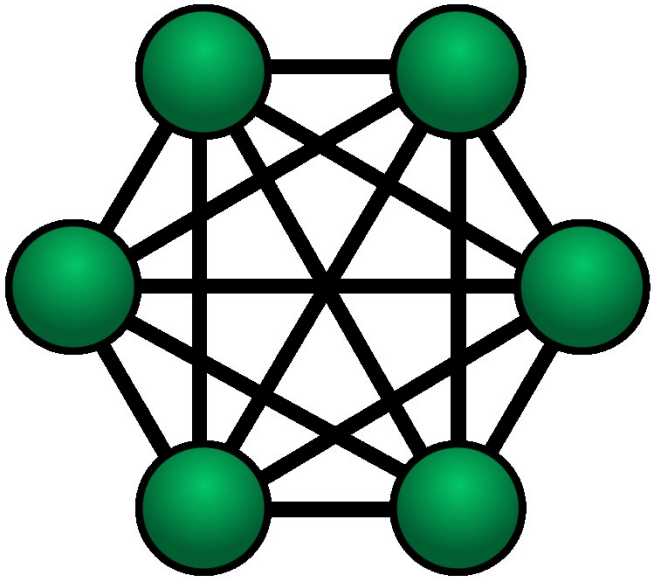

Figure 34: Network topology of a fully connected mesh network (Source: https://en.wikipedia.org/wiki/Network_topology)

Project Technical Consultant: 'Redes livres can be managed by the users themselves with their different goals and techniques. They allow for independence and autonomy from the telecom providers'

[13] https://www.youtube.com/watch?v=6CpAHfApXAk , promotional video of the Marist Technological Training Complex, accessed February 6th, 2016, in Portuguese.

[14] For examples of low-cost / free mesh networks projects, see for instance: http://villagetelco.org/about/ accessed February 6th, 2016 or https://libre-mesh.org/ accessed February 6th, 2016)

(*Informal conversation, Redes Livres, 22.09.2011*)

As the Marist Technological Training Complex houses bigger and government-funded projects such as CRC and Alquimia, Redes Livres benefits from the necessary and appropriate infrastructure. This conviniently facilitates the project's implementation (Unwin, 2005). Redes Livres' volunteers were selected from a group of high-performing students within other projects in the Complex by project coordinators. Project coordinators were searching for pro-activity, as they wanted the initiative to be led in a research and experimental fashion. A project coordinator thus spoke to the volunteers as follows:

> *Project Coordinator*: 'We are a research group now, you should act as such. You are no longer students, we are all in the same page'
>
> (*Informal group meeting, Redes Livres, 20.09.2011*)

Volunteers were divided into shifts, juggling school time with the responsibilities of the initiative. The project was divided into workgroups such as infrastructure, content, radio and graphic design. The volunteers were able to choose freely which areas they were more interested in. Figure 35 shows the volunteers during a mesh protocol workshop.

Figure 35: First official mesh protocol workshop; the volunteers learned how to configure the wireless antennas (Photo by author, 20.09.2011)

4.3.2 Methodological constraints

There were three main constraints when conducting field research in Redes Livres. The first was the very early stage that the project was in. What makes the use of soft systems thinking in ICT4D initiatives attractive is precisely the messy nature of the problems being dealt with (Petkov, 2003; Kapsali, 2011; Turpin and Alexander, 2014). However, it is important to distinguish the core interest in using the approach. In most cases, researchers focus on bringing the view of the whole system and defining the problem together with stakeholders (see Chapter 2, Section 2.2, p. 43). In the particular case of this research, I was interested in observing the process of collaboration between stakeholders (see Chapter 1, Section 1.4.1, p.36). I arrived at the very beginning of the Redes Livres initiative, and there was not yet any real collaboration to be observed, since even the objectives were unclear. It was an organic process:

> 'There is nothing written on how to implement the project, everyone brought their own points and the idea was to see what will happen in 2 months. But already they see a lot of potential;'
>
> 'Now, how to organize it? There are a lot of requests coming in from the Director of the Marist Province regarding the project'
>
> 'Other Marist projects are donating their resources to this project'
>
> 'There are 8 young volunteers so far, and they all have different stories' (*regarding how they were selected*)
>
> 'This is an emergent project in its very essence'
>
> *(Excerpts from a meeting with the juridical department of the Marist Province to formalize the project, notes from my diary, 09.09.2011)*

I therefore decided to start with informal conversations to understand the project itself since there was no written documentation. I only started interviewing the volunteers 2 months after I had begun working there, when I sensed that they had built up enough knowledge about the project and would have something to say with more autonomy.

The second constraint was the frequent unavailability of stakeholders. The Technological Training Complex participated constantly in all sorts of technological events, such as the Latinoware Congress (http://www.latinoware.org/en accessed

February 6th, 2016) or the government digital inclusion workshops (http://oficina.inclusaodigital.gov.br/ accessed February 6th, 2016). I went to the Complex more than once to find only then that no one would show up that day. This became an issue for the development of the project itself as is analyzed in Chapter 5 (Sub-section 5.2.2, p. 189). Moreover, it was also difficult to gather stakeholders from different hierarchical levels together. To try to solve this, I interviewed a director of the Marist Province, the general pedagogical coordinator and the institutional relations coordinator to add their views to those of the focus-group discussion with the volunteers.

As a third constraint, my role as a participant-researcher was not sufficiently clear to project stakeholders. I gave a presentation and explained at different times what my research was about. Perhaps because the project itself was so messy, stakeholders did not, though, pay sufficient attention in these meetings, and I regularly had to clarify my role to them. As such, I had to adjust my focus group discussions, so participants would engage more pro-actively. I changed my discourse and positioned the focus group discussions as something critical for the evaluation of project processes and better planning for the future, thus adopting a project management approach. As it gained more contextual relevance to them, the focus groups were accepted as something useful and part of the management process (Checkland, 2000). The next section lays out the visualizations of the organizational and the individual networks of Redes Livres at the time I conducted research.

4.3.3 Organizational and individual networks

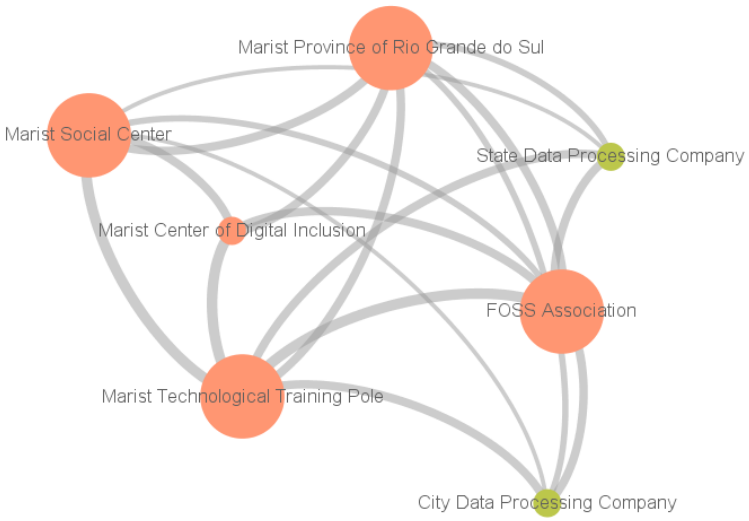

Figure 36: Social Network of Redes Livres organizational stakeholders generated with GEPHI.

Figure 36 shows the organizational network generated.The highest degree nodes are the Marist Province, the Marist Social Center (CESMAR), the Marist Technological Training Complex and the Free Open Source Association (FOSS/ASL). The Marist Province manages CESMAR; CESMAR is the home of the Technological Complex, which in turn houses Redes Livres and provides infra-structure. ASL lends human resources to the project. The smaller nodes are other institutions which collaborate more remotely and informally with the project.

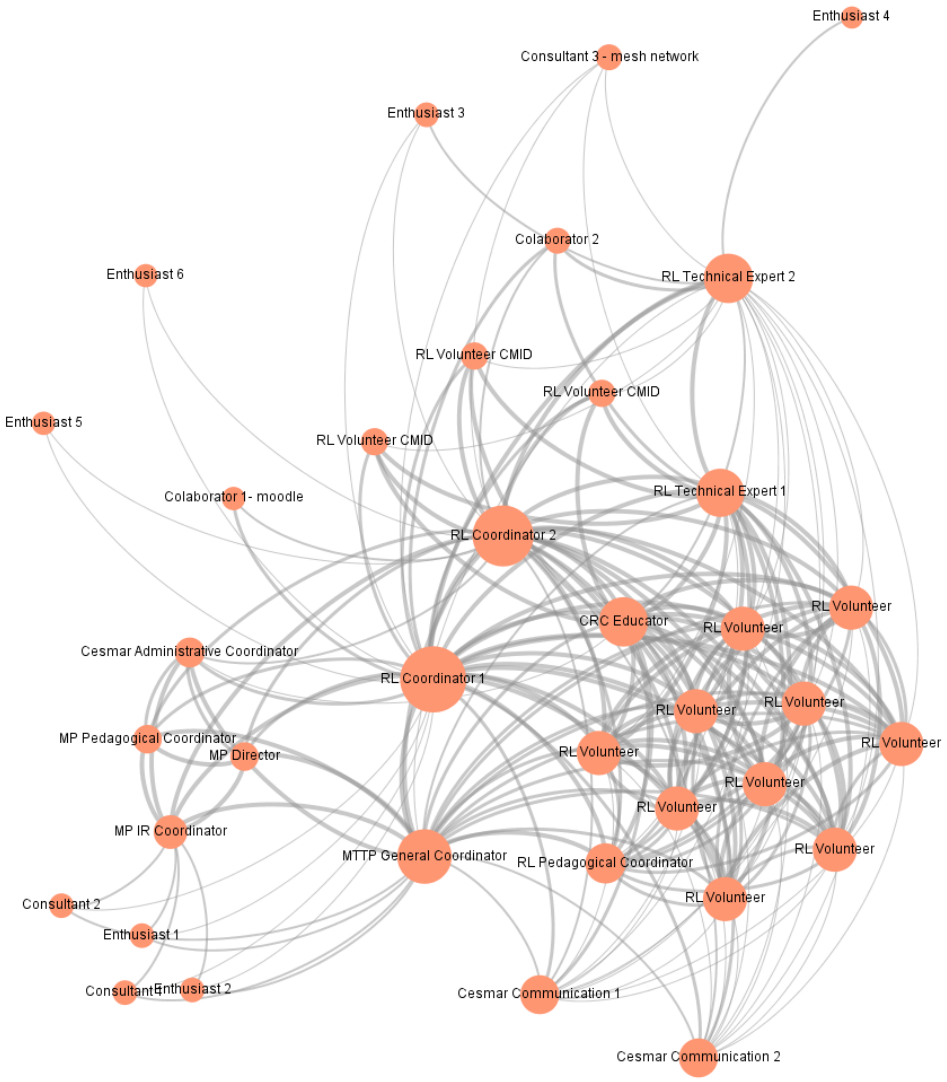

Figure 37: Social Network of Redes Livres individual stakeholders generated with GEPHI.

In the depiction of the network of individuals (Figure 37), the main cluster shows the core group of volunteers who are active in the project implementation. The less connected and peripheral nodes are not involved directly in the partnership, although they were mentioned by stakeholders as key individuals that inspired or assisted the project in moving forward. They were labelled as enthusiasts and consultants. The leading organizational culture is the civil society sector (pink). The hubs of this network, namely the highest degree nodes, are the two project coordinators who connect the different network clusters. The network clusters mirror a group that belongs to a specific institution or group with common interests (Centola, 2015). For instance, the smaller cluster across Redes Livres' implementation cluster is a group of employees from CESMAR who contribute to Redes Livres.

The implementation's cluster cohesion is very high, and the thicker lines mean that they communicate frequently. However, participant observation and interviews showed that even though there was a lot of communication, it was actually not very effective or productive:

> *FS*: 'Do you think the communication among you flows?'
>
> *Volunteer 1*: 'Well, it is very fluid; even so because we work in a good environment, everyone is friends (...) everyone knows each other around here.'
>
> *FS*: 'Any hurdles so far?'
>
> *Volunteer 1*: '(...) Only Facebook...it is a problem! (...) It is like our fridge; we know nothing is there, but we still open it (...)'
>
> *FS*: 'And no one says anything? Like "Come on guys, the project is late...let get off Facebook and work."'
>
> *Volunteer 1*: 'Well, not specifically about Facebook, but the coordinator says "hey, there are tasks on the board, come on "(...)'
>
> *FS*: 'Hum, and about tasks – I see that there are no dates on the tasks written in the board (...)'
>
> *Volunteer 1*: 'The coordinators tell us we are like Google; we have the free time, we can do the tasks when we want, as long as we do it...and that is the problem, no one is doing it.'
>
> (*Individual Interview, Redes Livres, 29.11.2011*)[15]

Moreover:

> *FS:* 'How do you know what the guys in the afternoon are doing?'
>
> *Volunteer 3*: 'Hum, than it is more difficult (...) only when they post something in the internet...it was easier when *(Volunteer 6)* was around; he was circulating both in the morning and afternoon (...)'[16]
>
> *(Individual Interview, Redes Livres, 01.12.2011)*

15 Original:
FS:' Tu acha que a comunicacao flui entre voces? '
Volunteer 1: 'Arra, bastante. Até porque a gente trabalha num ambiente legal, todo mundo é amigo (...) todos se conhecem por aqui.'
FS :' Impecilhos até agora? '
Volunteer 1: '(...) Só o Facebook..é um problema! (...) É como nossa geladeira (...) a gente sabe que nao tem nada dentro, mas ainda assim vai lá e abre (...)'
FS: 'E ninguém diz nada? Tipo: "Po caras, o projeto tá atrasado (...) vamos sair desse Facebook e trabalhar." '
Volunteer 1: 'Bom, nao sobre o Facebook, mas o coordenador diz "Poxa, tem tarefas no quadro, vamos lá" (...)'
FS : 'Hum, e sobre essas tarefas – Eu vejo que nao tem datas escritas no quadro' (...)
Volunteer 1: 'Os coordenadores nos dizem que somos como a Google. Temos tempo livre, a gente pode fazer quando quiser, desde que a gente faca (...) e o problema é que ninguém tá fazendo (...) '
16 Original:
FS:'Como voce sabe o que o pessoal da tarde esta fazendo?'
Volunteer 3:'Ah, aí é mais dificil (...) so quando alguem coloca algo na Internet (...) era mais facil quando o *voluntario 6* estava por ai (...) ele circulava de manha e de tarde (...)'

And:

> *FS:* 'How is the communication among you, besides face-to-face? I see that you all barely use the mailing list; there are 24 emails until today, I counted!'
> *Volunteer 6:* 'Well, I am always in messenger; I talk to (*volunteers 1, 2, 3)* (...)'
> *FS:'* Yes, but about Redes Livres?'
> *Volunteer 6:* 'Ah, very little actually (...)' [17]
> *(Individual Interview, Redes Livres, 13.12.2011)*

4.4 In-depth DEPROTEC

4.4.1 Context

DEPROTEC (Desenvolvimento de Projetos Tecnológicos[18]) was another initiative situated at the Marist Technological Training Complex, and it was part of a formal agreement between the Complex and the Brazilian Science, Technology and Innovation Ministry (MCTI). The initiative took place from March 2012 through March 2013, as a modular technical course for the local youth in the areas of software, electronics and communication. Its main objectives included capacitating the students for the labour market, particularly in the area of ICTs and citizenship development.

The Marist Province of Rio Grande do Sul was the only civil society organization participating in a tender process offered by MCTI directed mainly to Universities. They won the bidding and started to design an action plan for a project that came to be DEPROTEC. The coordinators of the Technological Training Complex envisioned this as an opportunity to become a formal technical college in the area of ICTs, thus ensuring formal government funding and sustainability. However, they had to organize the initiative within the MCTI's rigorous processes and bureaucracies at a very fast pace (see Figure 38), because they were not prepared as a University. This came to influence subsequent project processes and its impact is explored further throughout Chapter 5 (p. 181).

17 Original:
*FS:'*Como se dá a comunicacao entre voces, alem de cara a cara? Eu vejo que voces usam a lista de email muito pouco; tem so 24 emails ate agora, eu conteihoje!'
Volunteer 6: 'Bom, eu estou sempre no Messenger. Eu falo com voluntario (1,2,3) (...)'
*FS:'*Sim, mas sobre o Redes Livres?'
Volunteer 6: 'Ah, bem pouco na verdade (...)'

18 In English: Development of Technological Projects

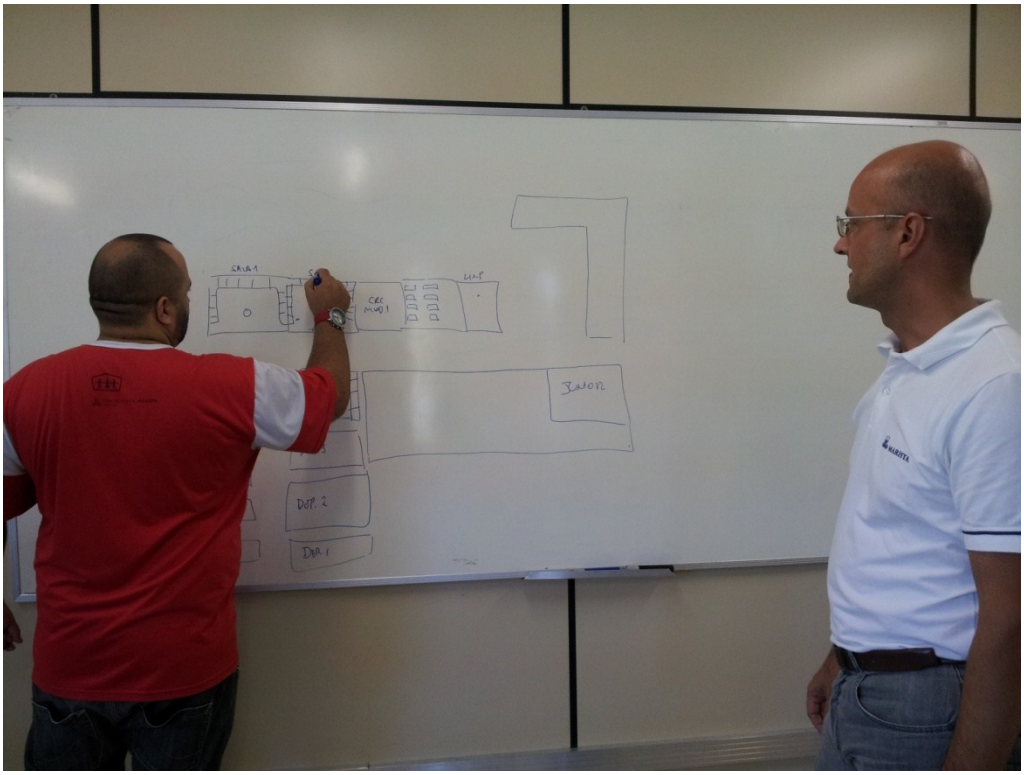

Figure 38: Meeting to decide how to re-organize the space in order to accommodate the new incoming project (20.04.2012, Photo by author)

4.4.2 Methodological constraints

There were two main methodological constraints during my research at DEPROTEC. First, the Technological Training Complex coordinator wanted to help me financially as I had spent the previous year conducting research on Redes Livres without any funding. I was then hired to work in DEPROTEC with the goal of planning a formal evaluation framework for the project. This had a different objective to that of my actual research and, at first we thought it was possible to reconcile both goals. However, this ended up causing confusion regarding my role to stakeholders. Furthermore, my colleague had a different methodology to work with on the focus group discussions and as much as she was willing to help me with my research, it was difficult to bring together stakeholders and cover all the issues we needed in one focus group discussion.

Second, five months after I started conducting research, there were three profound changes within the structure and processes of the Technological Training Complex. The first one concerned the biggest source of funding for the Technological Training Complex, the Telecentros.br national program. The program was being downsized by the Federal Government and many people would have to be laid off. The second one

concerned management replacement in CESMAR. The new director started to conduct several management changes in the entire institution, which also affected the Technological Training Complex and people were uncomfortable and unclear about the new processes. The last change concerned the Complex coordinator. He was preparing to leave and engage in a new Marist Technological Training Complex being constructed in another region of Porto Alegre. As such, he became incredibly controlling of the processes, as he wanted to leave everything organized for his successor and I did not have as much freedom as before to conduct research. One outcome from the combination of the events reported above led to me being fired by the new CESMAR director. This actually came as a relief, because it enabled me to concentrate only on my research.

4.4.3 Organizational and individual networks

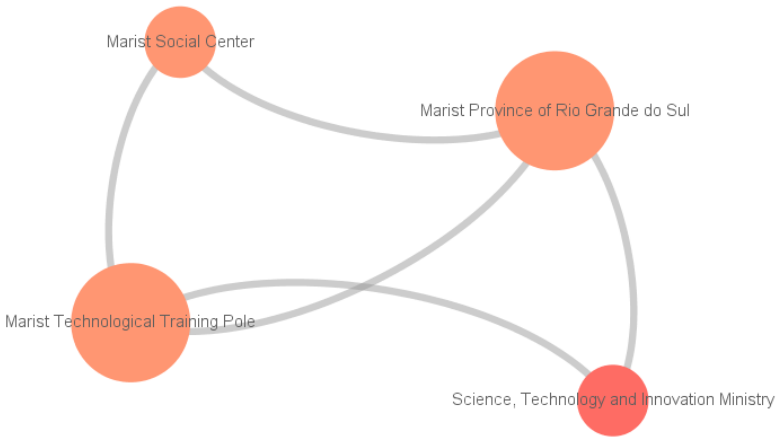

Figure 39: Social Network of DEPROTEC organizational stakeholders generated with GEPHI

The two highest degree nodes in DEPROTEC's organizational network depicted in Figure 39 are directly involved in the initiative's planning and implementation, the Training Complex and the Marist Province. The Science, Technology and Innovation Ministry (MCTI) and CESMAR contribute by lending resources to the initiative. The first one funds, and the latter houses the initiative. The leading organizational culture is the civil society sector (salmon pink).

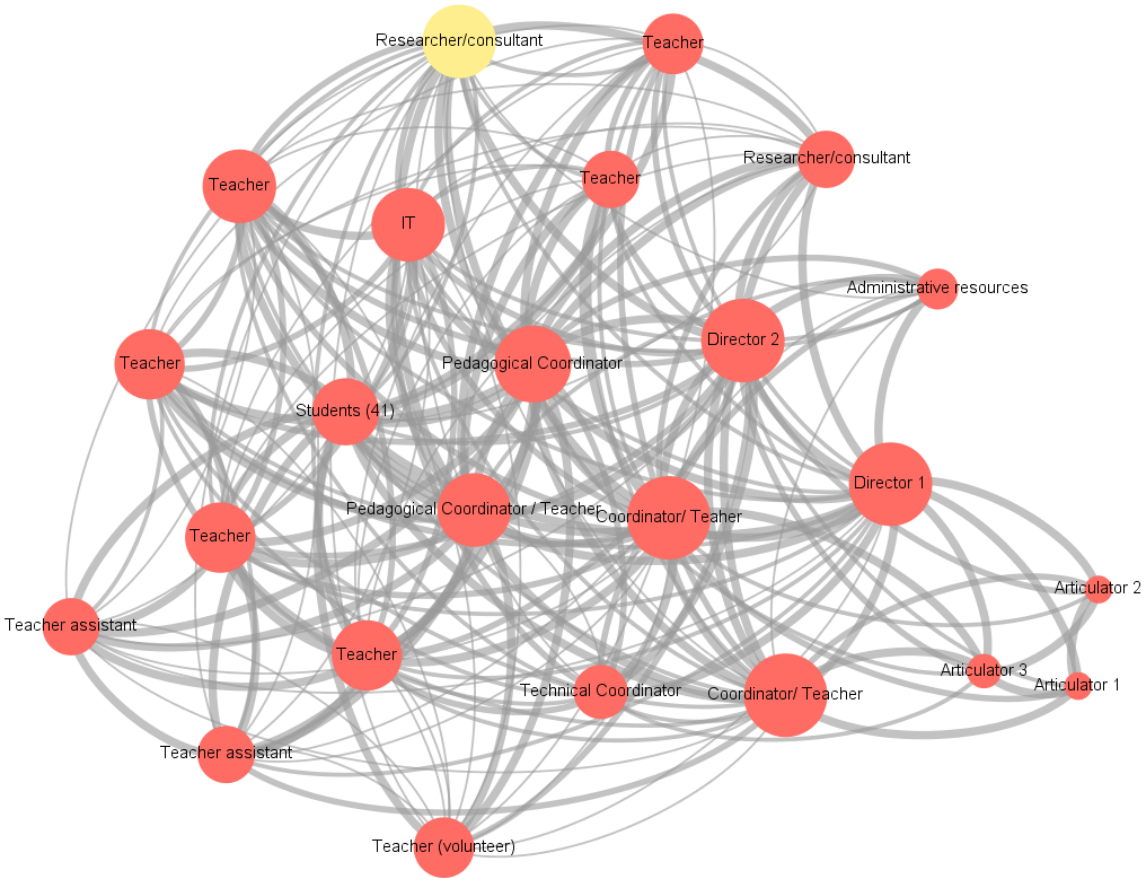

Figure 40: Social Network of DEPROTEC individual stakeholders generated with GEPHI.

In the individual network shown in Figure 40, one of the nodes (left middle) represents all students enrolled in the project. There were 41 students enrolled, but they are depicted as one node, since the focus is on the collaboration between stakeholders developing the initiative and their communication to all students was basically the same. During the project process some students became closer to one teacher or another, but this distinction is not relevant to this research's objectives.

DEPROTEC's network is highly cohesive, presenting one giant cluster containing the students, teachers and pedagogical coordinator. The highest degree nodes that connect this giant cluster to the very small one at the lower right are the coordinators of the project. The right side of the network comprises nodes that are higher in the hierarchy of the project such as directors and articulators of the project. The bulk of the

stakeholders who implemented the project are shown in the middle-left. Students, teacher assistants and volunteers of the project are on the far left side of the network. This network does not present many peripheral nodes because most of these stakeholders are placed physically in the same place and thus communicate often with one another as qualitative data also showed. This is represented by the thicker lines in this cluster. Furthermore, the articulators of the project (far right, smallest degree nodes) show high communication level with directors, but little communication with coordinators and even less with the teachers.

4.5 Short term IBM Smarter Cities

4.5.1 Context

The city of Porto Alegre, located in the state of Rio Grande do Sul, South Brazil, was selected to take part in the IBM Smarter Cities Challenge Program (2013). For this project there was no formal agreement or contract, but there was a Memorandum of Understanding. The IBM Smarter Cities Challenge consists of a donation of expertise by IBM high-level executives to a specific demand of the city, an initiative from the IBM Foundation. In the case of Porto Alegre, the project entailed a series of short, medium and long-term recommendations to lead the city towards becoming a truly cognitive and resilient city (or 'smarter', as coined by IBM):

> 'The Smarter Cities Challenge deploys top IBM experts to help cities around the world address their most critical challenges. We do this by putting teams on the ground for three weeks to work closely with city leaders and deliver recommendations on how to make the city smarter and more effective. The Smarter Cities Challenge is IBM's largest philanthropic initiative, with contributions to date valued at more than $50 million. Since 2010, IBM has deployed 700 top experts to help 116 cities around the world.'
>
> *(Source: Smarter Cities Challenge, 2016*)

This short term case study was formed through an agreement among IBM, Porto Alegre City Hall and the American NGO PYXERA Global. I engaged as a paid program coordinator from PYXERA Global (http://pyxeraglobal.org/, accessed in February 7th 2016). My role was to assist the IBM executives and the client, Porto Alegre City Hall, regarding

logistical issues or any conflicts that might have risen during the project life-cycle, be it concerning the project itself or social conflicts among project stakeholders.

Figure 41: IBM Executives presenting preliminary outcomes to Porto Alegre Local Governance Secretary (photo by author, March 2013)

4.5.2 Organizational and individual networks

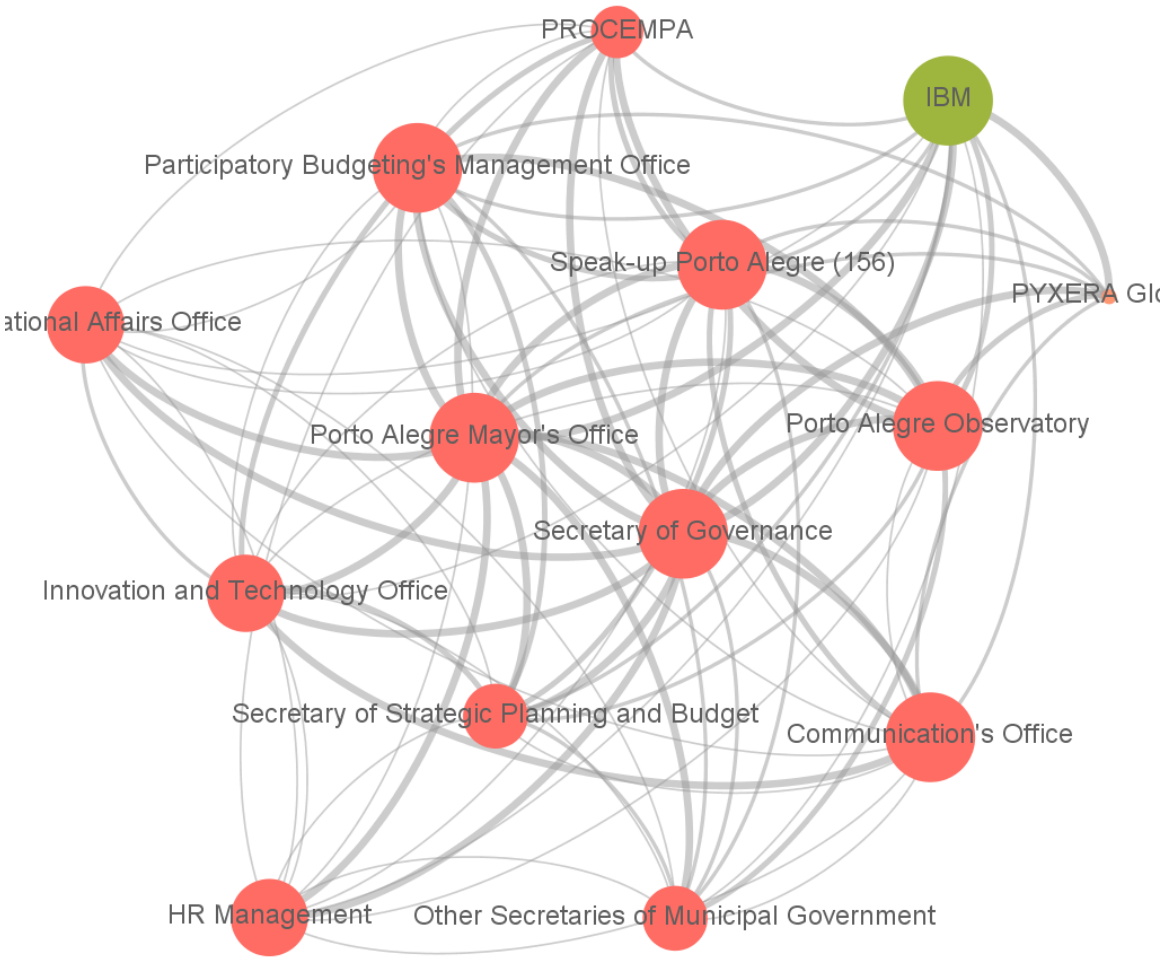

Figure 42: Social Network of IBM Smarter Cities organizational stakeholders generated with GEPHI.

The IBM Smarter Cities organizational stakeholders were mainly different secretariats within the City Hall office (Figure 42). The higher degree nodes in the middle were the main decision-makers, such as the Secretariat for Local Governance, the public service Fala 156 and the Porto Alegre Observatory. These nodes are closer to the IBM executives (upper right, green) because they communicated more often. The other secretariats acted mainly as providers of information. These public sector departments are under the umbrella of the Mayor's Office which has the higher centrality degree since it is the most connected node. However, although it was the main decision-maker in the project, it was not as close to IBM because communication did not happen very often.

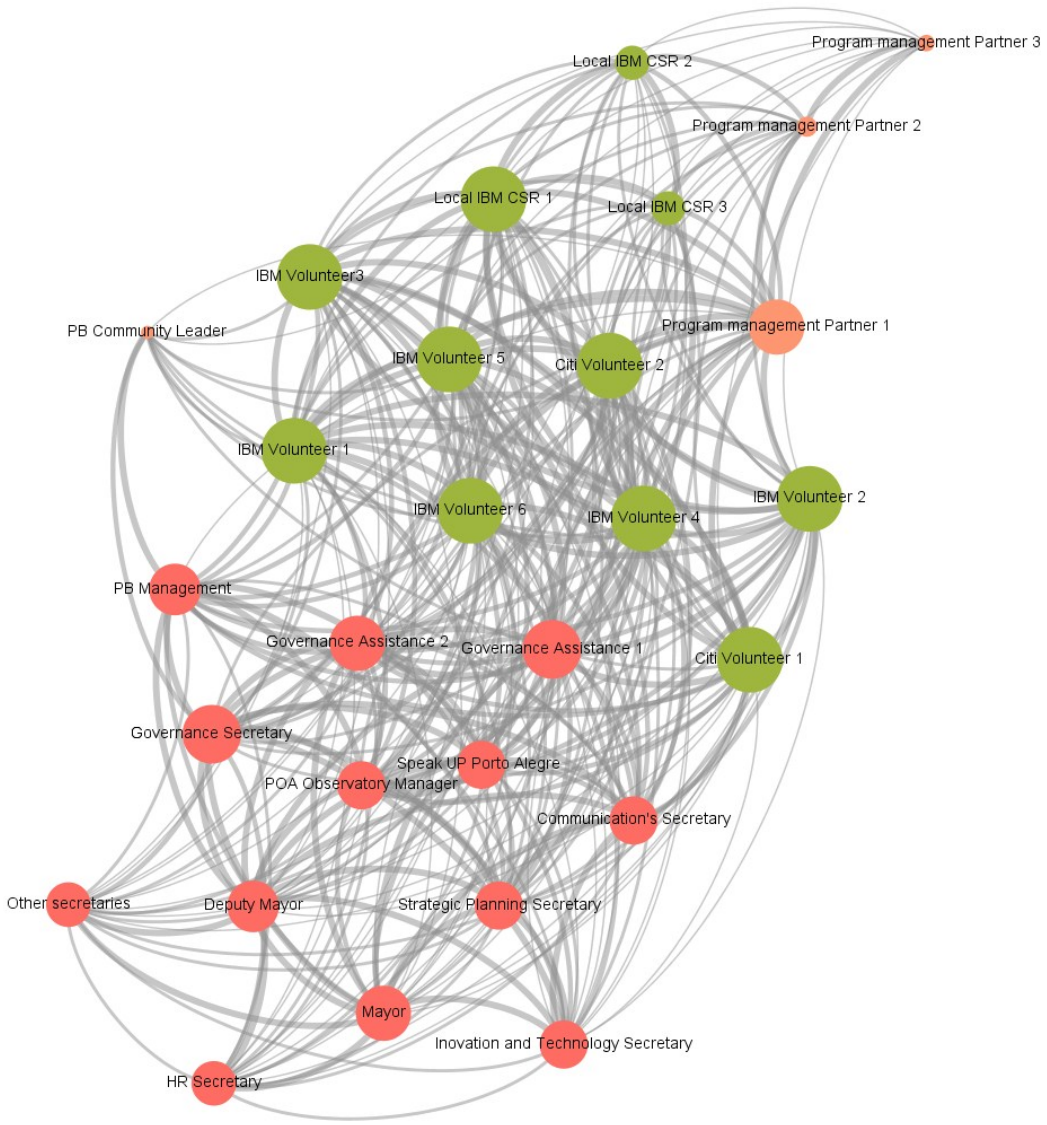

Figure 43: Social Network of IBM Smarter Cities Challenge individual stakeholders generated with GEPHI.

IBM executives (green nodes) have the highest centralization degree in the individual network, because they were the most active nodes as indicated by the thicker lines (Figure 43). This is the most cohesive cluster, as they worked relentlessly everyday on their deliverables, meeting with project decision-makers once a week for checkpoints and occasionally with other City Hall departments for information gathering and validation. Although they were mainly interacting with the public sector as the central client, they were also concerned with citizens' engagement as a fundamental stakeholder of this initiative; the very small node (middle left) is a community leader who they interacted with briefly (see also Figure 44 below).

Figure 44: IBM Executive visiting the Marist Technological Training Complex, along with Participatory Budget Community Leader (photo taken by author, April 2013)

4.6 Short term SAP Social Sabbatical – Fala 156

4.6.1 Context

The SAP Corporate Social Responsibility division offers to SAP employees the opportunity to take on a sabbatical month, working as volunteer consultants. This program is called SAP Social Sabbatical (2012) and is coordinated by the American NGO PYXERA Global as in the IBM Smarter Cities challenge. I engaged in the initiative as a program manager for PYXERA Global. This short term case study was a partnership among Porto Alegre's Secretariat for Local Governance (the client), SAP (technical expertise) and PYXERA Global (Logistics Partner). For this project there was again no formal agreement or contract, but instead a Memorandum of Understanding. The objective of the project was to optimize Porto Alegre's public service hotline system, Fala 156[19]. This hotline receives urgent demands concerning matters such as potholes,

[19] In English: Speak-up 156

non-functional public lighting, tree pruning services and the like. The SAP consultants delivered a roadmap for the optimization of the information system in the first phase of the project (Figure 45).

Figure 45: SAP Executives, SAP Latin America CEO, Porto Alegre Mayor and team, after the final presentation (photo by author, October 2013)

The second phase of this initiative focused on the optimization of one particular information system of the Fala 156, the Tree Pruning service from the Secretariat of Environment (Figure 46).

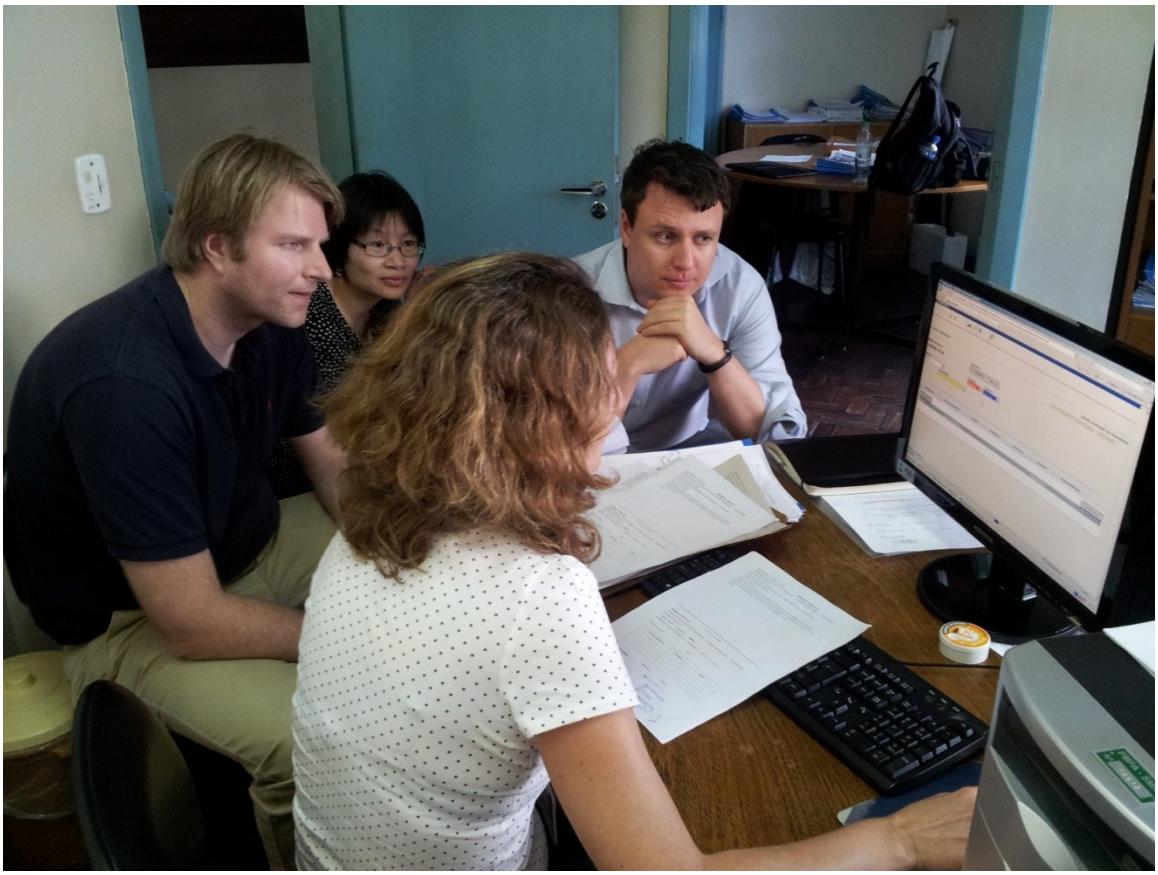

Figure 46: SAP consultants' team of Phase 2, learning about Porto Alegre's Tree Pruning System (photo taken by me, April, 2014)

4.6.2 Organizational and individual networks

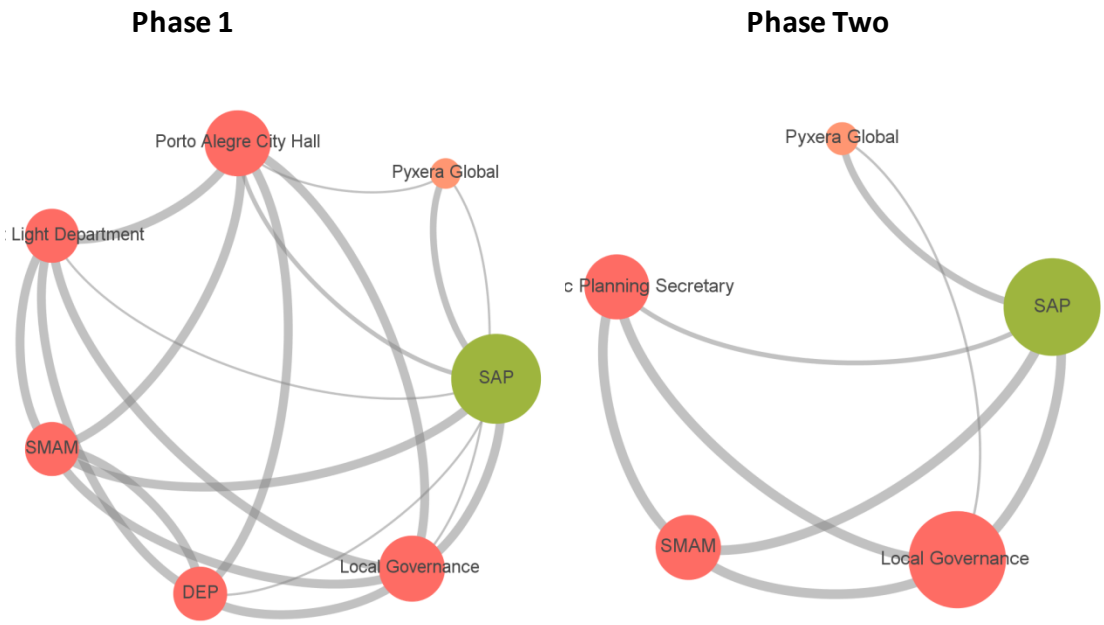

Figure 47: Organizational Networks of SAP Social Sabbatical Fala 156 Porto Alegre, phases 1 and 2 generated with GEPHI.

The SAP team (the green node) in Phase 1 identified the following main stakeholders to assist on the improvement of the Fala 156 system: The Secretariat of Local Governance, the Secretariat for Environment (SMAM), the Sewage Department (DEP), and the Street Light Department (Figure 47). The main decision makers were the City Hall and the Secretariat for Local Governance. The remaining public sector stakeholders (pink nodes) were contributing by providing needed information.

Phase 2 took place 6 months after Phase 1. The project scope was narrowed down, so the organizational network is smaller, comprising mainly the Secretariat for Local Governance and the Secretariat for Environment (SMAM). The Secretariat for Development Planning is depicted in the network because it was solicited by the SAP team information regarding budget availability (Figure 47).

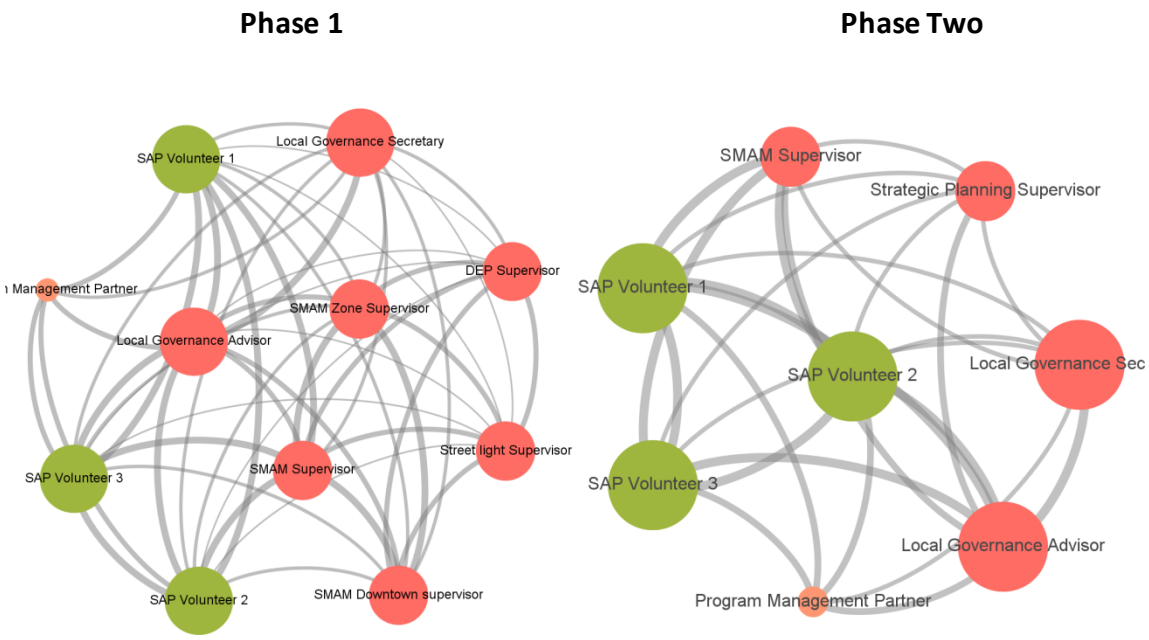

Figure 48: Social Network of SAP Social Sabbatical Speak up Porto Alegre Service individual stakeholders generated with GEPHI.

The SAP Fala 156 individual network in Phase 1 depicts the SAP team (green nodes) and the Local Governance Advisor and Secretary (pink nodes) with the highest degree of interaction and close to each other because they interacted on a daily basis. The remaining stakeholders, pertaining to the other departments interacted on a weekly basis, and hence are shown smaller and not as close to the SAP team (Figure 48).

The individual network of Phase 2 is similar to that of Phase 1. The highest degree nodes depict the SAP team (green nodes) and project managers (pink nodes) belonging to the Local Governance Secretary. The remaining stakeholders contributed with information and did not interact as often (Figure 48).

4.7 Short term SAP Social Sabbatical – 4th District

4.7.1 Context

This SAP Social Sabbatical Program was a partnership between Porto Alegre's civil society movement to revitalize Porto Alegre's 4th District (the client), SAP (Technical expertise) and PYXERA Global (Logistics Partner). For this project there was again no formal agreement or contract, but rather a Memorandum of Understanding. The objective was to design short, medium and long-term strategic recommendations for the

revitalization of the old industrial neighbourhood of Porto Alegre, namely the 4th District, with the objective to turn it into a creative economy district (https://4distrito.wordpress.com/ accessed February 7th 2016, in Portuguese).

In the first phase, the SAP team delivered a strategic action plan based on their assessment of the movement's goals, recognition of the neighbourhood and of resources available (Figure 49). During the second phase, the SAP team focused on the design of a roadmap for the development of an online collaborative platform for urban problem solving (Figure 50).

Figure 49: SAP consultants' team of Phase 1, learning about Porto Alegre's 4th District revitalization movement (photo by author, October, 2013)

Figure 50: SAP team of Phase 2, brainstorming with the client (photo by author, April, 2014)

4.7.2 Organizational and individual networks

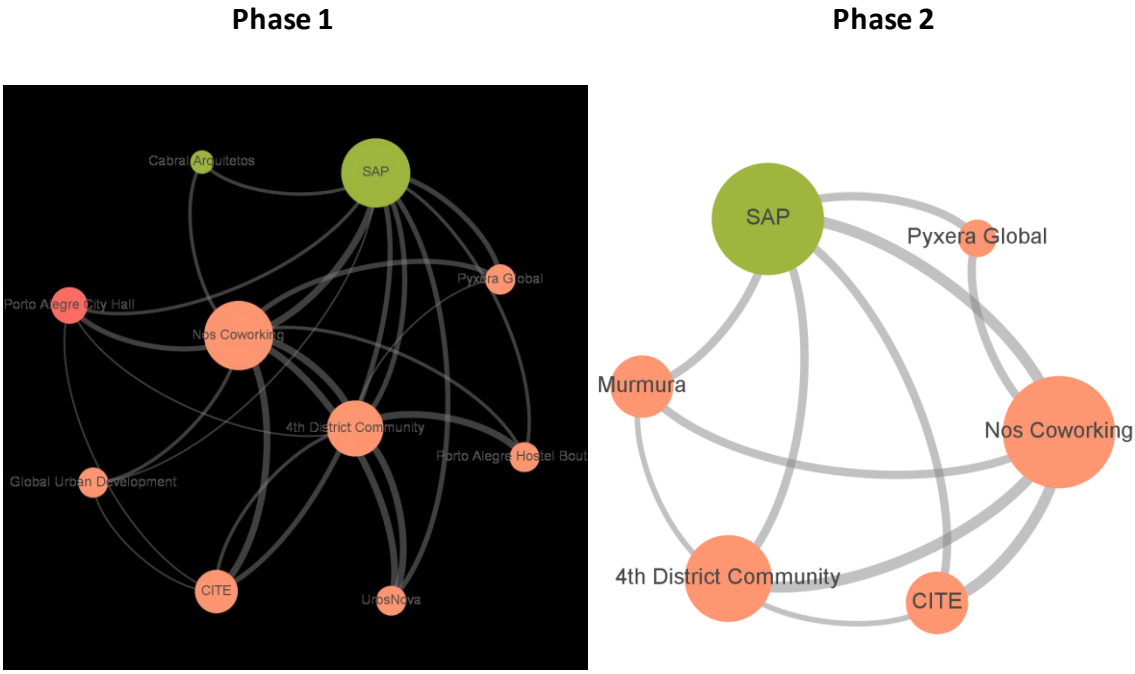

Figure 51: Organizational network of SAP Social Sabbatical 4th district phases 1 and 2, generated with GEPHI.

The SAP team (the green node) of Phase 1 identified the following main public, private and civil society organizations involved in developing a strategic action plan to revitalize Porto Alegre's 4th District: the Porto Alegre City Hall; American NGO Global Urban Development (2015); the entrepreneur movement Porto Alegre CITE (Caos Planejado, 2013); social design agency Urbsnova (2015) and stakeholders located at the 4th District, including several small businesses. The main decision maker was the shared workspace company NosCoworking (2015), located at the heart of the 4th District. NosCoworking and the 4th District community of small businesses are depicted as the higher centralization degree nodes as they were mostly involved in developing the strategic plan along with the SAP team. The other organizations contributed with information and were not involved directly in this initiative, hence their peripheral location in the network (Figure 51).

Phase 2 took place 6 months after Phase 1 (Figure 51). The project scope was narrowed down as with Fala 156, hence the smaller organizational network. The most active stakeholders remained NosCoworking and the the 4th District community of small businesses. In addition, there was a network of citizens concerned with improving urban environments, Murmura (http://www.shoottheshit.cc/murmura/, in Portuguese,

accessed 25 December 25th 2015), which was developing a collaborative platform for urban problem solving which was at a very early stage and the SAP team decided to use as a starting point for the roadmap they planned to develop.

Phase 1 **Phase 2**

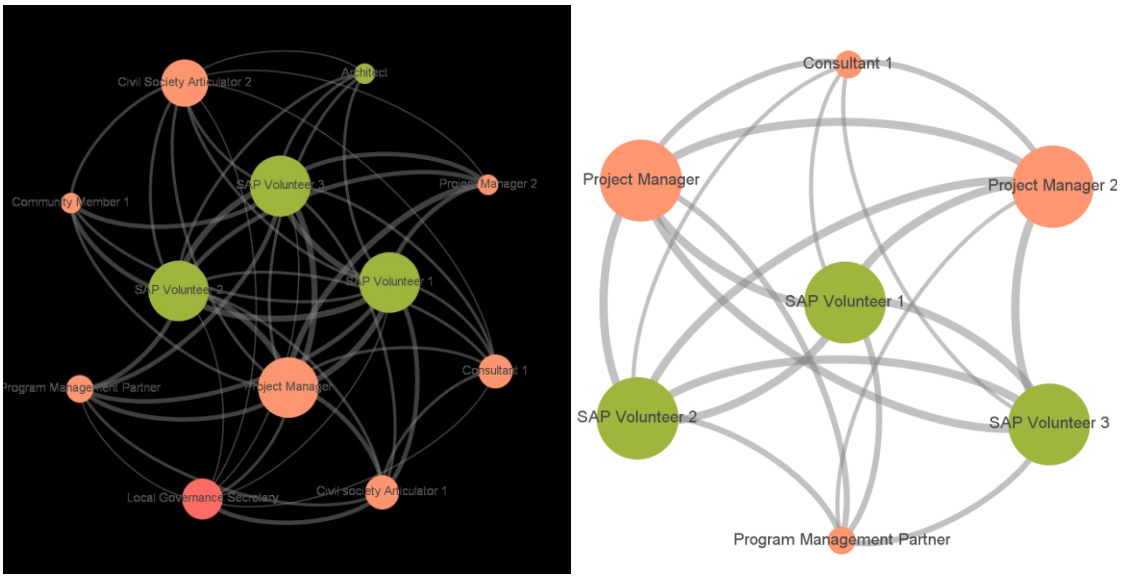

Figure 52: Individual Networks of SAP Social Sabbatical 4th district phases 1 and 2, generated with GEPHI.

Social Sabbatical 4th District individual network Phase 1 shows the SAP team with the highest centrality along with the NosCoworking project manager (Figure 52). These stakeholders communicated on a daily basis; the remaining stakeholders were consulted once or twice a week, hence their peripheral position in the network.

Phase 2 was much narrower (Figure 52). The highest degree nodes were the two project managers from NosCoworking and the SAP team, who interacted on a daily basis for this project. The remaining stakeholders were consulted once or twice a week.

4.8 Network topology interpretation

> '(…) the first step is to map out the network behind these systems. Then from these maps we need to infer the laws that govern the networks. At that point the internet topographer, the web mapper, and the cancer researcher will be in the same camp.' (Barabási, 2009:192)

The previous sections laid out the contexts of the case studies as well as their organizational and individual networks. This concerns both the importance of context to this research's systemic view (Bateson, 1979; Capra, 2002; Capra and Luisi, 2014) and the dimension *Network Structure* (Capra, 2002; Ravazs and Barabási, 2003). The network mapping approach was used in order to tackle two main research interests. The first was to gain initial insights regarding similarities and differences in the network structures observed (Bateson, 1979; Wassermann & Faust, 1994; Capra, 2002; Barabási, 2003; Recuero, 2005). The second was to analyse if the conjoint mapping of the networks affected participants from the in-depth case studies in one way or another, thus starting an inquiry and learning process (Chamber, 1997; Checkland, 2000; Tacchi, 2003). Moreover, complex network theory properties were used to analyse the network structures for three main reasons: first, to assist in the search for general properties that might affect network dynamics (Barabási, 2003); second, to understand how specific changes in topology might cause the emergency of new and unpredicted processes (Borgatti et al. 2009; Barabási, 2013; Centola, 2015); and third, to contribute to the debate of bridging the respective SNA approaches in the social and physical sciences (Borgatti *et al.*, 2009; Centola, 2015).

This section focuses on the first reason, namely the search for general properties; Chapter 5 (p. 181) and 6 (p.225) focus on the qualitative analysis of communication processes and address the two last reasons. In my research, I follow the core of the social sciences approach to social network analysis, focussing on the particular configurations of the social systems and individual node behaviour (Borgatti et al., 2009; Wang et al., 2011; Kapsali, 2011; Centola, 2015). From this perspective, the network depictions provide qualitative information on who are the most active stakeholders, who are main decision-makers and how they are positioned in the network. However, I also engage with notions of complex network theory. For instance, I recognize large

complex networks properties in my small networks (See Section 4.8.2 below). As Centola (2015) argues, such measurements have been increasingly used only in very large complex social networks. It is easier to achieve accurate measurements looking at larger data sets in the physical sciences; as a larger group, humans follow more strict patterns (Barabási, 2009). However, as individual nodes, unpredictability increases and thus it is difficult accurately to measure behaviour gains in such complex and unpredictable contexts (Bateson, 1979; Centola, 2015).

Moreover, the networks represent two overlapping realms. One is the organizational realm, which refers to the inter-organizational arrangements of the initiatives. The other is the individual realm, which refers to the team of individuals coming from these different organizations and is assembled to work together in a particular ICT4D initiative. Sub-sections 4.81 and 4.8.2 thus explore the depictions of the organizational and individual networks in the search for differences and similarities between structural patterns and the last sub-section synthesizes the findings of the two former sections together.

4.8.1 Organizational networks

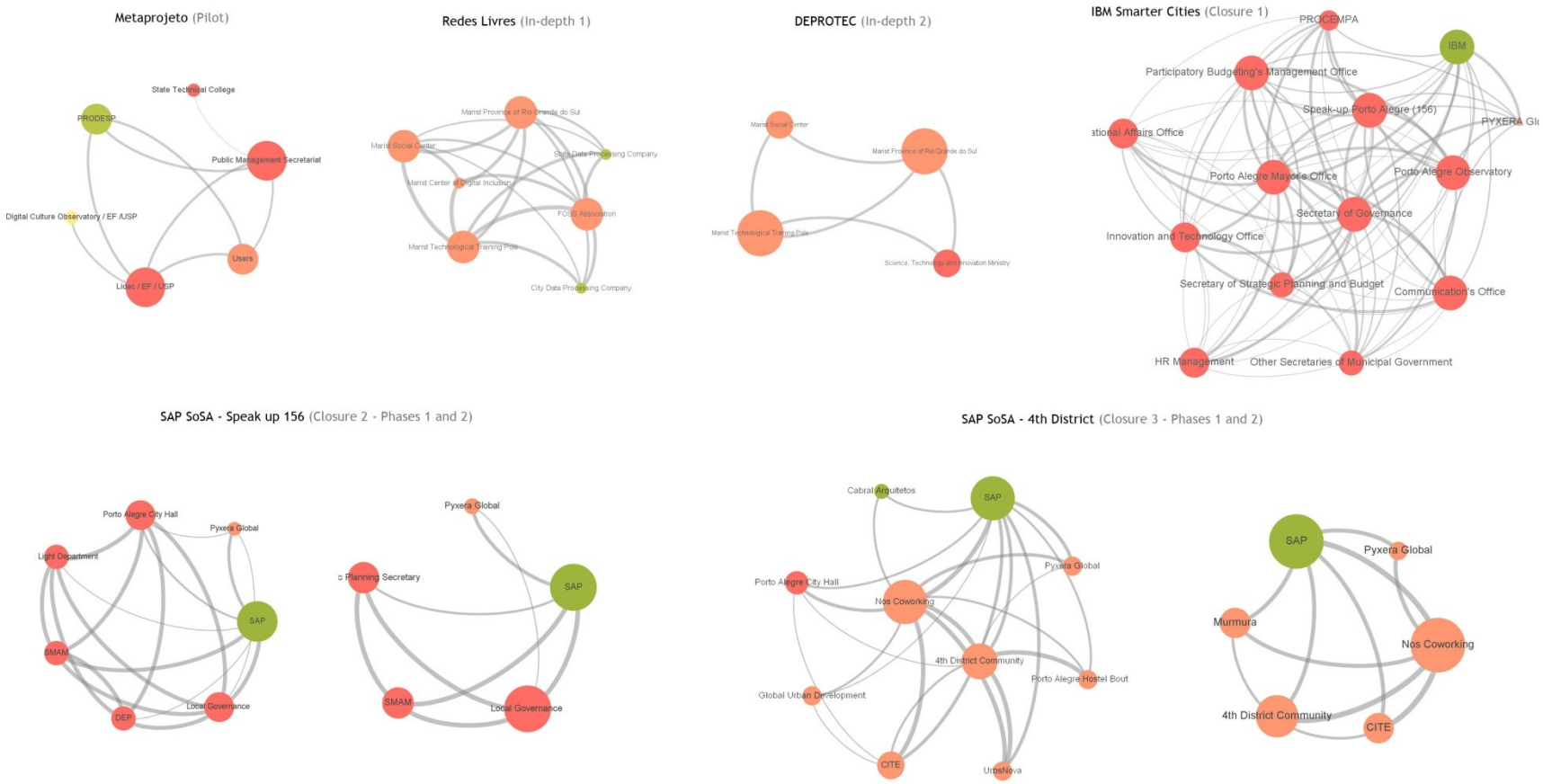

Figure 53: Organizational networks of all case studies, assembled in Photoshop by autho

Case Study	Network Density (Cohesion)	Avg. Clustering Coefficient
Metaprojeto (Pilot)	**0.53**	**0.75**
Redes Livres (In-depth 1)	**0.85**	**0.88**
DEPROTEC (In-depth 2)	**0.83**	**0.83**
IBM Smarter Cities (Short-term 1)	**0.91**	**0.94**
SAP SoSa Speak up 156 (Short-term 2 – Phase 1)	**0.85**	**0.91**
SAP SoSa Speak up 156 (Short-term 2 – Phase 2)	**0.80**	**0.86**
SAP SoSa 4th District (Short-term 3 – Phase 1)	**0.80**	**0.90**
SAP SoSa 4th District (Short-term 3– Phase 2)	**0.73**	**0.83**

Table 30: Calculation of Network Densities and Average Clustering Coefficients in GEPHI of organizational networks

Figure 53 brings together all of the networks generated at the organizational level for each case study, and Table 30 assembles their respective network densities (cohesion) and average clustering coefficients calculated by GEPHI. A network density closer to 1 means a high number of interconnected nodes, namely a highly cohesive network (Figueroa *et al.*, 2002). A high clustering coefficient means that a node has a high probability of connecting very quickly to another node to which it does not already have a direct connection (Granovetter, 1973; Barabási, 2009). Most of the organizational networks depicted are highly connected networks, with densities over 0.80. Pilot Metaprojeto measured a lower density (0.53) because some peripheral nodes were not directly involved in the project's implementation, and hence were not highly connected.

There are two main partial conclusions that can be drawn so far, without engaging yet with findings from the remaining two systemic dimensions of *Communication Level* and *Content*: *Knowledge Production and Exchange.* First, the measurements reinforce complex network theory findings that real networks display a high degree of clustering (Ravazs and Barabási, 2003). As such, the organizational network structures seem to be designed appropriately for effective collaborative action, since communication is considered a key element for effective partnering (Hardy *et al.*, 2005; Southern, 2015; see Chapter 2, Section 1.4.1, p. 36). However, such structural organization does not

mean that communication is necessarily fluid among these stakeholders, as will be shown by findings in subsequent chapters. What this means at this point, is that there are indeed appropriate communication channels, which provide opportunities to improve communication (Tennyson, 2003; Hardy et al., 2005; McManus and Tennyson, 2008; Southern, 2015).

The second finding is of a qualitative nature and concerns a feature that was easier to observe in the case studies with looser agreements. In these circumstances, individuals played a key role in making certain necessary organizational connections. In the case of the SAP and IBM short-term initiatives, consultants were highly experienced and as such were able to identify very quickly which were the main organizations that should take part in the networks. In the case of Redes Livres, older institutional nodes were able to get the necessary organizational partners for the project to take place. This example reinforces Barabási's (2013) argument that the chances for a successful collaborative endeavour are higher when there are older, more connected or more experienced nodes in the network. To exemplify, Redes Livres project coordinators acted as *network connectors* (Barabási, 2003) and were able to 'pull strings' with organizations that could give support to the project.

> *Coordinator 2:'* (...) So, (*Enthusiast 1*) is the advisor of the board of directors of PROCERGS (*State Data Processing Company*) - a high-raking position (...)- as well as the ASL (*Free Software Association*) coordinator. (*Enthusiast 1*) is the one who gave us support (...) and there is also (*Enthusiast 2)*, who is an ambassador for ASL and works in the State's government, in the IT Governance Secretary. He is high-ranking as well.' *(...)* 'Ah, and there is the PROCERGS president (...) (*Enthusiast 3*). He encouraged the project in a way, but did not do anything directly. He was part of the Marist Network, was the Polo coordinator, and today he is the mentor of everything, he gives us informal consultancy and it is the president of PROCERGS. If all these people from the government help us, we will be in a very good position; we have a lot of contacts (...)' [20] (*Focus group discussion, Redes Livres, 28.10.2011*)

4.8.2 Individual networks

[20] Original:
Coordinator 2: Então, o (entusiasta 1) é acessor da diretoria da PROCERGS, Segundo escalão da PROCERGS, e coordenador da ASL. O (entusiasta 1)é quem deu o apoio. (...) Tem o (entusiasta 2) que é e embaixador da ASL e trabalha no governo do estado, na Secretaria de governanca de TI. Ele é alto escalão.
FS: Entao tem gente de alto escalão conectado ao projeto
Coordinator 2: , ah, o presidente da PROCERGS (...) (entusiasta 3). Ele incentivou de alguma forma, mas não fez nada diretamente. Ele fez parte da Rede Marista, foi coordenador do Pólo, hoje ele e mentor de tudo, nos presta consultoria informal e é o presidente da PROCERGS. Se esse pessoal todo do governo nos ajudar nos vamos estar muito bem, a gente tem muito contato (...)

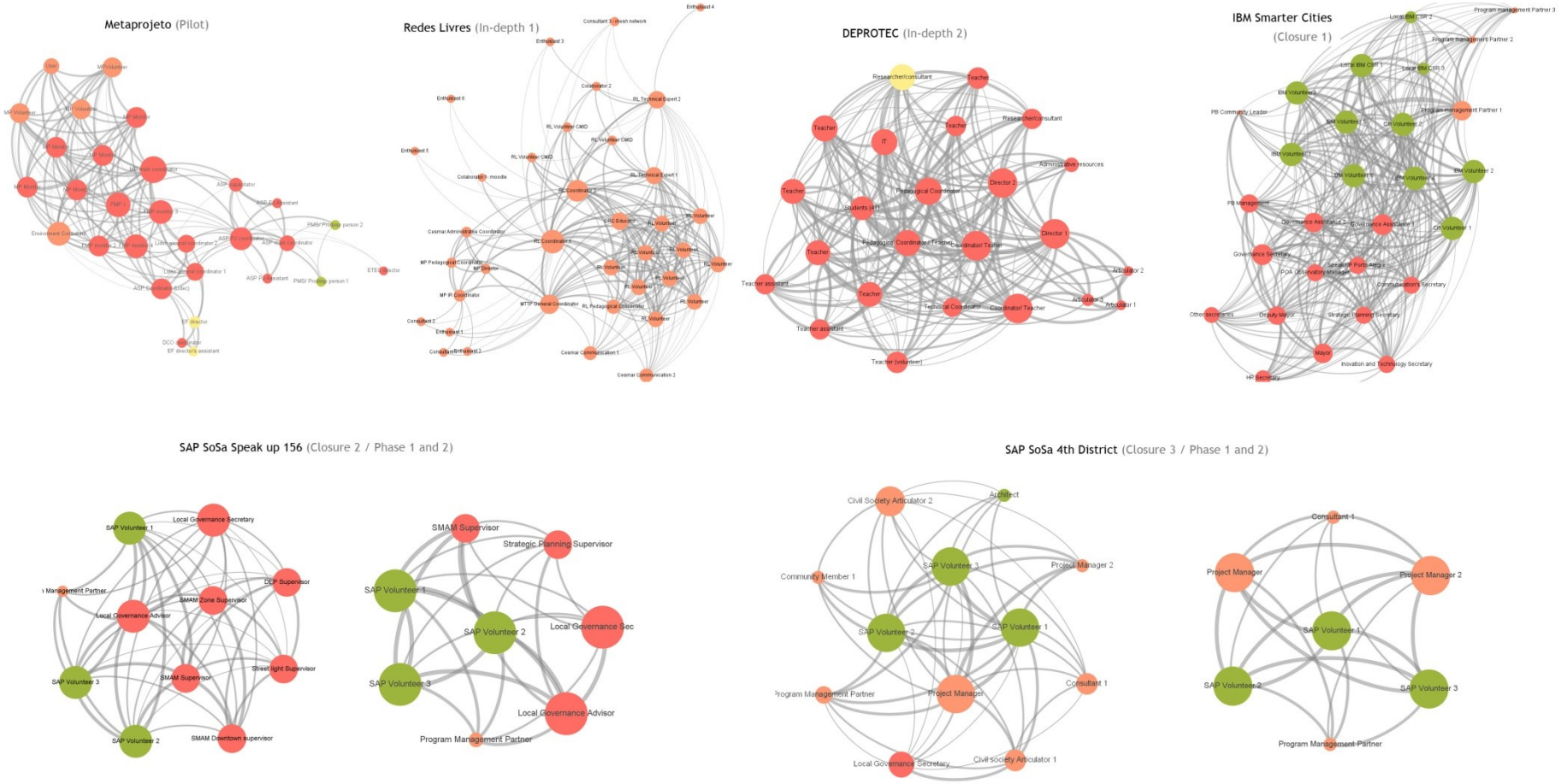

Figure 54: Individual networks of all case studies, assembled in Photoshop by author

Case Study	Network Density (cohesion)	Avg. Clustering Coefficient
Metaprojeto (Pilot)	0.38	0.82
Redes Livres (In-depth 1)	0.34	0.88
DEPROTEC (In-depth 1)	0.73	0.89
IBM Smarter Cities (Short-term 1)	0.84	0.91
SAP SoSa Speak up 156 (Short-term 2 – Phase 1)	0.90	0.94
SAP SoSa Speak up 156 (Short-term 2 – Phase 2)	0.92	0.94
SAP SoSa 4th District (Short-term 3 – Phase 1)	0.72	0.85
SAP SoSa 4th District (Short-term 3– Phase 2)	0.95	0.95

Table 31: Calculation of Network Densities and Average Clustering Coefficients in GEPHI for Individual Networks

Figure 54 shows the individual networks of each case study visually side by side, and Table 31 assembles the network densities (cohesion) and average clustering coefficients calculated by GEPHI. These networks confirm the high clustering tendency of real world networks (Wang and Chen, 2003; Ravazs and Barabási, 2003). While the average clustering coefficients were high and similar among the initiatives, ranging from 0.82 to 0.95, the short-term case study individual networks measured a higher network density than the in-depth initiatives. This was partly due to the methods applied in each of the case studies. The short-term case study networks were constructed from my participant observation data and as such, presented less complexity as there were no multiple perspectives to enrich the process. This reinforces the relevancy of multiple perspectives in order to build the networks more accurately (Checkland, 2000; Petkov et al., 2007; Kapsali, 2011; Turpin et al., 2009).

In general, all networks presented the possibility of achieving a highly cohesive circle of collaborators, as exemplified by the high average clustering coefficients (Barabási, 2005). The short-term case studies performed better, as shown by the similar measures between their respective network densities and clustering coefficients. Two main reasons could help to explain why this might be so in this cases.

First, the short-term case studies had an immediate need to gather information, as these were short duration initiatives. As such, these networks' communication feedback cycles were happening at a higher frequency than the pilot and in-depth case studies. The first days of all these specific initiatives were focused on identifying relevant stakeholders and collecting their inputs, thus making sure project deliverables were in tune with everyone that was previously identified as a potential stakeholder:

> 'At all the initiatives I have been helping to coordinate, the first concern the volunteers have is to establish a clear understanding of the context before designing a plan with clear steps. Although we try as much as possible to deliver to them a closed scope of work before they hit the ground, in every single case so far, the first week is all about assembling meetings with everyone they think might be of relevance to their project. After that first week, there are always changes to the scope of work accordingly'.
>
> *(08.11.2013, notes from my diary)*

Most individuals depicted in the short-term case studies were information givers who were not directly involved in implementing the project:

> 'Today Lisa was very anxious about the necessity to talk to some of the Participatory Budgeting community leaders. She told me there is no use in moving further if they can't understand what these people are expecting from them. Next Thursday I am taking the team to watch some one of the assemblies and they will be introduced to the community leaders'
>
> *(Excerpt from my diary, IBM Smarter Cities, 05.04.2013)*

Figure 55: IBM Volunteers visit a community leader (an identified stakeholder) to learn more about their needs, photo by author (April, 2013).

'I have lost the count of how many secretaries we have visited this past week. I am dizzy with so much information, I wonder how the volunteers will organize everything they learned!'

(Excerpt from my diary, IBM Smarter Cities, 12.04.2013)

Figure 56: A meeting at the Data Processing Company of Porto Alegre (PROCEMPA), one of the identified stakeholders of the IBM Smarter Cities Project. (Source:http://bancodeimagens.procempa.com.br/default.php?q=ibm&p=5#)

This formal concern in gathering information to build an adequate action plan was not as visible in the in-depth case studies. Redes Livres illustrates best this feature, as it started chaotically without any formal initial planning:

> *Project Coordinator 1:* '(...) there was no assembling of a specific team for it (...) but ideas from people of other projects (*such as*) CRC, Telecentros, Alquimia (...) it was the people who organized themselves to try to assemble this project (...) in its execution as well as in its conception (...)'[21]
>
> (*Individual Interview, Redes Livres, 05.10.2011*)

And:

> *Coordinator 2:* '(...) there is no one totally dedicated to the project, (*Project Coordinator 2*) is from CRC, (*Project Coordinator 1*) from Telecentros, (*Consultant 1*) as well (...) '
>
> *FS:* 'So the process is very free (...)'
>
> *Coordinator 1:* 'There is no budget, what we thought was this: There is the material from Alquimia, (*Project Coordinator 1*) from Telecentros, (*Project Coordinator 2*) from CRC, (*Coordinator 2*) (...) we got all these guys and materials together and we are making it happen, a resource from each other's project was gathered (...)'[22]
>
> *(Interview with two general coordinators, Redes Livres, 5.10.2011)*

The second reason for the high densities among short-term initiatives was that some of them had a narrower scope of work and fewer nodes. The reason for this is that the SAP Social Sabbatical Fala 156 was derived from recommendations previously done by the IBM Smarter Cities Initiative. The SAP Social Sabbatical 4th district Phase 2 reinforces this pattern, as it was a follow-up of Phase 1. Such small real world networks are expected to

21 Original:
(:...) Nao houve a montagem especifica de uma equipe especificamente pra isso, ideias de pessoas de outros projetos, crc, telecentor, alquimia (...). Pessoas que se organizaram pra tentar montar esse projeto redes livres, tanto na execução quanto na concepção (...).

22 Original:
Coordinator 1: '(...) ninguém é totalmente dedicado pro projeto, o Rafael é do CRC, o Felipe do Telecentros, o Eloir também (...)',
FS: 'O processo é muito mais livre (...)'
Coordinator 2:' Não tem orçamento, o que a gente pensou é o seguinte: tem o material lá do Alquimia, o (*coordenador de projeto* 1) dos Telecentros, o (*coordenador de projeto 2*) do CRC, o *(coordenador 2)*, ..juntou todo esse pessoal e tamo fazendo, junto um pouco do recurso de cada projeto (...)

be more cohesive according to predictive models (Wang and Chen, 2003; Ravazs and Barabási, 2003).

Moreover, the lowest network cohesions reflected in Metaprojeto and Redes Livres was partly due to these relationships being more complex than those in the short-term case studies. These initiatives are longer-term and as such present more complex relationships. Individuals placed higher in the project's hierarchy such as coordinators, articulators, managers and directors, measure high degree centralization in relation to the rest of the network. They are the most connected nodes and play a key role in bridging the other nodes, passing on information that it is relevant for the processes to continue (Barabási, 2003; Wang and Chen, 2003; Capra and Luisi, 2014). Wang and Chen (2003) emphasize the importance of these bigger nodes in affecting network flows. These knowledgeable nodes have the power to act on their '*connectedness'* and can modify process easier than nodes with smaller degrees. However, most of these decision-makers are not included in the largest cluster of the networks. The largest clusters are composed mainly of individuals who are actually implementing the project, because they tend to communicate more often with each other. The tendency for high clustering among nodes with similar features is called homophily (Centola, 2015). To exemplify, Pilot Metaprojeto's most active nodes are the project educators; Redes Livres, the volunteers; and DEPROTEC, the teachers. Chapter 5 analyzes further how these network configurations affected network processes.

These sections have outlined the initial differences and similarities between the initiatives, concerning the first dimension of the systemic view of my research, namely *Network Structure*. Many social researchers regard high network cohesion as a necessary property for social change to happen (Figueroa *et a*l., 2002; Tennyson, 2003; Hardy et al., 2005) and this is indeed the first step, as communication channels are open. However, initial assessment of the network densities has shown that there is a need to examine deeper the quality of the communication flowing through these channels. It is important to remember that these networks are embedded in one another (Bateson, 1979; See Chapter 2, Section 2.4, p. 70) and thus the project processes they act on become extremely complex to disentangle. The next section notes methodological adjustments that were made in the field because of this complexity.

4.8.3 Organizational and individual networks dynamics

This section explores the influences of organization and individual networks on each other and their implications for the different project dynamics, also addressing possible tension issues among existing control processes and creative processes, as discussed in Chapter 2 (Sub-section 2.4, p 70). There were two main relevant findings from the initial visualizations of both organizational and individual networks. The first refers to the organizational network structures in which the projects are born, and the second concerns changes happening at one level of the system affecting other levels and vice-versa (Bateson, 1979; Barabási, 2009).

The first finding reinforces the argument that organizational networks help to shape the project's initial contexts and patterns of communication processes, thus consolidating social norms (Capra, 2002; Centola, 2015). For instance, networks in which public sector or civil society entities were leading were not as dynamic as the private sector led initiatives. Metaprojeto is an example of a more designed network superimposing its processes onto the more emergent structure, as discussed in Chapter 2 (Sub-section 2.3.2, p. 64; see also Bateson, 1979 and Barabási, 2009). Project coordinators, educators and volunteers were struggling to emerge in the dense organizational structure of the project, despite being inserted in a highly cohesive cluster. These implementation stakeholders were unable to collaborate actively with each other as they did not enjoy autonomy to act, since decision-maker nodes were distant from them. Moreover, organizational and official communication with end users was flawed, despite the well-organized communication processes, reports and decisions being delivered and communicated on a regular basis. At the individual network level, this scenario was more informal and personal. The stakeholders depicted in the implementation cluster of the Metaprojeto individual network engaged actively with end users. They fed back the information and insights gained to decision-makers. However, this information was not always taken into account as there were forces from an organizational partner (government) that had a determining influence on project processes.

> 'A *staff meeting*: Metaprojeto main coordinator, two AcessaSP submanagers and AcessaSP EF Manager. I was just observing. Saw lots of conflicts. The sub-managers were complaining they could not do things the way it was envisioned in the beginning of their work at AcessaSP. They were saying that more and more, the government was the client and they just had to do what they were told. EF's manager said that unfortunately this is so; they can suggest approaches, the "client" will send their suggestions on top of these approaches back and they have to adapt. That's how it is now'.
>
> *(Staff meeting, 10.03.2010, notes from my diary)*
>
> 'At the staff meeting, (*AcessaSP EF Manager)* told me something I didn't know: We have to get approval from (*Main manager of AcessaSP)*. For that, I would have to write a proposal plan for approval (...) I worked on the presentation for (*Main manager of AcessaSP)*, a series of e-mails go back and forth between me and (*Research Coordinator*). (*Research Coordinator*) sends me a map of the "institutional relations" so I understand how the process works, since I am worried with the timeframe, giving the whole bureaucracy I am going through.'
>
> *(10.03.2010, notes from my diary)*

Reinforcing the above organizational control pattern, most of DEPROTEC's educators mentioned that there were clear rules to be followed and inflexibility, especially from a financial point of view (for a deeper account see Chapter 6, p. 225). DEPROTEC's behavioural patterns were more similar to those of Metaprojeto than of Redes Livres, for instance (See Chapter 6, p. 225). This is partly linked to the leadership culture of these projects, since DEPROTEC and Metaprojeto were influenced by Public Sector and Redes Livres was a research and experimental project led by volunteers that did not enjoy the influence of a formal agreement.

The influence of the organizational leading culture on project processes also influenced the shorter-term studies regardless of the differences in project duration they had to those of the in-depth ones. Similar difficulties appeared if the project included a client who belonged to the public sector, such as IBM Smarter Cities or SAP Fala 156. However, these short-term projects happened in a much faster timeframe and the most active nodes were highly experienced professionals who belonged to the private sector. These features facilitated the identification of problems (Checkland, 2000; Jackson, 2003; Barabási, 2009), but they did not lead to immediate action, since decision-makers did not engage in this process (Wang and Chen, 2003; Hardy *et al.*, 2005; Southern, 2015).

> '(*SAP Volunteer 2)* told me today that the Environmental Secretary of the City Hall is incredible inefficient partly due to the lack of optimization of their processes. With small adjustments they could raise productively at incredible low cost. The problem is to get approval from the City Hall. They have only one printer and no network system. If you want to print anything, you have to go down to the printer with an USB stick. Imagine how much time they would save by putting all the machinery in a single network!!!'
>
> *(Excerpt from my diary, SAP Fala 156, 10.04.2014)*

The second main finding concerns changes happening at one level of the system that also affected other levels and vice-versa (Bateson, 1979; Barabási, 2009). In Redes Livres, for instance, active stakeholders enjoyed great freedom towards project processes, partly because of the project's loose agreement. However, active stakeholders lost control over project goals when heavier structural changes started to happen after the Social Centre's managing director was replaced (see a deeper account on Chapter 6, p. 225):

> 'When (*CESMAR director*) started managing CESMAR and he noticed Redes Livres was not coming through due to lack of technical support, the idea of the community radio started to appeal more. The fact that DEPROTEC had a discipline of communication also pushed the goal changing. Bring also the fact that the kids are worried that they should be making money (family pressures), it seems some deviant processes that were not predicted took place.
>
> *(10.08.2012, notes from my diary)*

Moreover, the exchange of knowledge among the experienced SAP volunteers and the Secretariat of Environment employees of SAP Fala 156 reported above serves as a reverse example of changes in the emergent network affecting the designed network. Although the problems identified were not immediately addressed due to bureaucratic constraints, the employees were left with technical knowledge to validate and structure their demands. Eventually they got through the consolidated organizational structure of the City Hall and convinced decision-makers of the benefits of the proposed changes. They felt empowered with enough knowledge to act on it and changed the system.

The above findings reinforce the argument that more stable networks initially superimpose their contexts, mental models and consolidated social norms (Capra, 2002; Centola, 2015) on to the emergent social networks of the ICT4D initiatives observed. However, as much as it is impossible to predict individual behaviours, this section also

exposed features that can be explored further if the objective is effective collaborative action. These are discussed in detail in Chapter 6 (p. 225).

4.9 A Note on methodological adjustments

Chapter 2 (p. 60) explored the concept of logical typing and the superimposition of systems onto other systems (Bateson, 1979, Giddens, 1990; Capra 2002, Barabási, 2009, Capra and Luisi, 2014; Centola, 2015). My initial objective was to generate both individual and organizational networks at distinct moments of the field research process following these premises. Bateson's (1979) concept of calibration and feedback ladder was intended to be the methodological tool in order to interpret these networks at different points in time (see Chapter 3, Section, 3.2, p.76). Together with interviews and focus group discussions, the idea was to create a critical view of the processes of network formation.

However, there are always unpredicted issues, especially at an individual level, even if an initiative may be led by a highly experienced project manager (Bateson, 1979; Checkland, 2000; Jackson, 2003; Barabási, 2009). Adjustments had to be made to my initial methodological proposal, primarily because it was not possible to depict the evolution of the network structures as intended. There were two main reasons for this. First, the methodology initially assembled required that everyone involved in the project processes took part in the focus group discussions. In reality, it was extremely difficult to achieve this. People have their own agendas and responsibilities, and to get everyone in the same room was impossible in most cases. It was possible to get a good number of focus group discussions in the DEPROTEC case study, but these were divided by stakeholder clusters. One group discussion was composed of educators, another of students, and a third of coordinators. Gathering educators, coordinators and project managers in the same room was not feasible.

Second, the intention was to generate more than one network over time. However, in most cases the network had not changed significantly and there was no need to build it again. Section 4.8.2 above showed that most networks were cohesive, but the quality of the communication was grasped only through direct conversations (see Chapter 5, p. 181). There is a fundamental difference between the quality and the quantity of communication. Simply having strong links shown in the network diagrams does not

mean that there was indeed effective communication within the network. The cohesion of the networks remained the same throughout the period of observation even though people entered or left the network through time, thus reinforcing the scale-free network model (Barabási, 2003). General principles remained, such as the high clustering effect and preferential attachment. The remaining data required, regarding *communication level* and *content*: *knowledge production and exchange* was gathered by observing and talking to participants during the process. It is suggested that in the future such research the structure of the network dimension is assessed once through multiple perspectives approaches, and that the other two dimensions are re-iterated throughout the project life cycle, thus maintaining the focus on the quality of the communication and partnership (Tennyson, 2003; Hardy et al., 2005; McManus and Tennyson, 2008; Southern, 2015).

Network visualizations assisted in establishing a practical starting point for all of the participants to begin thinking about the processes into which they were inserted (Bateson, 1979; Checkland, 2000; Capra, 2002). Future research might seek to build new networks with stakeholders only when there are substantial organizational changes that might cause processes to be unknown, such as changes in management. This assists in clarifying new structural changes that might have occurred, so the iteration and learning processes can continue within the acknowledged new structure.

4.10 Final observations

This chapter has provided a description of each of the case studies in order to establish their situational contexts, a key concept of this research (Bateson, 1979) for setting the boundaries of the systems observed. It also presented the network visualizations generated and analysed issues of network cohesion and initial patterns identified across the different contexts observed. Tables Table 32, Table 33 and Table 34 below summarize the key findings of the sections of this chapter.

Organizational Networks *(p.162)*			
Main Findings	***Case study specific data***		**General issues**
Measurements reinforce complex network theory findings that real networks display a high degree of clustering (Ravazs and Barabási, 2003).	Pilot Metaprojeto	High clustering coefficient	Organizational network structures seem to be designed appropriately for effective collaborative action; however, this does not mean that communication is necessarily fluid among these stakeholders.
	In-Depth Redes Livres	High clustering coefficient	
	In-Depth DEPROTEC	High clustering coefficient	
	Short Term initiatives	High clustering coefficient	
Individuals played a key role in making certain necessary organizational connections (especially in initiatives with looser agreements).	Pilot Metaprojeto	No relevant data.	
	In-Depth Redes Livres	Older institutional nodes were able to get the necessary organizational partners for the project to take place, acting as networks connectors (Barabási, 2003).	
	In-Depth DEPROTEC	No relevant data.	
	Short Term initiatives	Consultants were highly experienced and as such were able to identify very quickly which were the main organizations that should take part in the networks.	

Table 32: Main findings on Organizational Structures

Individual Networks *(p.165)*		
Main Findings	***Case study specific data***	
Reinforcement of the relevancy of multiple perspectives in order to build the networks more accurately (Checkland, 2000; Petkov et al., 2007; Kapsali, 2011; Turpin et al., 2009).	Pilot Metaprojeto	No relevant data.
	In-Depth Redes Livres	Lack of a more formal concern in gathering information from multiple stakeholders to define an action plan, reflected on lowest network cohesion (also due to more complex relationships).
	In-Depth DEPROTEC	Lack of a formal concern in gathering information from multiple stakeholders to define an action plan, reflected on lowest network cohesion (also due to more complex relationships).
	Short Term initiatives	Similar measures between their respective network densities and clustering coefficients. Reasons: a) Immediate need to gather information (short duration initiatives, thus withhigher feedback cycles). b) Most individuals were information givers, not directly involved in implementation

Table 33 Main Findings on Individual Networks

Organizational and individual network dynamics *(p.172)*		
Main Findings	***Case study specific data***	
Organizational networks help to shape the project's initial contexts and patterns of communication processes, thus consolidating social norms (Capra, 2002; Centola, 2015)	Pilot Metaprojeto	Project coordinators, educators and volunteers were struggling to emerge in the dense organizational structure of the project, despite being inserted in a highly cohesive cluster.
	In-Depth Redes Livres	
	In-Depth DEPROTEC	Educators mentioned that there were clear rules to be followed and inflexibility, especially from a financial point of view.
	Short Term initiatives	Similar difficulties appeared if the project included a client who belonged to the public sector, such as IBM Smarter Cities or SAP Fala 156.
Changes happening at one level of the system that also affected other levels and vice-versa (Bateson, 1979; Barabási, 2009).	Pilot Metaprojeto	No relevant data.
	In-Depth Redes Livres	Active stakeholders enjoyed great freedom towards project processes, partly because of the project's loose agreement. However, active stakeholders lost control over project goals when heavier structural changes started to happen after the Social Centre's managing director was replaced.
	In-Depth DEPROTEC	No relavant data.
	Short Term initiatives	On case study SAP Fala 156, the the Secretariat of Environment employees were left with technical knowledge to validate and structure their demands. Eventually they got through the consolidated organizational structure of the City Hall and convinced decision-makers of the benefits of the proposed changes.

Table 34 Main findings for organizational and individual network dynamics

These initial findings provide the ground for the next Chapter 5 (p.181) to answer this research's first main question on why these network topologies influenced project dynamics the way they did and vice-versa:

> *What are the relationships between network topologies and communication processes within Brazilian multi-stakeholder ICT4D initiatives, and why do they function as they do?*

In this light, the next chapter analyses data concerning proxys of the *Communication Level* dimension (see Chapter 3, Section 3.2, p.76), namely stakeholder's knowledge of project content and each other's roles and the particular behavioural patterns encountered, such as relationships of power, social norms and the sense of collective identity. These observations constitute the ground for the subsequent analysis in chapter 6 (p. 225) regarding the last main research question:

> *What role do individual actions play in forwarding or hindering effective collaboration at the unfolding network interaction patterns of ICT4D initiatives?*

5 Network topology and communication patterns

5.1 Introduction

'The whole is other than the sum of its parts'
(Kurt Koffka, Gestalt Psychologist, 1935)

The previous chapter provided contextual information about each initiative, summarising the project backgrounds and the respective organizational and individual network topologies as they were at the time this research was conducted. According to Larsson *et al.* (1998), the highly complex communication and learning processes embedded and unfolding at these layers, both formally and informally, need to be explored from a situational context if we seek to understand what is hindering or facilitating the partnership (see also Bateson, 1979; Hardy *et al.*, 2005; Capra and Luisi, 2014; Southern, 2015). As such, the mapping of organizational and individual network topologies provided initial insights into the *network structure* dimension (Chapter 2, Section 2.2 and 2.3, p. 59). This chapter now analyses the *communication level* dimension which concerns the communication feedback cycles leading to the system's recurrent self-organization mechanisms (Von Bertalannfy, 1977; Bateson, 1979; Maturana and Varela, 1992; Luhmann, 1995; Capra, 2002; Meadows *et al.,* 2004). It directly addresses the first fundamental question that my research seeks to answer:

> *What are the relationships between network topologies and communication processes within Brazilian multi-stakeholder ICT4D initiatives, and why do they function as they do?*

This chapter's sections are divided into the *communication level* proxys noted in Chapter 3 (Section 3.2, p.76). Each section starts with a synthesis of the main findings followed by examples of the proxys. If an initiative is not mentioned, this is because there was no relevant data regarding the proxys being addressed in that particular case study. Section 5.2 analyses the stakeholders' perceptions of project content, and Section 5.3 explores the reflections on the self and on the other. These proxys provide insights regarding how different views and meanings were accommodated (Larsson *et al.*, 1998; Figueroa *et al*., 2002; Tennyson, 2003; Adam *et al.*, 2007; Hardy *et al.*, 2005; Southern, 2015; see also Chapter 2, Section 2.4, p. 70 and Chapter 3, Section 3.2.2, p. 80) and why some projects

were successful in achieving their agreed objectives better than others, according to how much relevant information was travelling through the links of the networks described in Chapter 4 (p. 125; Bateson, 1979; Barabási, 2009).

Section 5.5 draws on the findings of the previous sections and reviews the network topologies accordingly, thus reflecting on the reasons for certain behavioural patterns found in the different case scenarios (Bateson, 1979; Barabási, 2009; Capra and Luisi, 2014; see Chapter 2, Section 2.4, p. 70). The network topologies were discussed with stakeholders not only so that we could explore them in focus group discussions and interviews, but also to stimulate them to think about these issues without formal interventions. The objective was to start a learning process so as to adjust partnership mechanisms towards more effective collaborative action (Larsson *et al.*, 1998; Checkland, 2000; Southern, 2015).The data collected from participant observation, focus group discussions and interviews revealed how the communication channels were used in the different contexts. The findings presented in this chapter are then used to support the next chapter's suggestions for useful guidelines aiming at effective collaborative action within ICT4D initiatives (p. 225).

5.2 Knowledge on content

This section concerns the views that stakeholders have of their projects at the time this research was conducted. The goals were to access differences in perceptions regarding project goals as well as what was perceived as unintended outcomes or constraints by different stakeholders (Figueroa *et al., 2002*). In particular, it analyses whether differences in perceptions and lack of mutual agreement influenced the effectiveness of collaboration, a concept believed to hinder project processes (Bateson, 1979, Larsson et al., 1998; Capra, 2002; Figueroa *et al*., 2002; Tennyson, 2003; Adam et al., 2007; Hardy *et al.*, 2005; McManus and Tennyson, 2008; Southern, 2015).

5.2.1 View of project goals

Views of project goals were observed by asking participants questions such as who was involved in planning project goals, whether the stakeholders on the demand side of the projects recognized project goals as something that was useful to them, whether there

was an action plan and who had access to it, if there were any stakeholders unsatisfied with defined project goals, if there were any mechanisms for conflict resolution in place, and, most importantly, what were the expected project results (See Appendix II, p. 297). Three main findings were apparent: the first concerns the relevancy of awareness of stakeholder's views; the second, the importance of establishing mechanisms at early stages of the project to achieve the former; and last, the importance of setting tangible goals to affect individual's motivation.

The first finding confirms that awareness of each other's views is relevant in order to diminish errors in logical typing in order to build a common context around the initiative (Bateson, 1979, Larsson et al., 1998; Capra, 2002; Figueroa *et al.*, 2002; Tennyson, 2003; Adam et al., 2007; Hardy *et al.*, 2005; McManus and Tennyson, 2008; Southern, 2015).The visualizations in Chapter 4 (p.125) have shown that real world networks tend to have a high density (Barabási, 2003; Wand and Chen, 2003), which means that there are communication links available for most nodes of the networks. It is important, though, that this high cohesion is shifted from being a quantitative fashion to a qualitative one, in the sense that meaningful content travels through these communication channels. As advocated by many, mechanisms that focus on the creation of a common context are a necessary tool for collaboration (see for instance Larsson *et al.*, 1998; Checkland, 2000; Jackson, 2003; Hardy *et al.*, 2005; Adam et al., 2007; McManus and Tennyson, 2008;Southern, 2015).

In general, the importance of mutual understanding about project goals was common to all of the initiatives observed. However, mechanisms in place to leverage this process differ from case to case, and at times they were non-existent. In Metaprojeto, for example, stakeholders shared a common concern in creating context for the importance of technology appropriation (Chapter 4, Section 4.2, p.126). The project's newest educator was very clear about these goals, despite being there for no longer than a week at the time I interviewed him:

> *FS*: '(…) was there an orientation, any materials, how was the conversation to instruct you to build the workshops the way you did? (…)'

Educator 3: 'There was (...). All these people, at least the ones I told you I have personal contact to, they all gave me tips (...), a didactic issue, of how to work with the public (...). About our infrastructure, they instructed me a lot (...), what kind of material we work with, what I can use, what I can't...actually, what I can't didn't even come up, only what I can (...) Here you can do everything.'

FS: 'There is this philosophy, right?'

Educator 3: 'Yes, yes. Do the best you can, and freedom, you know? Do it well.'[23]

(Individual Interview, Metaprojeto, 15.04.2010)

DEPROTEC also shared an ultimate common goal across network clusters of directors, coordinators, articulators and educators:

Pedagogical Coordinator 1: 'Professional qualification, entry into the labor market, personal improvement, human formation, and technological innovation in the digital inclusion area.'[24]

(*Individual Interview, DEPROTEC, 26.06.2012*)

Educator 3: '(...) Two lines, a more humane thing and another of training (...) to train young people for me is not the main thing because most of them will not work with this, but it has several things that help in reasoning, on the day-by-day (...) and (...) human development (...)to allow the inclusion of new technologies (...) and demystify that robotics is a business from another planet (...)'[25]

(*Individual Interview, DEPROTEC, 22.07.2012*)

The initial assembling of Metaprojeto and DEPROTEC were successful from a context formation point of view, as common project goals were shared by the stakeholders as a

[23] Original:
FS: '(...) Teve essa orientação, algum material, Como foi a conversa pra te instruir a montar as oficinas da maneiracomo tu estás montando? (...)'
Educator 3: 'Teve. (...) todas essas pessoas, pelo menos essas que eu falei que tenho contato pessoal, todas elas me deram dicas (...), uma questão didática, de como trabalhar com o publico (...). Sobre a nossa infra-estrutura em si, eles me instruiram bastante (...), que tipo de materiala gente tá trabalhando, o que que você pode usar, o que não pode usar, na verdade o que você não pode não entrou, só o que você pode (...) Aqui você pode tudo.'
FS: 'Tem essa filosofia, né?'
Educator 3: 'Tem (...). Faça o melhor possível, e liberdade, entendeu? Faça bem feito.'

[24] Original:
Coordenadora Pedagógica 1: 'Qualificação profissional, inserção no mercado de trabalho, construção da pessoa, formação humana, e inovação tecnológica na área da inclusão digital. '

[25] Original:
Educador 3: 'Duas linhas, uma coisa mais humana e outra de formação (...) formar jovens que pra mim não é o principal, pois a maioria nao vai trabalhar,seprofisionaliar nisso, mas tem varias coisas que ajudam no raciocinio, no dia a dia (...) e mais a formação humana (...0 possibilitar a inclusao de tecnologias novas (...) e desmistificar aquele negocio que robotica é aquele negocio de outro planeta (...)'

whole. This is considered by Figueroa *et al.* (2002) to be a positive factor in forwarding collaborative processes.

Redes Livres's stakeholders were also clear about project goals, even without a formal action plan (Chapter 4, Section 4.3, p. 134). However, some goals were not widely shared across the network clusters. For instance, a Marist Brothers Director, who was a firm supporter of Redes Livres, was also interested in its replication:

> *FS*: 'And the replication model, does it exist?'
>
> *Marist Director*: 'So, I asked them (*the workgroup*): We have to write (...) how the project will be deployed. I have to have the steps of an implementation. And now there are two things that we need, that I asked them: what are the real costs of this (...) and I need this technical description.'[26]
>
> (*Individual Interview, Redes Livres, 26.10 2011*)

The volunteers, on the other hand, never mentioned replication and were focused mainly on local goals:

> *FS*: 'And people in the community who will receive this infrastructure, had participation?'
>
> *Volunteer 2*: 'The project so far has been very little promoted. In my street nearly everyone knows (...) because I live there, I explained to my grandmother, she told the other women, hence they came to ask me(...) '
>
> *FS*: 'And what they think (...) they think it is useful, or?'
>
> *Volunteer 2*: '(...) (*the project*) will not involve the person who wants MSN, Facebook, Orkut, but more people that like Informatics (...) that uses Linux, works with Wikipedia (*they prepared an offline version of it*), because there is no internet link and little things so far. It's not 100%, I tell you, we have two mesh points and there are not two people that connect to that network per day, this (*the project*) is something that has to be more disclosed.'[27]

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[26] Original:
FS: 'E o modelo de replicação, ele existe?'
Diretor Marista: 'Entao, que eu pedi para eles – nos temos que escrever (...). O projeto, como vai se dar a implantação. Tenho que ter os passos de uma implementação. E agora são duas coisas que precisa ter que pedi a eles. 1) quais os custos reais disso (...) preciso deste descritivo técnico.'

[27] Original:
FS: 'E as pessoas da comunidade que vao receber a infra, tiveram participacao?'
Voluntário 2: 'O projeto ate agora foi bem pouco divulgado. Na minha rua praticamente todo mundo sabe como é (...) porque eu moro ali, expliquei pra minha vó, ela falou para as outras mulheres, dai vieram me perguntar (...)
FS: E o que eles acham (...), eles pensam que é útil, ou (...)'
Voluntário 2: '(...) (*o projeto*) nao vai envolver a pessoa que vai so pra MSN, Facebook, Orkut, mais as pessoas que gostam da informatica em si, usar Linux, fazer trabalhos com Wikipedia (*eles instalaram uma versão offline*), por não ter um link de internet e pouca coisa até agora. Nao tem 100%, vou te dizer, temos dois pontos e não tem duas pessoas que se conectam nessa rede por dia, é uma coisa que tem que divulgar mais. '

(*Individual Interview, Redes Livres, 13.12.2011*)

These interests were not divergent or hidden; they were kept inside each cluster and not shared across the network. A similar pattern was found in DEPROTEC. General project goals were a consensus within the cluster of coordinators, institution directors and articulators of DEPROTEC, as these stakeholders were involved in the project's planning process. DEPROTEC's educators, on the other hand, were not involved in developing a general action plan. Their focus was on their respective discipline's content.

> *Project Coordinator 1*: '(...) we divided things (...) the ones who planned the disciplines were much more those (*educators*) (...) the first ones (*coordinators and organizers)* worked on the Ministry proposal. The second (*educators*), worked in the planning of the action plan. It had this division.'[28]
>
> (*Individual Interview, DEPROTEC, 28.06.2012*)
>
> *FS*: 'Was there something on the planning to involve the demand side?'
> *Educator 3*: 'I did not participate in the planning (...) from what I understand it was done in quite a rush (...) there are several things we are adjusting (...)'[29]
> (*Individual Interview, DEPROTEC, 22.07.2012*)

This pattern was worsened within the cluster of students, who presented mixed views regarding the project's goals. This partly affected student interaction with the course's subject matters as well as with some educators, as reported by students in the focus groups. The focus groups and an opening event assisted in managing student's expectations, and these mechanisms decreased the noise created by the project' rough start, as was reported by educators in subsequent focus groups.

The above also relates to the second finding of this section, and reinforces many previous researchers' vindications for constant iteration among stakeholders regarding project processes (Bateson, 1979; Larsson et al., 1998; Tennyson, 2003; Hardy et al., 2005; Adam et al., 2007; Southern, 2015). The DEPROTEC student focus groups attested

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[28]Original:

Coordenador do Projeto:' (...) por que ai a gente dividiu as coisas...quem planejou as disciplinas foram muito mais eles (...) Os primeiros (*coordenadores e articuladores*), na proposta pro MCT. Os segundos (*educadores*), no planejamento do plano de ação. Tem essa divisão. '

[29]Original:

FS: Foi feito algo na parte de planejamento pra envolver o lado da demanda
Educador 3: Eu nao participei do planejamento...pelo que eu entendi foi feito na correria (...) tem varias coisas que ate estamos ajustando (...)

that accessing individual' views of project goals at times, helps to accommodate and adjust different understandings during project processes as a reassuring mechanism.

Moreover, the main reason for students' mixed views in DEPROTEC was the fast pace at which the project had to be assembled, which gave no time to disclose proper information about the project to end users. After the Technological Training Complex was granted funding from the Federal Ministry, deadlines were tight:

> *FS*: 'And do you think there is something missing?'
>
> *Pedagogical Coordinator 1*: 'So far we are working as we can, making adjustments actually. Ten days ago we took a look and began to realize that the teacher came in the classroom and the resources were not working ... I spent time watching classes and much of the class was around such issues, the projector was not connecting, the computer with bad memory, or the chairs, the room is tight (...) so (...)the little time we were talking about it, an insecurity hit me (...)'[30]
>
> (*Individual Interview, DEPROTEC, 26.06.2012*)

As argued by Unwin (2005), pressure coming from an organizational stakeholder who is funding the project is a recurring issue in ICT4D initiatives and it often leads to poor planning regarding the timing needed to accommodate what was initially planned (Scur, 2005). The focus groups conducted with DEPROTEC student batches at the beginning of the project was welcomed by them, as they could clarify any mixed views (Figure 57).The Technological Training Complex also celebrated them as an important tool to manage views and expectations, as well as to gather important input and suggestions at such an early stage.

[30]Original:
FS: 'E acha que ta faltando algo?'

Coordenadora Pedagógica 1: 'Ate aqui a gente foi trabalhando conforme o que deu, adequando na verdade. Há uns dez dias atras a gente fez uma re-olhada pra isso e comecei a perceber que o educador chegava em sala de aula e não tinha os recursos funcionando (...) passei assistindo as aulas e boa parte da ala era esse função, o projetor nao liga, o computador ta com a memoria ruim, ou as cadeiras, a sala tá apertada (...) entao (...) a pouco tempo a gente tava conversando sobre isso, me bateu uma insegurança (...)'

Figure 57: Focus Group Discussion with DEPROTEC students, 05.07.2012 (Source: http://socialmarista.org.br/inclusao-digital/linha-de-tempo-do-deprotec)

This argument was further reinforced by the weekly checkpoints that were part of the short term case studies processes. PYXERA Global, the logistical partner of these initiatives was in charge of assisting the clients in the development of the scopes of work to be delivered to the corporate volunteers. Once volunteers hit the ground, gathering information for further clarification and adjustment of the scopes was the first week's agenda. After that first week, differences regarding the level of shared understanding of project goals among these initiatives leaned primarily on how well the clients had prepared to share relevant information:

> 'This team (*SAP SoSA 156 - 2 Phase*) had a good checkpoint meeting with the Secretary last Monday. (…) Today (…) they have another checkpoint with the Secretary (…)'

And:

> 'This team (*SAP SoSa 4th District - 2 Phase*) said to be working on several layers for their project. There was a meeting with the Secretary of Innovation that never happened - they went, but the meeting did not happen (…)'
>
> (*Excerpts from Diary, 15.04.2014*)

This last finding reinforces Barabási's (2009) argument that the presence of tangible goals affects individual motivation positively. The shorter project deadlines of the short term case studies affected individual stakeholders' focus and pro-activity positively, regardless of the organizational structures they were inserted in. This was indeed the case in all of the corporate volunteering projects I assisted with over my 5 years as a project coordinator for PYXERA Global.

Organizational structures with greater consolidation of social norms, such as public sector institutions, can affect an initiative's emergent networks by constraining its system's feedback cycles as a consequence of their stricter rules (Capra, 2002; Barabási, 2009; Centola, 2015; see Chapter 2, Sub-section 2.3.2, p. 64). This was illustrated best by the influence of the funding partner on the pace of DEPROTEC's initial progress (see above).The findings suggest that a way out of these mechanisms might to establish smaller goals even within such tight organizational structures. This mechanism can motivate implementation stakeholders positively until certain strict organizational mechanisms change to improve productiveness, if ever they do. A positive example where this was embraced was in the IBM Smarter Cities case study. After an assessment of the processes, volunteers realized that effective action counts for a lot within the City Hall processes. Aware of this fact, they decided to adjust the recommendations they had into short, medium and long term goals. To this date, this has proven to be a successful strategy, as the city of Porto Alegre has been indeed enjoying the legacy of that project. For instance, the city has now an open data portal (http://datapoa.com.br/, accessed in February 9th, 2016, in Portuguese) from which several relevant city service applications have been built and made available to the public in the areas of health, transportation, security, culture, environment and education.

5.2.2 Perceived constraints

Perceived constraints indicate the identification by stakeholders of elements that hinder project processes. If such constraints were acknowledged by individuals from all clusters within a network, the assumption is that action would be taken to overcome such constraints (Figueroa *et al*., 2002). There were two main findings concerning this proxy. First, the position of the node in the network affects the perception of which constraints

are relevant and the initial assumption that action would be taken could not be confirmed. Second, types of constraints are of different nature, caused by unpredictable processes due to the diversity of mechanisms embedded in the different initiatives observed.

In general, stakeholders from different clusters perceived constraints differently. For instance, some DEPROTEC educators were apprehensive, as they were told not to engage with the project in advance. These educators would start working only in the second semester of the project and were told by project coordinators not to get involved with DEPROTEC until then. This was seen as a constraint by these educators:

> *FS*: 'How about DEPROTEC?'
>
> *Educator 7*: 'Actually I already knew the project from the beginning (…) it was for us already to be preparing the base (…), we cannot demand programming from them (*the students*). So we should be creating the structure for when they get here (...) I already spoke in meetings (...) "you are leaving things for the last minute" (…)'
>
> *FS*: 'Have you talked to him (*Project Director*)?'
>
> *Educator7*:' (…) I said, "Man, we have to read the project well, because we could not understand the project yet."'[31]
>
> (*Individual Interview, DEPROTEC, 26.06.2012*)

Another constraint reported by DEPROTEC educators and some project coordinators was that of initial infrastructure. Rooms and equipment were either still missing or not ready. When educators learned about the project, they had to act fast because of the agreed deadlines with the Federal Ministry and new rooms and equipment were provided in haste, although they were not fully functional. However, the project directors believed that the project enjoyed a good infrastructure, '*with only a few things needing improving*' as reported in interviews. This reinforces Bateson's (1979) logical typing argument, that different levels have different understandings or give different relevancy

[31] Original:
FS: 'E deprotec?'
Educador 7: 'Na verdade ja sabia do projeto desde o inicio,(...)era pra gente já estar preparando a base (...) a gente nao tem como cobrar programação deles (...). Entao a gente devia estar criando a estrutura pra quando chegar perto deles (...) Eu já falei na reunião (...) '"vocês tão deixando tudo pro ultimo minuto"(...)'
FS:' Já conversou com ele (*Diretor do Projeto*)?'
Educador 7: '(...) já falei "cara, a gente tem que ler o projeto direitinho, pq a gente nao conseguiu entender o projeto ainda"'

to the same issues. In this case, the further a stakeholder was from the implementation cluster, the easier it was to smooth problems over:

> *FS*: 'Within DEPROTEC, is there any resource missing?'
> *Project Director 1*: 'Humanand material are OK. Structurallymaybethereisoneclassroomwe still haveto improve. A veryspecificthing(…)as soon as wefocuson it, wewill solve it (...)'[32]
>
> *(IndividualInterview, DEPROTEC, 26.07.2012)*

When talking to educators and pedagogical coordinators, who were involved with project directly, the perception was different:

> *FS*: 'And do you think there is something missing?'
>
> *Pedagogical Coordinator 1*: 'So far we are working as we can, making adjustments (...). Ten days ago we took a look and began to realize that the teacher came in the classroom and resources were not working (...) I spent time watching classes and much of the class was around such issues; projector was not connecting, the computer with bad memory, or the chairs, the room was tight (...) so, the little time we were talking about it, this insecurity hit me (...)'[33]
>
> *(IndividualInterview, DEPROTEC, 08.08.2012)*
>
> *FS*: 'Equipment now, how is it?'
>
> *Educator 4*: 'It not quite good yet, it can get better. Wi-Fi here at the complex is very precarious. (...) I think there should be a closet in the classroom to put the material away (...) these markers, there should be more (...) actually I had to buy some from my own pocket (...) it is such a difficulty, some machines don't even have the reader (CD), others fail(...)so even to get them at the CRC (course) is a bureaucracy (...) sometimes you get there "I just want to borrow it, to solve this problem at the moment, I swear that in an hour I will give it back (...)"so there are these bureaucracies(...)'[34]

[32] Original:
FS: 'Dentro do deprotec que recurso e se tá bem ou tá faltando alguma coisa.
Diretor de Projeto 1: Tanto pessoas quanto de material tranquilo. Estruturalmente talvez falta a gente arrumar uma sala ali. Uma coisa específica, assim que a gente focar a gente resolve (...)

[33] Original:
FS: E acha que ta faltando algo?
Coordenadora Pedagógica 1: Até aqui a gente foi trabalhando conforme o que deu, adequando (...). Há uns dez dias atras a gente fez uma re-olhada pra isso e comecei a perceber que o educador chegava em sala de aula e não tinha os recursos funcionando...passei assistindo as aulas e boa parte da ala era esse função, o projetor não liga, o computador tá com a memoria ruim, ou as cadeiras, a sala tá apertada...entao...a pouco tempo a gente tava conversando sobre isso, me bateu uma insegurança(...)

[34] Original:

(Individual Interview, DEPROTEC, 24.07.2012)

Most interviewees agreed that the project had a rough start, and the above account stressed the necessity of managing and accommodating project constraints through appropriate mechanisms.

The second finding concerns the different nature of the constraints observed, reinforcing the high complexity of the dynamics involved in ICT4D projects (Turpin and Alexander, 2014). These constraints came from the political, economical, technological or social realms. A main constraint found across the projects concerns the organizational structures of some of the initiatives. Many researchers agree that more institutionalized organizations are rigid, because of clearer and consolidated relationships of power and social norms across the network (Giddens, 1990; Capra, 2002; Benkler, 2006; Barabási, 2009; Centola, 2015). As such, the system's feedback cycles are not as recurrent and the system remains stable for longer periods. For instance, Metaprojeto suffered from bureaucratic processes inherited from the organizational network in which it was inserted, even though there were mechanisms to communicate stakeholder's opinions. Educators expressed their concerns, but no action was taken towards such issues at the time this research was conducted because the main decision maker was the public sector institution; educators were told that this organizational partner had the last word. However, the public sector partner would not listen directly to what educators had to say. This was an established mechanism of this initiative. The meetings that happened among Metaprojeto educators (see Figure 58 below) felt more like sessions for complaining section than an actual meeting to address and develop an action plan to solve identified constraints:

FS: De equipamento agora, como está?

Educador 4: Ainda não ta legal, pode melhorar. O wi-fi e a rede aqui do polo é muito precario. (...) (...) acho que deveria ter um armario na sala para guardar o material(...) esses pinceis atomicos, deveria ter mais. (...) inclusive alguns eu comprei do bolso (...)é uma dificuldade, as maquinas não tem até o leitor (de CD), algumas falham...entao até pegar no CRC é uma burocracia (...) ás vezes tu chegava 'eu quero só emprestado só , pra resolver o problema do momento...juro que daqui a uma hora eu te devolvo'...então tem essas burocracias (...)

A staff meeting: Sub-managers were complaining they could not do things the way it was envisioned in the beginning. More and more, the government is the client, they said. *(Project Manager 1)* said that unfortunately this is so. They should make suggestions and the 'client' will give their feedback. Then, Metaprojeto adapts to this. That's how it is now.

(*Diary Notes, Metaprojeto, 10.03.2010*)

Figure 58: Metaprojeto Staff Meeting (Photo by author, 10.03.2010)

DEPROTEC also presented a similar pattern. The financial report's methodology required by the Federal Ministry was a recurrent constraint, as it was not adapted properly to the project's reality (Unwin, 2009):

Educator 3 :'(...) the problem is the buying, it took a while to assemble the computers (...) many basic things are inflexible (...) for instance, adhesive tape, that I use everyday, I can't buy (...) because I needto close an R$5400 budget (*approx. U$1350*) (...). I need a lot of things (...) there won't be a company that will have everything I need, and I can't buy just in one place. But it has to be a one-time buy. '[35]

[35]Original:
Educador 3: '(...) o problema são as compras, demorou bastante pra montar os computadores (...) muita coisa basica que tá engessada (...) por exemplo, fita isolante que eu uso todos os dias eu nao consigo comprar (...) pq preciso fechar uma compra de R$5400 (...). Eu preciso de muitas coisas. (...) nao va i ter uma empresa que vai ter tudo isso e não consigo comprar num lugar só, tem que ser uma compra. '

(Individual Interview, DEPROTEC, 22.07.2012)

FS: 'How did the tools come?'
Assistant 1: 'Yes, we asked for three budgets, bidding (...)takes a while(...)and then it comes (...) since the beginning we are asking for these tools, but they only got here last month.'[36]

(Individual Interview, DEPROTEC, 19.07.2012)

Another type of constraint identified was of a social nature. These constraints concern relationships of power and social norms within the networks observed (see also Section 5.5 below). A series of conflicts between educators and students in DEPROTEC were reported by those with whom I spoke. Pedagogic coordination was efficient in dealing with such occurrences, as reported by both the students and educators. However, there was one person who was frequently cited as being difficult to work with by the educators. These types of conflicts were only resolved when they reached a critical point, as I observed on several occasions in the field. DEPROTEC's support to students was good, whereas to the educator it was generally not:

Educator 6: 'There is nothing being done. (...) To the students, there is a support, but when it comes to educators, I feel alone (...).'[37]

(*Individual Interview, DEPROTEC, 24.07.2012*)

Redes Livre was the case study which presented the greatest variety of constraints among all case studies. Even though project coordinators discourse was that volunteers should have autonomy towards the initiative, the combination of the lack of a broader action plan involving all stated goals, a clear leadership arrangement, human resources and infrastructure shortages were fatal to this project's lifecycle.

[36] Original:
FS: 'Como chegaram essas ferramentas?'
Assistente 1: 'Sim, a gente fez três orçamentos, licitação...demora...e depois vem (...) desde o começou a gente já esta pedindo essas ferramentas...mas só veio no mespassado.'

[37] Original:
Educador 6: Não tem nada sendo feito (...) Pros educandos, existe um apoio, mas quando chega nos educadores, eu me sinto sozinha (...). (*Entrevista Individual, DEPROTEC,24.07. 2012*)

> *Director 1*: '(…) It is a group that does not report, has no hierarchical definition. We made a workgroup that had the idea of Redes Livres and that workgroup that's there; it has two masses, the group staff and the boys. (...) We thought of putting the project mainly for the young boys to operate.'[38]
>
> (*Interview with Director 1 and Coordinator 1, Redes Livres, 5.10.2011*)

At the other end of the spectrum that institutionalized organizations are more rigid and therefore do not facilitate project processes (see above), an initiative with such a loose agreement and less clear relationships of power like Redes Livres would be expected to have more dynamic processes, more feedback cycles and therefore greater self-organization mechanisms in place, which in turn would lead to greater creativity and innovation within the systemic and network views embedded here (Bateson, 1979; Benkler, 2006; Barabási, 2009; See Chapter 2, Sub-section 2.3.3, p. 67). However, project constraints exposed extensively by project volunteers showed that a network structure that allows for communication to flow alone is not sufficient to foster collaboration, depending also on other factors needed for the project to happen. Four issues were important. First, Redes Livres did not enjoy any direct financial support. Second, volunteers lacked the necessary technical knowledge to conduct the project, with only one experienced stakeholder being fully dedicated to this project; the others worked formally in other projects of the Marist Technological Training Complex and therefore had to prioritize their tasks. Third, there was a lack of infrastructure to conduct the project, and their server did not work properly. Finally, there was social pressure on the young volunteers who were supposed to be looking for paid work instead of volunteering:

> *FS*: 'Do people express themselves regarding the project? Is the channel open?'
> *Volunteer 1*: 'I think you can see in everyone's look that (...) is OK, there is just one thing, everyone is young, everyone is unhappy because they are volunteers…everyone is at a time they should be looking for jobs (...). But for the project, everyone is happy, it is because we like it.'[39]

[38] Original:
Diretor 1:' (…) É um grupo que não reporta, não tem definição hierárquica. A gente fez um gt que teve a idéia de fazer as redes livres e esse gt que ta ali, tem duas massas, o pessoal do grupo e os meninos (…) a gente pensou em botar o projeto principalmente pra gurizada operar.'

[39] Original:
FS: 'As pessoas se expressam em relação ao projeto? O canal tá aberto?'

(*Individual Interview, Redes Livres, 29.11.2011*)

FS: 'Do you believe in the project'spotential? You are staying, aren'tyou?'
Volunteer 2: 'I will have to leave anyway. I will go live with my mom, at Vila Jardim, then it willget complicated. I need to get out and find a job. '[40]

(*Individual Interview, Redes Livres, 13.12.2011)*

The physical structure of Redes Livres was also moved to a new building when they had just started to organize the project. A few volunteers mentioned that this meant that they lost the momentum and did not re-organize in the new home, due to the poor management processes of the initiative already exposed. Figure 59 shows the volunteers visiting the new space and discussing how they would organize the new office.

Figure 59: Redes Livres volunteers and project technical consultant visiting the new space (Photo by author, 27.07.2011)

Voluntário 1: 'Acho que dá pra ver no olhar que tá todo mundo legal, só tem uma coisa, todo mundo é jovem, Todo mundo tá descontente porque é todo mundo voluntário...todo mundo tá numa epoca que tinha que estar correndo atrás de emprego (...) mas pelo projeto já tá todo mundo feliz, é por gostar.'

[40] Original:
FS: 'Tu acredita no potencial do projeto? Tu vai ficar né?'
Voluntário 2: 'De qualquer forma vou ter que sair. Vou morar com aminha mae .na vila jardim, dai fica complicado. Sair e arrumar um trampo.'

> *Volunteer 2*: '(…) at the meeting (...) I said it, that like that day that we made the workgroup separation, each one got something. There, we shared well, started working at it, than we moved to the complex (...), we did not re-organize, many people got lost, I lost myself too. I saw that I got lost, because I did not have a specific focus, every day I was a different thing, radio, server, Wikipedia, technical, everyone was doing a little bit.'[41]
>
> *(Individual Interview, Redes Livres, 13.12.2011*)

Stakeholder advocated the idea that there should be no project leader, since the intention was to become a decentralized mesh network research group. However, there were no mechanisms in place to discuss how they would conduct the project:

> *Volunteer11*: 'I think that first, everyone had to think not the same, but act together (...) because I go there, am supermotivated, and (*volunteer 7*) is not (...) then the fact that he is not motivated ends up demotivating me (...) I think we need someone more rigid to (...) "ah, this hasn't been done yet, you have to do it" (...) to stimulate deadlines (...)'[42]
>
> (*Individual Interview, Redes Livres, 02.10.2012*)
>
> *FS*: 'Do you think that it is missing (...) not a boss, but a leader(...)someone who says "let's go"?'
> *Volunteer2*: '(*Coordinator 1*) is like our boss in there. I have no complaints over him, he is awesome (...) but he could boss around, tell us what to do (...)not boss around, but say, let's go, let's go, let's go(...)'[43]
>
> (*Individual Interview, Redes Livres, 13.12.2011)*

All of the above examples from Redes Livres reinforce Centola's (2015) argument that consolidation of social norms within social networks at some level is necessary for the

[41] Original: *Voluntário 2*: '(…) Na reunião (...) eu botei isso, que nem aquele dia que a gente fez a separação, cada um ficou com uma coisa, até ali. Lá a gente dividiu bem, começou a trabalhou com aquilo, dai trocou para o Polo e foi fazendo como tava, não se re-organizou, muita gente se perdeu, eu me perdi também. Vi que me perdi, porque não tinha um foco especifico, cada dia fazia uma coisa, radio, servidor, Wikipedia, técnica, cada um faz um pouquinho.'

[42] Original: *Voluntário 11*: Acho que primeiro todo mundo tinha que pensar não igual, mas se puxar junto...pq eu vou lá, to motivado o voluntário 7 não tá, dai o fato dele não estar motivado...acaba me desmotivando...e acho que precisa de alguem mais rigido pra (...) 'ah, isso não foi feito ainda, tem que fazer'(...) estimular prazo (...)

[43] Original: *FS*: Tu acha que falta...não mandar, mas um líder, alguém que diga 'vamo lá'?
Voluntário 2: O coordenador 1 é como se fosse o nosso chefe ali. Eu não tenho reclamação dele, ele é demais (...) mas ele podia dar uma de chefe, mandar...não digo mandar, mas dizer, vamovamo, vamo...

diffusion of innovation and creativity (see also Checkland, 2000; Capra, 2002; Kapsali, 2011). It is suggested then, that a good manager, practitioner or decision-maker should be able to identify these mechanisms of rigidity and creativity and stimulate the balance among them, within the reality of each initiative. This is further explored in Chapter 6 (p. 225), when discussing how to assemble useful guidelines for effective collaborative action.

To sum up, a system is composed of multiple and intertwined relationships among its components (Capra and Luisi, 2014) and constraints might come from various parts or moments of the system's lifecycle. However, if there are mechanisms in place consciously to acknowledge perceived constraints across network clusters, this might assist better decision-making regarding necessary action to improve project processes. In fact, soft systems methodologies advocates have extensively reinforced the relevancy of identifying messy problems through multiple perspectives, especially in ICT4D initiatives (Checkland, 2000; see also Jackson, 2003; Andrew and Petkov, 2003; Gunawardena and Brown, 2007; Petkov *et al*., 2007; Kapsali, 2011; Turpin, 2012).

Moreover, constraints derived from organizational networks might be more difficult to overcome due to their more rigid configuration and consolidated social norms (Giddens, 1990; Barabási, 2009; Centola, 2015). In the case studies above, stakeholders were unable to act on such constraints due to the organizational structures they were inserted in, even when there was awareness about the constraints. Ineffective cluster to cluster communication is the main reason attributed here to this issue (see Metaprojeto and DEPROTEC). This was also true for case studies with different project agreements and types of partners (see DEPROTEC and Redes Livres). As a result, decision-makers did not have a clear view of the constraints as perceived by the implementation clusters.

5.2.3 Unintended outcomes

This section explores the unintended outcomes of the initiatives, which were not agreed upon at the start of the projects (Figueroa *et al*., 2002) and how these were managed by different network dynamics observed. Redes Livres was the only project that presented significant changes by the end of my research. Nevertheless, the observation of this proxy for even this one project provided relevant insights. After a year and a half of

observing Redes Livres, the project goals had changed considerably, due to a combination of mainly three factors: first, the under-achievement of milestones at the end of the first year; second, most of the volunteers decided to leave the project by January 2012 to join the army or to look for paid work; and third, the CESMAR Director had been replaced and the new director was conducting a series of organizational changes to even out the processes of the Social Centre with that of the Technological Training Complex. With no technical workgroup at hand to configure and install the antennas, the focus of Redes Livres shifted to a community radio project called *Conexão Radio Livre* (Free Radio Connection, http://www.radioconexaolivre.org/ accessed February 9th, 2016, in Portuguese). Figure 60 shows the initial moment of the community radio.

Figure 60: Building of the Community Radio Conexão Livre (Photo by author, 30.08.2012)

By the time my field research ceased in December 2012, the focus was purely on the community radio and DEPROTEC students who were focused on the communication module merged with the Redes Livres workgroup (see Figure 61). At that stage, the community radio objective was more achievable from a technological point of view and it provided greater interaction with the local community, which was one of the main

aims of the project. Although older project stakeholders insisted that they would not let the initial objective to build a mesh network die, this shift ended up being positive for stakeholders' motivation as they could finally see actual outcomes of their work.

Figure 61: DEPROTEC and Redes Livres together at the Conexão Livre Radio booth during the International Free Software Forum (http://softwarelivre.org/fisl16, accessed February, 9th 2016, in Portuguese) (Photo by author, 26.07.2012)

By December 2015, Conexão Radio Livre had come a long way. One of the outcomes was a partnership with a NGO called THEMIS, which focuses on justice and gender issues (http://themis.org.br/ accessed February9th 2016, in Portuguese). This partnership extended the benefits of web radio from beyond the Social Marist Centre. *Volunteer 6*, along with other Technological Training Complex stakeholders, built a web radio suitcase which was donated to one of the NGO's projects, *Promotoras Públicas Legais* (*Legal Popular Public Defenders*).These are women in situations of vulnerability who are now able to spread the word around issues of gender and injustice through the project *Vozes em Ação* (Voices in action, http://plpsradioweb.blogspot.com.br/accessed February 9th 2016, in Portuguese).

Figure 62: A Legal Popular Public Defender with the web radio suitcase (Picture by *Volunteer 6*, 18.09.2015)

The process of change in goals of Redes Livres reinforced the relevancy of setting short-timed milestones within the greater and overall goals of the project as well as the collective capacity of adaptation. This provided relevant insights useful guidelines that foster motivation and collaboration (Chapter 6, Section 6.4, p. 244).

5.3 Collective self-awareness

The above sections have analysed the case studies in the light of the content of the projects. This section focuses instead on expressions of shared understanding around network dynamics. The objective is to analyse how critical are stakeholder's views of communication processes and acknowledge their understanding of each other's role. This is still the realm of context building (Bateson, 1979; Checkland, 2000; Capra, 2002; Figueroa *et al.,* 2002; Keiding, 2011), but now concerns issues of self-reflection and social relationships through proxys that assisted in validating the understanding of each other's role in the project and perceived shared benefits and risks by all stakeholders.

5.3.1 View of one's responsibilities

This proxy analyses stakeholder understanding of each other's roles. The correct assessment of stakeholder's roles and strengths is one of the main reasons for using mapping techniques as qualitative participatory tools in project implementation phases, with the purpose to improve team performance (Jackson, 2003). Participants were asked if they knew who was responsible for each activity, how responsibilities were assigned and who was responsible for the monitoring and evaluation of the projects (see Appendix II, p. 296).

There were three main findings concerning this proxy. First, none of the initiatives observed invested officially in mechanisms for the clarification of both organizational and individual stakeholder roles in the networks, which reinforces a common trait of ICT4D partnerships (Tennyson, 2003; Unwin *et al.*, 2011). After my interventions with the focus groups, stakeholders agreed that such knowledge is crucial for more effective collaboration, as they saw opportunities for improvement in their on-going communication. Second, it is useful to iterate from time to time (Larsson *et al.*, 1998; Hardy *et al.*, 2005; Southern, 2015), as emphasized by the lack of clarity regarding stakeholder's roles or position in the network in the in-depth case studies, compared with the clarity in the short-term projects. Third, it was easier to identify organizational and individual roles in the initiatives with more formal agreements and more rigid organizational structures composing the partnerships during the interventions. This is a pattern to be expected as relationships of power and social norms are better consolidated in such network structures (Giddens, 1990; Capra, 2002; Centola, 2015; see Chapter 2, Section 2.3.2, p. 64).

In Metaprojeto, most individuals were clear about each other's roles, not because of any specific mechanism in place to clarify these, but because the project had already been active for two years at the time research was conducted and stakeholders already knew each other. However, perceptions of network structure both at an organizational and individual level were diverse in the focus group discussion. It was an energy-consuming task to define the proximity of stakeholders in the network, as participants kept re-arranging the network, as illustrated by Figure 63 below.

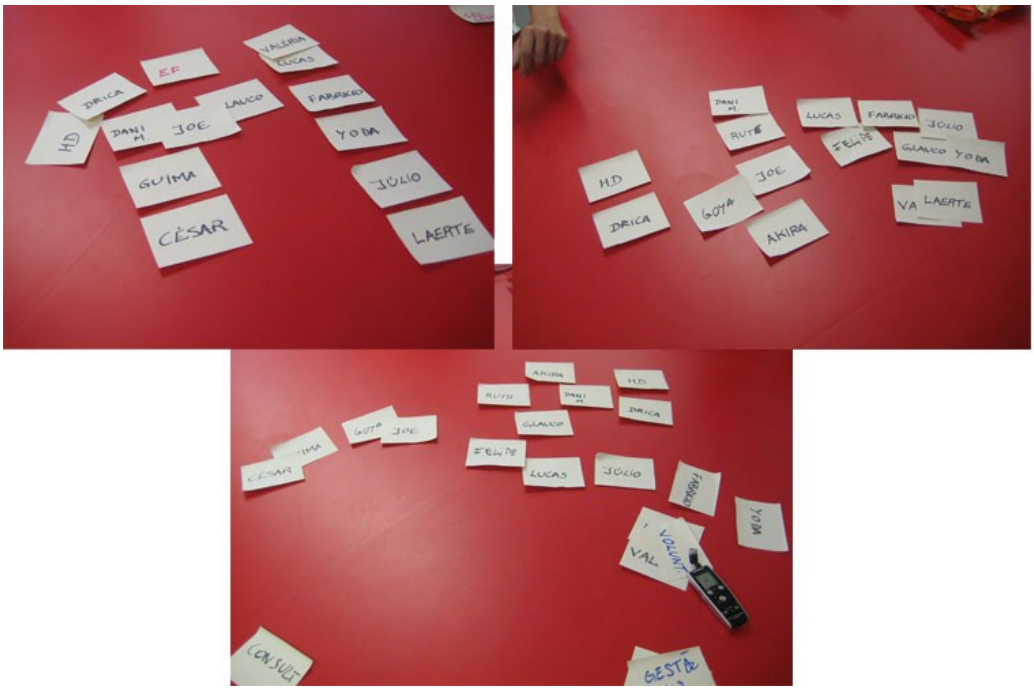

Figure 63: Different arrangements of Metaprojeto's network (for illustrative purposes, photo by author, 15.04.2010).

At DEPROTEC, stakeholders' roles were in general clear and it was easier to achieve a consensus on the network configuration, since the project was at an early stage and the network was starting to be arranged. It was easy to see the relationships. In the short term case studies, stakeholders engaged actively in the early stage of the projects in identifying key stakeholders and decision-makers and their respective roles. These experienced individuals had a good overview of the network dynamics as they acknowledge the relevancy in having roles identified at earlier stages of a project (Checkland, 2000; Jackson, 2003; McManus and Tennyson, 2008; Barabási, 2009).

In contrast to the cases above, Redes Livres stakeholder's roles were not so clear at the early stage of the project. Volunteers could choose what they would like to do as there was no defined action plan and there was no general concern in structuring roles or assigning responsibilities.

> *Director 1*: '(…) It is a group that does not report, has no hierarchical definition.'[44]
>
> (*Focus Group Discussion, Redes Livres, 5.10.2011*)

[44] Original: *Diretor 1:*'(…)É um grupo que nao reporta,nao tem definicaohierarquica.'

> *Technical Coordinator*: 'It was very informal from the beginning, (...) let's go and do it. There wasn't this concern either of documenting or the delegating.'[45]
>
> (*Individual Interview, Redes Livres, 06.12. 2011*)

The above has shown that initiatives with formal agreements showed clearer views of each other's roles (see Metaprojeto and DEPROTEC). However, network configuration was not as clear for Metaprojeto stakeholders, hinting that time plays a role in fusing the configuration of the network if no recurrent clarification mechanisms are in place (Hardy *et al.*, 2005; Southern, 2015).

However, it is not enough to be clear about stakeholder's roles. It is also important to visualize the *Network Structure*, in other words, to identify who is closer to whom. During the focus group discussions it was noted that mechanisms to clarify such views make a difference. Possibilities for interaction open up when a stakeholder truly acknowledges another's position and connections. Project network structures are not absolute over time; they continuously change, and to keep such clarity it is necessary to keep the exchange of quality information. If network individuals are constantly aware of network configuration, this makes the dynamics of the network more organic and efficient (Capra, 2002) since one knows who to address in the case of specific constraints or ideas (Barabási, 2009). Data also revealed that stakeholders usually have a good knowledge of individuals' roles whereas this was not true concerning the roles of the wider organizations involved. Thus, clarifying organizational partners and their roles might benefit individuals as they feel empowered to understand the institutional relationships into which they are inserted.

5.3.2 Shared risks and benefits

Shared risks and benefits compose the group of proxys regarding the shared context of stakeholders. Participants were asked if all stakeholders agreed on the assignment of responsibilities, if leaders were also sharing responsibilities, and what resources were needed to implement their project (see Appendix II, p. 296). There was one main finding concerning this proxy, and this is that there is a high feeling of disconnection to the

[45] Original:
Coordenador Técnico: 'Bah, foi muito informal desde o inicio, (...) vamos lá e vamos fazer. Nao teve muita essa preocupação nem do documentar nem do delegar.'

initiative when stakeholders belonging to the network cluster that implements the project are not part of the planning process of the initiative. This reinforces Checkland's (2000) concern in assuring that people's sense of purpose is addressed through systemic methodologies that embed purposeful activities. This relates to the idea that if something has meaning to me, the probability that I will act is greater (see also Capra, 2002). A second finding is that *shared risks and benefits* were perceived within each cluster and not across clusters, following the same pattern found with *perceived constraints* (see Sub-section 5.2.2 above).

DEPROTEC educators expressed two main shared risks. First, the different modules did not interact with each other. Their perception was that if there was such interaction, this could improve project dynamics for the students. Second, there was a lack of planning regarding the project as a whole. This cluster was not involved in general project planning; they became involved only after the bid with the Federal Ministry was successful:

> *Pedagogical Coordinator 1*: '(...) it is not really clear to me this thing about rethinking the project (...) Maybe they're calm, but I am concerned about this continuity. Who's taking care of it? Who is going to renegotiate the project and when (...) to them, everything must be all right, they must be thinking (*about it*). It gives me that feeling of 'my god, how it will it be' [46]
>
> (*Individual Interview, DEPROTEC, 26.06.2012*

> *Educator 4*: '(...) when the project proposal came, I freaked out. It was a lot. No paid schools or expensive courses had such curriculum.' [47]
>
> (*Individual Interview, DEPROTEC, 24.07.2012)*

[46] Original:
Coordenadora Pedagógica 1: '(...) não tenho bem claro pra mim essa coisa de repensar o projeto, (...). Talvez eles estejam trnaquilos, mas eu fico preocupada com essa continuidade. Quem é que tá cuidando isso. Quem é que vai renegociar o projeto e quando...acho que pra eles deve estar tudo certo, devem estar pensando (nisso). Me da aquela sensação de agora, meu deus, como vai ser. '

[47] Original:
Educador 4: '(...) quando veio a proposta toda do projeto, eu me apavorei. Era muita coisa. Nem escolas pagas, cursos de valores exorbitantes nao tinha esse grade curricular. '

> Educator 7: '(…) we will develop software, but it was not established which language (...) there was no planning, there are very good ideas, but to develop something of quality and fast, we need to have a structure.'[48]
>
> (*Individual Interview, DEPROTEC, 26.06.2012*)

At Redes Livres, the informal project processes were perceived as being a shared benefit by all stakeholders sat the beginning because of the freedom it entailed. However, it became increasingly views as a shared risk as time went by, especially among volunteers. Project Coordinators were resistant to play the role of leaders both because they were already engaged formally on other activities and also because they wanted the volunteers to act autonomously.

> *FS*: 'Is there a plan of action for the project? How is it being implemented?'
>
> *Volunteer 1*: 'Write on the board and when you do it, scratch it off (...) (*Technical Coordinator 1)* and (*Project Coordinator 1)* often say we are like Google (...) we have free time, we can do when we want, as long as we want it(...) this is the problem, no one is doing it (...)'[49]
>
> (*Individual Interview, Redes Livres, 29.11.2011*)
>
> *Volunteer 2*: '(...) I spoke up and they don't want to have a group to boss around. But hey, if free like this we do not get things done. Let's do this, each one has a goal and do it (...) people want to do it all loose, but it's not working (…)'[50]
>
> (*Individual Interview, Redes Livres, 13.12.2011*)

As an initiative with no financial resources, there were no real hard deadlines; if they were not met, nothing was going to happen. The group shared the vision that this was

[48]Original :
Educador 7:' (..) a gente vai definir um software, mas nao foi definido que linguagem, (..) nao teve planejamento, tem ideias muito boas, mas pra desenvolver algo de qualidade e rapido, precisa ter uma estrutura.'

[49]Original:
FS: Existe um plano de ação para o projeto? Como ele esta sendo implementado? Existe um plano?

Voluntário 1: Escreve no quadro e quando tu fizer risca. (…) O *coordenador técnico 1* e o *coordenador de projeto 1* costumam dizer que somos que nem a Google...temos tempo livre, podemos fazer quando a gente quiser, contanto que tu faça..Esse é o problema, ninguemta fazendo(…).(*Entrevista Individual, 29.11. 2011*)

[50]Original:
Voluntário 2: (...) eu falei e eles nao querem fazer grupo para mandar fazer alguma coisa. Mas poxa, se livre assim a gente naota conseguindo fazer alguma coisa. Vamos fazer isso,cada um ter uma meta e tocar. Ó, esse grupo tem que fazer isso, essa é a meta de voces. Vamos fazer. Só que o pessoal quer fazer bem solto, mas não tá dando. (…) (Entrevista Individual,Redes Livres, 13.12.2011)

an important project for the community and being a volunteer was a good thing. However, the lack of financial income was also understood as being a shared risk among all of the volunteers. Moreover, the dynamics of the group were those of avoiding conflict; everyone knew what was happening but no one took action. The discourse was 'each one knows what one does'. This sort of autonomy was stronger than talking and acting about what is happening with the project (Figueroa *et al.,* 2002).

In the short term case studies, a shared benefit often mentioned was that the projects entailed a *win-win-win situation*. The corporations gain employees who are better fit to work in multicultural environments; employees earn life experience and resilience; and clients obtain high level consultancy which otherwise they would not be able to have access to.

Focus Group Discussions reinforced Figueroa *et al*.'s (2002) argument that collaborative action can be enhanced by having mechanisms in place to improve collective self-awareness (see also Checkland, 2000; Keiding, 2011; Southern, 2015). However, it is not enough simply to discuss and acknowledge each other's relationships and roles. In the cases where such issues were discussed, they remained in the realm of discussion rather than action. It is suggested that to go along with such knowledge, project leaders need to provide clear steps for action (Germani, 2011; Capra and Luisi, 2014; see Chapter 6, Section 6.4, p. 244).

5.4 Behavioural patterns

This section concerns the mental models that are present, created or brought upon by stakeholders and translated into behavioural patterns during the process of context building of the initiatives (Bateson, 1979; Capra, 2002; Barabási, 2011; Centola, 2015; see also Chapter 2, Section 2.3, p. 59).The sub-sections analyse respectively the three proxys *relationships of power, identification of social norms* and *collective capacity.*

5.4.1 Relationships of power

The proxy *Relationships of power* (Chambers, 1997; Figueroa *et al.*, 2002) concerns issues of hierarchy, roles, trust and self-awareness. Participants were asked, for instance, if they thought the social network of their project was more hierarchical or flat, and why they thought it was that way. There are two main findings relevant to this research's objectives. First, networks in which the relationships of power are more hierarchical were seen to be more controlling of communication processes, imposing respective rules over the entire network and in most cases, hindering the diffusion of innovation across the networks (Capra, 2002; Scur, 2005; Barabási, 2009; Kapsali, 2011; Centola, 2015). Second, the presence of a discourse of creativity, autonomy and innovation was usually not in accordance with reality, causing issues of trust among stakeholders (Bateson, 1979).

Excessive bureaucratic processes might hinder productivity (Teofilovic, 2002) and the organizational networks of Metaprojeto and DEPROTEC confirmed this pattern. The influence of the public sector brought both stability and control to these initiatives. However, implementation stakeholders faced difficulties to innovate, to create new forms of action and to bring new information into these networks. This was partly due to the fact that these initiatives had to follow strict rules within their contexts. For instance, Metaprojeto educators' ideas were not taken into consideration and DEPROTEC educators had difficulties in buying specific material, as illustrated in the sub-section on *perceived constraints* above (p.189).

Furthermore, communication processes were also influenced by organizational hierarchy and hierarchical roles, especially in older and more established organizations. For instance, the Marist Brothers organization is an old religious and very well established institution. The Technological Training Complex, inserted in this scenario, aimed for creative and innovative ways of managing stakeholders, but the change in management at CESMAR imposed new rules to the Marist Technological Training Complex as a whole. As an example, the working hour's registration process was an issue recurrently discussed among stakeholders during informal conversations. CESMAR used punched cards for clocking on and the Complex did not have any registration method. The new CESMAR director requested this to be changed in order to unify

processes. Many stakeholders from the Technological Complex were not happy about such changes, especially because it was imposed on them without discussion. At the IBM Smarter Cities Challenge case study, higher hierarchical roles influenced communication processes. It took the high executives one week and a half to accommodate their own roles and define an action plan because everyone was used to act as the leader and wanted to be at a senior controlling level in the processes, but this program required them to work in teams. In short, more established institutions and individuals either from the private, public or civil sectors tend to impose control through hierarchical structures. As such, the dialectic between *network structure* and *communication processes* of these more rigid structures seems to evolve towards stability; the more these stochastic processes lead to clearer relationships of power and rules, the more the diffusion of innovation among network clusters is hindered (Bateson, 1979; Centola, 2015).

The second finding concerns issues of discourse. The most relevant example is from Redes Livres. Volunteers were still being treated as students, even though the discourse of managers and coordinators embraced them as independent and autonomous researchers. This naturally led to behavioural conflicts, but also conflicts in my relation with the director, as I felt compelled to intervene in the process:

> '*Director 1* gave a whole speech to volunteers as how they had the status of educators now (...) I got confused; first, they were treated as students (*or independent researchers*) the entire time (*in a year of project*); they have never been communicated to as educators! Then *Director 1* demands they act as educators, at the same time they are facing a serious motivation problem and lack of leadership. *Director 1* does not know what they are going through and speaks like that! I get so mad, I tried to get the focus out of this speech, told them that this is part of the system and they have to look at the whole picture. They calmed down. What if there was no one to tell them that? Wouldn't this occurrence generate an even greater lack of motivation?'
>
> *(Diary notes, Redes Livres, 27.09.2012)*

Many informal conversations with project managers and pedagogical coordinators while in the field brought to surface the difficulties of dealing with young people in situations of vulnerability. Some educators had the tendency to be tough as a way of making the students realize they should value what is being given and that they have to struggle to be valued as well. I understand the approach of not making things easy so students

value them, but I have also felt a lack of sensitivity on the part of some of the educators and managers. Perhaps it was because they were inserted in this scenario too long and this was preventing them from seeing alternative, more loving and empathetic ways of acting. Redes Livres volunteers were already chosen because they stood out in previous programs. Maybe they needed a change of behaviour from coordinators towards them. They were constantly assessing they own behaviour and aware that they needed to do better, but they did not know how to change that, let alone act as educators.

> *FS:* '(...) do you think they don't value (you)?'
>
> *Volunteer 11:* 'I feel bad sometimes when they speak about us, it sounds like we are kids, "ah, they are coffee-with-milk" (*imature*).'
>
> *FS:* '(...) and what do you think (...) of what (*Director 1*) told you, that you are educators, not students (...) what did you think about that? It was a speech to motivate you (...) and with that some responsibilities came along (...)'
>
> *Volunteer 11:* 'I think that was (...) a slap in the face that we needed (...) everyone deserves to be valued, to be treated differently, but we don't act so to deserve it'[51]
>
> *(Individual Interview, Redes Livres, 02.10.2012)*

Bateson (1979) argued changes occur much faster at an individual level than at a collective level. Also, a rigid system influences the creative nature of individuals involved in the initiative; bureaucracy can have dehumanizing and disheartening effects at times (Teofilovic, 2002). In other words, what seems logical to the wider and more established system can lose its meaning at the individual level (Chapter 2, Sub-section 2.3.1, p.60). These are processes that configure living experiences and leave a trace in the project's path evolution. It is difficult to work on the rigidity and flexibility of these systems; perhaps the challenge lies in focusing at the individual and more emergent level (Bateson, 1979; Checkland, 2000; Capra, 2002).

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[51] *FS:* '(...) tu acha que nao valorizam (vocês)?'

Volunteer 4: 'Eu me sinto mal às vezes quando falam da gente, parece que a gente é criança, ah, eles são café com leite (*imaturos*)'

FS: ' (...) que tu achou (...) daquilo que o (*Diretor 1*) foi falar pra vocês (vcs são educadores não educandos (...) o que tu pensou daqui-lo ali? Foi um discurso pra motiva-los (...) com isso vieram algumas responsabilidades (...)'

Volunteer 4: 'Acho que foi (...) um tapa na cara que a gente tava precisando (...) todo mundo aqui quer ser valorizado, ser tratado diferente, so que a gente também não faz por merecer'

5.4.2 Identification of social norms

The *Identification of social norms* proxy (Figueroa et al., 2002; Centola, 2015) concerns rules and behaviours accepted in the context of the emergent networks of the projects. Participants were asked, for instance, if leaders were more like bosses, or collaborators, how good and how accessible they thought their managers were (if the case), and if there were mechanisms encouraging participation. The analysis of this proxy reinforced the findings of the *relationships of power* proxy above, but also brought to surface one specific relevant finding for this research. This was that the non-disclosure of expected behaviour by organizations and institutions hinders project dynamics. The previous section reinforced the view that designed networks are more controlling of communication processes, usually imposing their rules of behaviour (Checkland, 2000; Capra, 2002; Jackson, 2003; Scur, 2005; Barabási, 2009; Kapsali, 2011; Centola, 2015).It was found that if these mechanisms are not clearly exposed to all stakeholders, this can lead to conflict among the perceptions of the diverse network clusters (Bateson, 1979).

This was particularly worse in projects with looser agreements, such as in Redes Livres. Volunteers were still confused regarding their tasks and roles four months after the project had begun. This confusion seemed to be brought about by the lack of agreed social norms between all stakeholders involved:

> *FS: 'Are* most individuals willing to do what was delegated?'
>
> *Technical Project Coordinator:'* I think it's unbalanced. We are trying to make the workgroups, each volunteer joined one, but it was kind of like (...) we lack clarity that research would be good for them to do and I think also we lack a little power will (...) that's why I think someone with more leadership, demanding activities to be done, perhaps in a workshop format (...) sometimes it seems that individualities are highlighted, like *Volunteer 1*is running the web business. The idea of the project is very cool (...) what is missing is perhaps some cohesion (...)[52]
>
> (*Individual Interview, Redes Livres, 06.12.2011*)

[52] Original:
FS: 'E a parte deles. A maioria ali tá dispostas a fazer o que lhe foi delegado?'

Coordenador Técnico: 'Acho que tá mais desequilibrado. Tentamos fazer os GTs, cada um entrou num, mas ficou meio assim...falta clareza que a pesquisa seriam bom que eles fizessem e acho que falta tb um pouco de vontade..por isso que acho que alguem com mais liderança, que cobre mais atividades, talvez em formato de oficina(...) as vezes parece que sobressai individualidades, tipo o gui tocou o negocio da web. A ideia do projeto é muito massa (...) O que falta é talvez alguma coesão (...) '

Social norms and behaviours were shared within, but not between, clusters. This reinforces Centola's (2015) argument that the consolidation of social norms plays a central role in determining the collective properties of emergent social networks. The more consolidated a cluster was regarding its mental models and perceptions, the less integrated and the more segregated the whole network was. For instance, volunteers would talk among themselves regarding project frustrations, but not raise these issues with project key decision-makers:

> *Volunteer 12:* (*talking about volunteer1*): 'He's already kind of pissed, he made the website (...) he handed the thing in two days, he looked everything up(…) and they came and said "well you did no more than what you had to do" (...)so he prefers to do things in silence (...)'[53]
>
> *(Individual Interview, Redes Livres, 25.09.2012)*

On the other hand, key decision-makers did not check project status frequently enough because Redes Livres was an informal initiative and there were no deadlines or strict action plans to be followed. As a consequence, there was a lack of support from this cluster:

> *FS*: '(...) what discourages you?'
>
> *Volunteer 11*: 'What discourages me is the fact that we are not valued, not because we do not receive money, when I signed, I committed myself, I knew it was volunteer work (...) but they could treat us better, value our work (...) I do not blame the brother (..) he invests money in what he sees, Redes Livres is not out and about, but he could come here, see what is happening, as Brother John used to (...)'[54]
>
> (*Individual Interview*, *Redes Livres*, *02.10.2012*)

[53] Original:
Volunteer 12: 'Ele já tá meio mordido, foi la fez o site do fisl online historia mais antiga, uma vez no churras do marcus ele falou(...) ele tá meio mordido com os caras, ele entregou o negocio em dois dias, procurou tudo, pesquisou tudo e o pessoal chegou e disse assim tu nao fez nada mais do que tu tinha que fazer(...) dai ele ficou tao mordido(...) dai ele prefere fazer no silencio(...) '

[54] Original:
FS: '(...) o que te desanima?'

Volunteer 11: 'O que me desanima é o fato de a gente não é valorizado, não porque a gente não recebe, quando eu assinei, assumi o compromisso, eu sabia que era voluntpario(...) mas eles podiam tratar a gente melhor, valorizar o nosso trabalho (...) nao culpo o irmão (..) ele investe dinheiro no que ele ve, redel livre nao tá bombando, mas ele podia vir aqui, saber o que esta acontecendo, como o joão fazia (...) '

> *Project Coordinator 1*:' Yeah, there is more an evaluation of "let's sit down..." (...) it is this record, this documentation (...) how many times I've seen things being repeated because they are not anywhere, things, words (...) and I'm talking about the big projects, I don't even mention the small ones (...)[55]
>
> (*Individual Interview, Redes Livres, 26.06. 2012*)

Processes embedded in the Social Marist Centre such as the one described above by Project Coordinator 1, affected Redes Livres' emergent character. The 'freedom' they supposedly enjoyed was leading to a lack of focus and motivation instead of promoting collaboration and creativity. Evidence from DEPROTEC confirmed this view: because the general action plan was not shared with educators, the behavioural culture was reactive instead of proactive:

> *FS*: 'And if you wanted to say something (...) for example, you told me your doubts regarding your tasks (...) why don't you speak up?'
>
> *Educator 6*: 'Because (...) no one knows what will happen (...) for instance(...)*Director 2* does not know, maybe there will be other partners coming, so he cannot measure what our tasks will be. We know that we will be the software factory developers, but we do not know our role, whether we teach, or not, nobody knows.'[56]
>
> (*Individual Interview, DEPROTEC*, *24.07.2012*)

More than once I witnessed big announcements from key decision-makers and the remaining stakeholders then had to accommodate rapidly to new processes without knowing why, as with the punched card system mentioned in the previous section. The dominant behaviour was of not sharing or asking for information. Decision-making was generally top down due to the emergent character of the Technological Marist Complex as a whole, in consonance with usual Brazilian management processes (see Chapter 1, Section 1.3.2, p. 28). Changes happened at such a fast pace, that there was no time for

[55]Original:
Project Coordinator1:' É, tem mais é uma avaliação de vamo sentar(...) o que não tem é esse registro, essa documentação(...) quantas vezes eu vi as cosias serem repetidas porque nao tem em nenum lugar as coisas, as palavras (...) vi varias vezes as coisas serem repetidas, pqnao tem nada registrado, isso que eu to falando dos projetos grandes, os menores nem se fala (...)'

[56]Original:
FS: 'E se tu quisesse falar alguma coisa (...) por exemplo, tu me falou dessas tuas duvidas quanto às tuas tarefas (...)porque tu naofala?'

Educator 2: 'Porque(...)ninguem sabe ainda o que vai acontecer(...)por exemplo(...) *diretor 2* nao sabe, ate porque ta por vir parceiros, entao ele nao tem como dimensionar como vai ser nossa tarefa. a gente sabe que vai ser programadores da fabrica, mas nao sabe o nosso papel, se vai dar aula, nao, ninguem sabe'

discussion with every stakeholder and as a result, management processes were led by centralized and controlled communication process even though the discourse was the opposite. However, this led to mixed messages, as also previously found (see Sub-section 5.4.1, p. 208); there was a discourse of collaborative action conflicting with a discourse of not invading each other's network cluster:

> *FS*: 'What will be your role?'
>
> *Educator 2*: 'Software Factory Developer, me and (*Educator 7)*.'
>
> FS: 'Not an educator?'
>
> *Educator 2*: 'We still don't know how this will go down, but this is an indefinition that we don't know, so we are also anxious. It was only agreed with us that we do not get involved with DEPROTEC right now this first 6 months, to keep our focus on PRISMA (*another project*) (...) It is difficult to tell you, because I know I will be a developer, but I dont know how far I will go, if I will teach, you know? I don't know, so in this sense we are kind of lost.(...)' [57]
>
> (*Individual Interview, DEPROTEC*, *26.06.2012*)

And:

> *FS*: 'Do you see the structure as more vertical or horizontal?'
>
> *Pedagogical Coordinator 1*: 'Horizontal (...) I also think it is not very clear (...) maybe if it was (*clearly stated*), "it is vertical, it is horizontal(...) it varies sometimes, this thing comes "no, I am the one who decides', but wait, this guy is messing with this thing (...) so in this sense, sometimes we have to realize that there is a hierarchy (...) this happens and it makes things difficult (...) if it was clear, there would be no problem in being vertical or horizontal.' [58]
>
> (*Individual Interview, DEPROTEC, 26.06.2012*)

---

[57] Original:
FS:' Qual vai ser o teu papel?'
Educator 2: 'Programador da fabrica de software, eu e o educador 7.'
FS: 'Não educador?'
Educator 2: 'É que a gente ainda não sabe como é que vai ficar mas isso é uma indefinição que tá que a gente não sabe, entao a gente tb tá ansioso. So foi combinado que a gente não se envolvesse em nada do deprotec agora desses 6 meses, pra focar no prisma, pra não dar atraso (...) É dificil te falar , porque eu sei que vou ser programador, mas não sei ate que ponto eu vou ir, se vou chegar a dar aula, entendeu? Eu nao sei, entao nesse sentindo a gente ta meio perdido ainda. (...)'

[58] *FS*: Você enxerga aestrutura mais hierarquica, horizontal?

Pedagogical Coordinator 1: 'Mais horizontal (...) acho que tb não tá bem claro...talvez se fosse uma coisa bem definidia, ela é vertical, é horizontal...de vez em quando ela varia, vem uma coisa 'nao mas quem decide sou eu', mas mas perai, fulano ta se metendo numa coisa...entao nesse sentido...dai as vezes a gente tem que se dar conta que tem uma hierarquia (...)isso acontece e dificulta nesse sentido...se fosse claro, nao teria problema ser vertical ou horizontal.'

As Capra (2002) argues, one of the greatest organizational challenges of our time is to balance both stable and emergent aspects of such systems (see Chapter 2, Section 2.4, p. 70). To disclose clear and transparent rules on such social norms could be considered as good practice to achieve effective collaborative action (Figueroa *et al., 2002*; Capra, 2002). Moreover, it is not sufficient to disclose unidirectional information if the objective is to foster collaboration (Vaccaro and Madsen, 2009; Southern, 2015). The challenge is to share, rather than purely disclose information. Such an approach requires stakeholders to be active participants and it therefore demands time and energy from all sides (Mitchell, 1998). This is one of the greatest challenges of effective collaborative action.

5.4.3 Collective capacity

Collective capacity concerns the sense of trust among stakeholders in the capacity of the group to act together to solve problems. The network is considered more resilient when projects constraints arise if such sense of collective trust is high (Figueroa *et al*., 2002).Participants were asked, for instance, how they perceived the group's efficacy to take action, how they perceived their peers' capabilities, and the group's capacity to solve problems. The main finding was that, in most cases, the sense of collective capacity was high. However, there was little action taking place concerning perceived constraints (see Sub-Section 5.2.2). This also reinforced a discrepancy between discourse and reality found in previous proxys.

For instance, Metaprojeto advocated the forwarding of appropriation, and remixing of ideas as main goals. As such, innovation was recurrent because it was the core of the project, despite the frustration of the implementation cluster regarding their inability to act autonomously (see Sub-section 5.2.2). DEPROTEC's stakeholders also agreed that the group's collective capacity was high, but individual interviews showed that there were some issues that were not being openly talked about across network clusters. Redes Livres also followed that pattern, as was mentioned above (see Sub-section 5.4.1). The reasons for this might lie in the combination of the findings of all proxys together, and the next section therefore synthesizes all the findings in the light of this research's first main research question.

5.5 Final observations

This chapter has analysed the research proxys at the systemic *communication level* dimension which concerns the communication feedback cycles leading to the system's recurrent self-organization mechanisms (Von Bertalannfy, 1977; Bateson, 1979; Maturana and Varela, 1992; Luhmann, 1995; Capra, 2002; Meadow et al., 2004). This section leans to the findings so far to address my first main research question:

> *What are the relationships between network topologies and communication processes within Brazilian multi-stakeholder ICT4D initiatives, and why do they function as they do?*

This chapter has shed light on the communication patterns of the diverse scenarios reflected in the case studies (Bateson, 1979; Barabási, 2009; Capra and Luisi, 2014; see Chapter 2, Section 2.4, p. 70). Each case study comprised a different set of factors both at the organizational and individual levels, which led them through their specific paths. It is very difficult to generalize constraints across case studies, as they were context-specific (Bateson, 1979; see Sub-section 5.2.2, p. 189). It is also not possible to pinpoint specific sources of the problems just by looking at each proxy separately. These proxys need to be looked at simultaneously, so as to grasp what is happening at the whole. The systemic perspective enabled a dialectical view of the form and processes of the case studies, assisting in a greater understanding of relationships among these proxys (Bateson, 1979; Checkland, 2000; Capra and Luisi, 2014). Tables Table 35, Table 36,Table 37, Table 38, Table 39, Table 40, Table 41 and Table 42 below summarize the main findings of the sections of this chapter, along with a cross case comparison showing the nature of these findings.

View of project goals (p.182)		
Main Findings	**Case Study Specific Data**	
The relevancy of being aware of each other's views	Pilot Metaprojeto	All initiatives presented a pattern of keeping interests inside particular clusters of the networks.
	In-Depth Redes Livres	
	In-Depth DEPROTEC	
	Short Term initiatives	
The importance of establishing mechanisms at early stages of the project to achieve the former	Pilot Metaprojeto	No mechanism present
	In-Depth Redes Livres	No mechanism present
	In-Depth DEPROTEC	Effectiveness of the focus group discussion with all student batches at the beginning.
	Short Term initiatives	Weekly checkpoints proved to be effective.
The importance of setting tangible goals to affect individual's motivation	Pilot Metaprojeto	No mechanism present
	In-Depth Redes Livres	No mechanism present
	In-Depth DEPROTEC	No mechanism present
	Short Term initiatives	Shorter project deadlines for short term case studies affected individuals focus and pro-activity regardless of organizational context.

Table 35: Main findings for View of Project Goals

Perceived Constraints (p.189)			
Main Findings	**Case Study Specific Data**		**General Issues**
The position of the individual (central, peripheral) in the network affects his/her perception of which constraints are relevant and the initial assumption that action could be taken could not be confirmed	Pilot Metaprojeto		All initiatives presented this pattern in greater or lesser level. The further a stakeholder was from the implementation cluster, the easier it was to smooth problems over (see p.189). This reinforces Bateson's (1979) logical typing argument, that different levels have different understandings or give different relevancy to the same issues.
	In-Depth Redes Livres	This pattern was more clearly observed in this initiative, as I was there for a longer period.	
	In-Depth DEPROTEC		
	Short Term initiatives		
Types of constraints are of different nature, caused by unpredictable processes due to the diversity of mechanisms embedded in the different initiatives observed (Capra and Luisi, 2014).	Pilot Metaprojeto	Stakeholders were unable to act on constraints due to the organizational structures and decision-makers did not have a clear view of the constraints as perceived by the implementation clusters.	All initiatives presented constraints of different natures.
	In-Depth Redes Livres	The diverse setting of constraints found in Redes Livres, also reinforced reinforce Centola's (2015) argument that consolidation of social norms within social networks at some level is necessary for the diffusion of innovation and creativity (see also Checkland, 2000; Capra, 2002; Kapsali, 2011).	
	In-Depth DEPROTEC	Stakeholders were unable to act on such constraints due to the organizational structures decision-makers did not have a clear view of the constraints as perceived by the implementation clusters.	
	Short Term initiatives	Does not apply.	

Table 36: Main findings for Perceived Constraints

Unintended Outcomes (p.198)		
Main Findings	**Case Study Specific Data**	
Reinforcement of the relevancy of setting short-timed milestones within the greater and overall goals of the project as well as the collective capacity of adaptation.	In-depth Redes Livres	This was the only project that presented significant changes by the end of my research that was not agreed upon its start (Figueroa *et al*., 2002). The project focus shifted to community radio projects that lead to other significant outcomes (see p.198).

Table 37: Main findings for Unintended Outcomes

View of one's responsibilities *(p.202)*		
Main Findings	**Case Study Specific Data**	
Reinforcement of a common trait of ICT4D Partnerships (Tennyson, 2003; Unwin et al., 2011). None of the longer-term initiatives invested officially in mechanisms for the clarification of organizational and individual stakeholder roles in the networks.	Pilot Metaprojeto	Most individuals were clear about each other's roles because the project had already been active for two years. However, perceptions of network structure both at an organizational and individual level were diverse.
	In-Depth Redes Livres	Stakeholder's roles were not so clear at the early stage of the project.
	In-Depth DEPROTEC	Roles were in general clear since the project was at an early stage and the network was starting to be arranged.
	Short Term initiatives	Implementation stakeholders engaged actively in the early stage of the projects in identifying key stakeholders and decision-makers and their respective roles.
It is useful to iterate from time to time (Larsson et al., 1998; Hardy et al., 2005; Southern, 2015)	Pilot Metaprojeto	Not clear on individual's roles and responsibilities as time went by.
	In-Depth Redes Livres	Not clear on individual's roles and responsibilities as time went by.
	In-Depth DEPROTEC	Not so clear on individual's roles and responsibilities as time went by.
	Short Term initiatives	As these cases had weekly checkpoint meetings, stakeholders were much clearer regarding other's roles and positions than the former case studies.
It was easier to identify organizational and individual roles in the initiatives with more formal agreements and more rigid organizational structures composing the partnerships during the interventions. This is a pattern to be expected as relationships of power and social norms are better consolidated in such network structures (Giddens, 1990; Capra, 2002; Centola, 2015)	Pilot Metaprojeto	Clearer Views of each other's role (more formal and consolidated relationships of power).
	In-Depth Redes Livres	Unclear view of each other's role (less formal and no-consolidated relationships of power).
	In-Depth DEPROTEC	Clearer Views of each other's role (more formal and consolidated relationships of power).
	Short Term initiatives	No relevant data.

Table 38 Main findings for View of one's responsibilities

Shared Risks and Benefits *(p.204)*			
Main Findings	***Case study specific data***		**General issues**
There is a high feeling of disconnection to the initiative when stakeholders belonging to the network cluster that implements the project are not part of the planning process of the initiative (related to lack of meaning, see Capra, 2002).	Pilot Metaprojeto	No relevant data.	Focus Group Discussions reinforced Figueroa *et al*.'s (2002) argument that collaborative action can be enhanced by having mechanisms in place to improve collective self-awareness (see also Checkland, 2000; Keiding, 2011; Southern, 2015). However, it is not enough simply to discuss and acknowledge each other's relationships and roles. In the cases where such issues were discussed (Redes Livres and DEPROTEC), they remained in the realm of discussion rather than action.
	In-Depth Redes Livres	The informal project processes were perceived as being a shared benefit. However, it became increasingly viewed as a shared risk as time went by.	
	In-Depth DEPROTEC	Educators expressed lack of interaction among different course modules and lack of planning of the project as a whole as shared risk.	
	Short Term initiatives	A shared benefit often mentioned was that the projects entailed a *win-win-win situation*.	

Table 39: Main findings for Shared Risks and Benefits

Relationships of Power *(p.208)*			
Main Findings	**Case study specific data**		**General issues**
Networks in which the relationships of power are more hierarchical were seen to be more controlling of communication processes, imposing respective rules over the entire network and in most cases, hindering the diffusion of innovation across the networks (Capra, 2002; Scur, 2005; Barabási, 2009; Kapsali, 2011; Centola, 2015).	Pilot Metaprojeto	Excessive bureaucratic processes might hindered productivity (Teofilovic, 2002); Educators' ideas were not taken into consideration Communication processes were also influenced by organizational hierarchy and hierarchical roles.	The dialectic between *network structure* and *communication processes* of these more rigid structures seems to evolve towards stability; the more these stochastic processes lead to clearer relationships of power and rules, the more the diffusion of innovation among network clusters is hindered (Bateson, 1979; Centola, 2015).
	In-Depth Redes Livres	No relevant data.	
	In-Depth DEPROTEC	Excessive bureaucratic processes might hinder productivity (Teofilovic, 2002); educators had difficulties in buying specific material. Communication processes were also influenced by organizational hierarchy and hierarchical roles; Marist Pole Director imposing new registration method without discussion causing discomfort among collaborators.	
	Short Term initiatives	Communication processes were also influenced by organizational hierarchy and hierarchical roles; IBM Smarter Cities took a week and a half to learn how to work in teams, as they were executives used to lead.	
The presence of a discourse of creativity, autonomy and innovation was usually not in accordance with reality, causing issues of trust among stakeholders (Bateson, 1979).	Pilot Metaprojeto	No relevant data.	Bateson (1979) argued changes occur much faster at an individual level than at a collective level. What seems logical to the wider and more established system can lose its meaning at the individual level (Chapter 2, Sub-section 2.3.1, p.60). Perhaps the challenge lies in focusing at the individual and more emergent level (Bateson, 1979; Checkland, 2000; Capra, 2002).
	In-Depth Redes Livres	Volunteers were still being treated as students, even though the discourse of managers and coordinators embraced them as independent and autonomous researchers.	
	In-Depth DEPROTEC	Not applicable	
	Short Term initiatives	No relevant data	

Table 40: Main findings for Relationships of Power

Identification of Social Norms *(p.211)*		
Main Findings	**Case study specific data**	
Reinforcement of findings of "Relationships of Power" and non-disclosure of expected behaviour by organizations and institutions hinders project dynamics	Pilot Metaprojeto	No relevant data.
	In-Depth Redes Livres	The lack of agreed social norms between all stakeholders involved reinforced confusion regarding roles. Social norms and behaviours were shared within, but not between, clusters. Key decision-makers did not check project status frequently enough because Redes Livres was an informal initiative and there were no deadlines or strict action plans to be followed. As a consequence, there was a lack of proper support from this cluster.
	In-Depth DEPROTEC	The dominant behaviour was of not sharing or asking for information. Changes happened at such a fast pace, that there was no time for discussion with every stakeholder and as a result, management processes were led by centralized and controlled communication process even though the discourse was the opposite. However, this led to mixed messages; there was a discourse of collaborative action conflicting with a discourse of not invading each other's network cluster:
	Short Term initiatives	No relevant data.

Table 41: Main findings for Identification of Social Norms

Collective Capacity *(p.215)*		
Main Finding	**Case study specific data**	
The sense of collective capacity was high in all cases. However, there was little action taking place concerning perceived constraints (see Sub-Section 5.2.2). This also reinforced a discrepancy between discourse and reality found in previous proxys.	Pilot Metaprojeto	Metaprojeto advocated the forwarding of appropriation, and remixing of ideas as main goals. As such, innovation was recurrent because it was the core of the project, despite the frustration of the implementation cluster regarding their inability to act autonomously (see Sub-section 5.2.2).
	In-Depth Redes Livres	Redes Livres also followed the above pattern. (see Sub-section 5.4.1)
	In-Depth DEPROTEC	DEPROTEC's stakeholders also agreed that the group's collective capacity was high, but individual interviews showed that there were some issues that were not being openly talked about across network clusters.
	Short Term initiatives	No relevant data.

Table 42: Main Findings for Collective Capacity

The findings of this chapter reinforced two issues advocated in chapter 1. First, ICT4D initiatives need to invest in collaborative learning processes (Sub-section 1.4.2, p.38); second, many of the issues that hinder collaboration processes are, above all, a communication challenge (Tennyson, 2003; Hardy et al., 2005; McManus and Tennyson, 2008; Southern, 2015). *Knowledge on content* has shown that views are usually segregated in clusters, reinforcing the importance of acknowledging multi-stakeholder perspectives at early stages (Checkland, 2000). *Collective Self-Awareness* has shown that implementation clusters are usually left out of planning stages and this causes a lack of sense of purpose which in turn mines collaborative action.

Drawing on Bateson's (1979) comments, the *network structures* influenced the *communication processes* observed. This in turn, reinforced the *network structures*, consolidating further both organizational social norms across the entire network. This dialectic movement happens at the level of the specific network clusters as well. It consolidated social norms within these clusters, thus segregating the diffusion of information generated across the entire network (Centola, 2015). This means that the more designed networks superimposed their respective rules and norms over the emergent networks, thus making it difficult to accommodate different interests, behaviours and even innovation that could come from other clusters of the network.

Chapter 6 (p. 225) now draws on this chapter's findings and explores the role of individual stakeholders in acknowledging the communication processes explored so far, addressing the following research question:

> *What role do individual actions play in forwarding or hindering effective collaboration at the unfolding network interaction patterns of ICT4D initiatives?*

It starts by exploring the meaning generated by the project dynamics analysed in this chapter, searching for useful guidelines that assisted in generating effective collaborative action. It then explores possibilities of conscious interference on these system's micro levels, through a set of suggested guidelines supported by the findings and that take into account specific contexts. The intention is to provide a customizable set of such guidelines that will assist practitioners, researchers and decision-makers into forwarding effective collaborative action of all stakeholders involved, including them.

6 Effective collaborative action

6.1 Introduction

The previous analytical chapters have explored the relationship between two of the dimensions of this research's systemic view of Brazilian ICT4D initiatives, namely *network structure* and *communication level*. Chapter 4 provided a description of each of the case studies and presented the respective organizational and individual network topologies followed by an analysis of initial patterns identified across the different contexts observed. Chapter 5 analysed the research proxys of the systemic *communication level* dimension. This dimension concerns the communication feedback cycles leading to the system's recurrent self-organization mechanisms (Von Bertalannfy, 1977; Bateson, 1979; Maturana and Varela, 1992; Luhmann, 1995; Capra, 2002; Meadow *et al*., 2004). These proxys have assisted in analysing and synthesizing the complexities of the human interactions and individual actions of the case studies' observed. Moreover, it has also embraced the multiple perspectives held by different stakeholders where possible (pilot and in-depth case studies). The present chapter explores the third and last systemic dimension of *content: knowledge production and exchange*, with the objective to observe how individual stakeholders accommodated new knowledge within the context of their respective initiatives, hence addressing the following research question:

> *What role do individual actions play in forwarding or hindering effective collaboration at the unfolding network interaction patterns of ICT4D initiatives?*

Section 6.2 starts by recalling this research's systemic approach as a framework to observe ICT4D Initiatives supported now by the processes of the accomplished fieldwork activities. Section 6.3 explores the formation of common context and meaning as a consequence of the dialectical processes between *network structure* and *communication level* (Bateson, 1979), through proxys for the dimension *context: knowledge production and exchange* (Chapter 3, Sub-section 3.2.3, p. 82). It focuses on mechanisms that can be considered useful guidelines in assisting effective collaborative action within the case studies observed. Section 6.4 explores specific characteristics that might have hindered or forwarded collaboration both from an emergent and more designed (rigid)

perspectives. At the end of this chapter, the hope is that the analysis of the three systemic dimensions made throughout this research's chapters will have provided relevant insight regarding useful guidelines for effective collaborative action through the systemic approach suggested. Chapter 7 (p. 259) will summarize this research's contributions from a theoretical, methodological and practical perspectives and expose a set of useful guidelines derived from such contributions.

6.2 The systemic view of ICT4D partnerships and collaborative action

One of the main objectives of this research was to build a systemic view of ICT4D partnerships in the light of the conceptual framework proposed and to feed this knowledge back to stakeholders, so as to start a collective learning process about their own interactions (Chapter 2, Section 2.2, p. 43). According to this systemic view (see Figure 64 as a reminder), social network configurations and components recurrently tend to a state of self-organization, as a result of their communication feedback cycles (Von Bertalannfy, 1977; Luhmann, 1995; Capra, 2002).

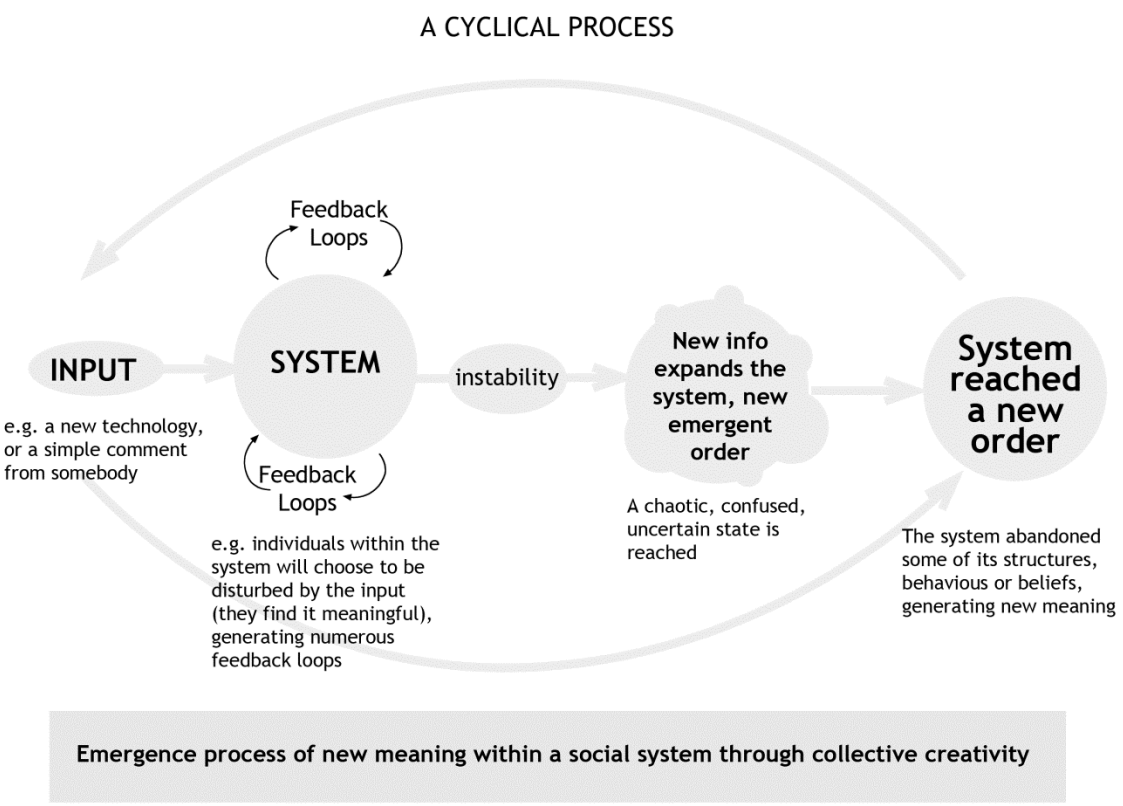

Figure 64: Based on Capra's (2002) description of a system's self-regulation (recursiveness) (Illustration by the author)

In many of the cases observed and more clearly in the projects with formal agreements, such as Metaprojeto and DEPROTEC, self-organization and the system's recursive ordering was led by the designed network, which presents more consolidated social norms (Centola, 2015). This reinforced Gidden's concept of disembedding mechanisms, emphasized on Chapter 2, Section 2.3.2 (p. 64) in which designed structures forward social norms, behavioural rules or relationships or power from one system to another. These expert systems (Giddens, 1990) impose their logic onto other systems thus creating very clear power relationships and the emergence process of new meaning is not as open as it could be, because the system will have more difficulty in abandoning many of its behavioural rules, for instance. By reconfiguring structures, designed networks are helping to shape the mental images social networks create to configure their living experiences (Capra, 2002). Figure 65 below is brought back to illustrate this concept once more.

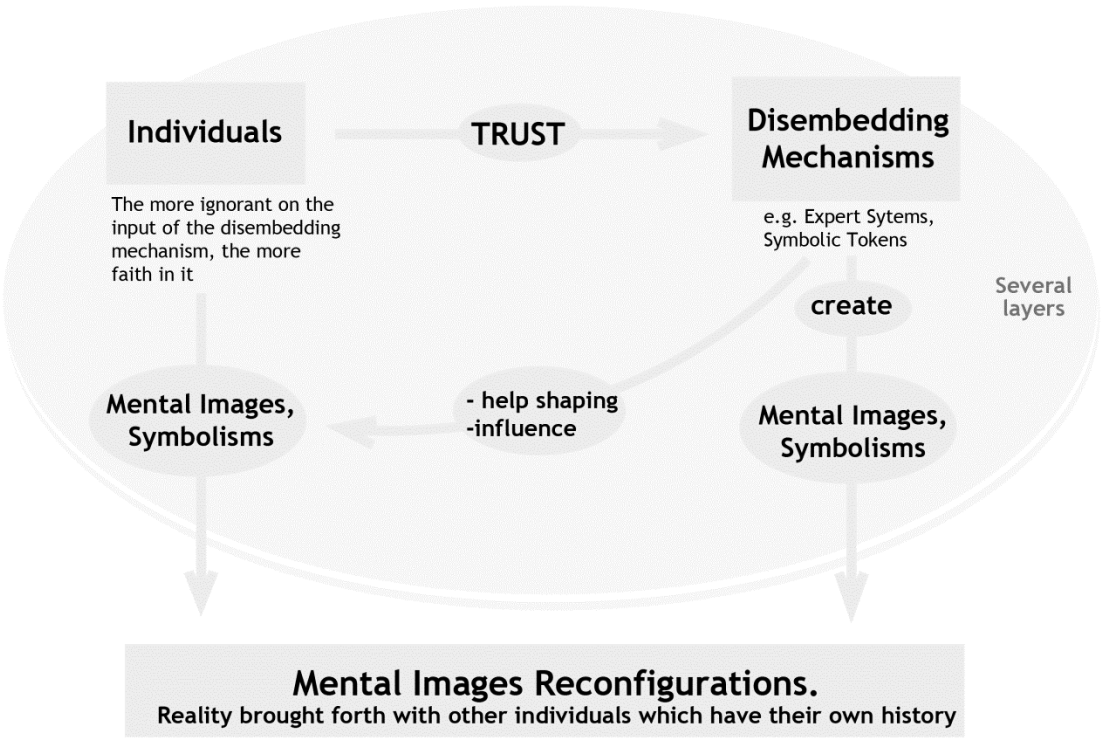

Figure 65: Loop of mental images reconfiguration based on notions from Bateson, 1979; Giddens, 1990 and Capra, 2002 (Illustration by Author).

Findings also showed that some consolidation is necessary for diffusion of innovation (Centola, 2015). Redes Livres was the most open system, however it did not succeed with its initial goals. Therefore, I argue that these communication feedback cycles can be translated into a conscious dialogue process that leads to clearer mutual understanding as well as a clearer understanding of the dynamics of the superimposed structures of ICT4D initiatives (Figueroa *et al.*, 2002).

This argument is further reinforced by literature in the fields of organizational learning and multi-stakeholder partnerships (see for instance Larsson *et al.*, 1998; Tennyson, 2003; Jackson, 2003; Hardy *et. al*, 2005; Adam *et al.*, 2007; McManus and Tennyson, 2008; Kapsali, 2011; Southern, 2015) in which dialogue processes are indeed believed to increase the sense of understanding of the other, which in turn should direct the system's self-organization towards intended and agreed goals rather than pending mostly to mental models influenced by the more consolidated system (see Figure 65 above).

In previous hard systemic approaches to project management (Hammond, 1997; Checkland, 2000; Jackson, 2003; Kapsali, 2011), the intention of attaining the view of the whole and the parts served only managers, so they could make well-informed decisions, without taking into sufficient consideration the multiple perspectives of different stakeholders. The parts of the system were not active, just acknowledged by decision-makers. The social system is still under centralized control in this scenario. However, as argued by Centola (2015), informal and alternative channels of communication facilitate and reinforce the diffusion of information, innovation and social norms across network clusters, in contrast to a solely top-down diffusion of social norms, as seen in for instance in Metaprojeto and DEPROTEC (see Chapter 5, Section 5.4, p. 207). If decision-makers embrace this approach, stakeholders from all network clusters are empowered with information, especially regarding different individual and organizational contexts, and are thus able to act in accordance with common agreed project goals more autonomously, truly embracing collective creativity, in which all nodes are able to contribute with inputs (see Figure 64 above). Such knowledge should forward a more effective and conscious iteration between stakeholders. They are able to provide conscious feedback into the system's configurations and processes, and hence the chances for effective collaborative action are greater.

The argument is that if the systemic view is embraced by stakeholders, especially top decision-makers, as a set of communication processes leading to the system's self-organization, then active and independent collaboration between nodes of the network can be considered as positive for a system's survival. Constant iteration becomes a relevant mechanism for stakeholders, since they are aware that as parts of an open system, they are constantly going through communication feedback cycles. If they are empowered critically to analyse the information being fed into the system, they can harness what is considered positive for the system's self-organization and neutralize what is considered negative. This is, of course, provided that stakeholders are in tune with the directions of the system; otherwise, more iteration is needed to achieve consensus.

In the in-depth case studies, qualitative approaches were used to bring these communication feedback cycles to the surface and to observe how such knowledge influenced stakeholders and the dialectical movement of *network structure* and *communication level*. In these terms, the next section explores the systemic dimension *content*: *knowledge production and exchange* as mechanism for the formation of a common meaning around the initiatives observed, namely the system's boundaries according to this research's systemic approach.

6.3 Knowledge production/exchange: The formation of meaning

The systemic dimension *content*: *knowledge production and exchange* comprises two of the system's fourfold structure of life in the social domain suggested by Capra (2002): the system's *matter*, namely the content generated through the communication feedback cycles; and the formation of the system's *meaning,* namely the mental models bounding the system (see Figure 66 below for reminder purposes). Mental models generated through the dialectical movement of *network structure* and *communication processes* give stakeholders the sense of belonging to the particular ICT4D initiatives through the creation of a common context between the superimposed structures coming together (Bateson, 1979; Kapsali, 2011; Turpin and Alexander, 2014).

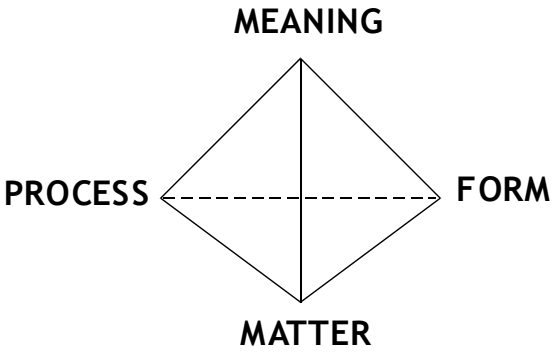

Figure 66: Capra's systemic understanding of life in the social domain (2002, p. 74)

My objective was to explore how stakeholders were accommodating new knowledge and thus calibrating differences in logical typing (Bateson, 1979). In other words, the thesis explores the system's mechanisms to leverage a common interpretation of the system's generated content. I observed whether in this process networks tended to become increasingly more stable and rigid, thus losing the creative and innovative features of emergent networks, or whether they were able to balance these processes. The hypothesis is that if there were indeed such mechanisms, this would lead to a greater sense of collective meaning and purpose by individuals, which in turn, would lead to more effective collaborative action (Checkland, 2000; Figueroa et al, 2002; Hardy et al., 2005; Southern, 2015; Centola, 2015). In this light, this section explores how meaning and content generated within the initiatives impacted collaborative action processes.

This proxy was observed by asking participants questions such as who was involved in the planning process, who had access to the plan of action, if there were any conflicts among stakeholders regarding projects objectives, what were the results expected by different members, if there were any unexpected results up to that point, and if there were any mechanisms to clarify people's perception of the project. There are three proxys regarding *content: knowledge production and exchange* that are explored sequentially in the next three sub-sections (Chapter 3, Sub-section 3.2.3, p. 82): the first are *expressions of individual and shared interests*; second, *monitoring and evaluation processes*; and third, stakeholders' sense of *collective identity*.

6.3.1 Expressions of individual and shared interests

> 'When different points of view and beliefs arise (divergence), further communication is required to reduce the level of diversity (convergence) to the point where there is a sufficient level of mutual understanding and agreement to engage in collective action and solve mutual problems.'(Figueroa *et al.*, 2002:5)

The proxy *expressions of individual and shared interests* (Figueroa *et al*., 2002; Unwin, 2005) explored possible conflicts between people's personal interests and the project's overall stated goals. There were two main findings relevant to this research. First, collaborative action was not necessarily an inherent feature of initiatives with higher communication feedback cycles, namely a higher level of repeated iteration among stakeholders. Second, the level of shared understanding regarding project goals was usually high, whereas regarding individuals' interests and feelings was not.

It was expected that higher communication feedback cycles would lead to greater collaborative action (Checkland, 2000; Figueroa *et al.*, 2002; Hardy *et al.*, 2005; Southern, 2015; Centola, 2015). Responses from those involved in my research have shown that this might be true, but only when combined with other features. For instance, Redes Livres and SAP 4th District network clusters expressed shared understandings at a greater level than in the case studies with more formal agreements. Such mutual understanding would be expected to generate collaborative action (Figueroa *et al*., 2002), but the level of collaborative action of these two case studies was quite different. These two initiatives also shared other similar patterns. For example, both occurred in a volunteering fashion and struggled with a general lack of leadership. Despite the similarities, there were differences that caused the SAP 4th District to perform better as a team than Redes Livres. There might be two main reasons for this: situational context; and individual behaviour. The SAP 4th District was a short term project, with a clear action plan, funded by a private sector multinational which also enjoyed from good infrastructure. Redes Livres was a long term project, with no action plan, no funding and infrastructure relied on other projects' resources from the Marist Technological Training Complex. Moreover, in the first initiative, individuals were highly experienced professionals, and in the second, individuals did not have enough technical skills and were inexperienced.

Kapsali (2011) argues that more informal and alternative communication processes lead to a greater recurrence of feedback cycles and this provides the opportunity to shape the emergence of the system's self-regulation into a desired direction. Such ideas have been only considered metaphorically so far (Jackson, 2003) and one of the objectives of my research was thus to test this empirically. However, my findings reinforced the argument that to provide informal and alternative communication processes alone is not sufficient for creativity, innovation and collaboration to occur. The analysis supports the idea that these communication processes need to be considered in combination with other factors. Among such factors, it is suggested that the presence of good, well-connected and experienced nodes is a crucial factor (Barabási, 2009; Mesicek and Svoboda, 2012).

Meanwhile, in the initiatives embedded and influenced by more rigid organizational structures and formal agreements, namely Metaprojeto, DEPROTEC, IBM Smarter Cities and SAP Fala 156, expressions of shared understanding across clusters did not flow as efficiently when compared to the two previous initiatives. As argued by Barabási (2009) and reinforced by Centola (2015), the more consolidated a network is, the harder it is for the diffusion of information to occur and as such, it is a common characteristic of real world networks for shared understandings to remain within the same cluster. However, besides the similar organizational patterns, there were differences between the initiatives' collaboration level as well. Situational context and individual behaviour also played a key role in these cases.

The Metaprojeto network clusters were further apart than the DEPROTEC clusters. However, DEPROTEC's greater cohesion did not mean more effective collaboration. This initiative's behavioural pattern was that of not sharing and discussing problems, as data revealed (see Chapter 5, Sub-section 5.4.2, p. 211). In the short term initiatives IBM Smarter Cities and SAP Fala 156, the public sector organizational culture influenced the project's needs assessment, as they struggled to synthesize the demands of the various secretaries in their set of recommendations.

The above observations reinforce Giddens' (1990) argument and previous findings (see Chapter 5, Section 5.4, p. 207) that designed and more inflexible networks usually superimpose their behavioural processes and social norms, and this makes it more

difficult to accommodate the interests of all clusters, even if there are mechanisms in place to discuss them, as in Metaprojeto (see Chapter 5, Sub-section 5.3.2, p.204). The lack of proper communication across network clusters appeared recurrently in several sections of this research (see for instance, Chapter 5, p. 181). This reinforces the argument that mechanisms are needed to build a common context over the whole system, as the individuals and groups of individuals interpret the same issues differently (Bateson, 1979; Figueroa *et al.*, 2002; Chapter 5, Section 5.5, p. 216).

The second finding is that individual interests and feelings were in general not shared and these usually related to project constraints and relationship issues. As argued by Benkler (2006), it is relevant to consider individuals' aspirations, as this helps to create a sense of collective identity because people feel more connected to each other and to the initiative (see also Checkland, 2000; Southern, 2015). Some of DEPROTEC's stakeholders desired to change project processes that they considered were constraints. This included the pace at which the initiative was brought together or the budgeting methodology to be followed, mentioned earlier in Chapter 5 (Sub-section 5.2.2, p.189). However, these feelings were not openly shared from one cluster to another and sometimes not even within the own cluster. Each educator was involved in their own module and DEPROTEC as a whole was not being discussed by them. This even happened in the initiative with the most cohesive network (see Chapter 4, Sub-section 4.4.3, p. 146). Redes Livres followed a similar pattern. Individuals did not express their feelings towards the project to stakeholders belonging to the coordinator's cluster (Chapter 5, Sub-section 5.3.2, p. 204). It seems that the organizational culture of the Marist Technological Training Complex was influencing both projects in this regard, despite their distinct systemic arrangements.

Although coordinators of both initiatives argued that communication channels were open, these channels were not being used. The construction of meaning and context was concentrated in shared interests mainly related to the projects in question and the construction of a mutual understanding of individual interests was being left out. As discussed in Chapter 1 (Sub-section 1.4.2, p. 38), ICT4D Initiatives usually do not plan sufficiently explicitly for partnership and collaboration mechanisms to be embedded in project processes (Unwin *et al.*, 2011). Moreover, methodologies that account for multiple perspectives require much time and energy to be digested (Chambers, 1997;

Checkland, 2000; Petkov *et al.*, 2007) and indeed insufficient time is spent on this in the planning stages of the initiatives (Unwin, 2009). Moreover, when detailed participatory methodologies are applied in earlier stages of the project or in the form of later interventions, it usually concerns project goals, not stakeholder collaboration per se (Checkland, 2000; Turpin and Alexander, 2014). These methodologies should act as a learning process embedded in the project (Checkland, 2000; Jackson, 2003). My intention was to motivate such a learning environment through my participation in the in-depth case studies. However, it turned out to be difficult to allocate sufficient time for the iterations planned, even having them previously agreed with project decision-makers (see Chapter 5, Sub-section 5.4.1, p. 208).

The short term case studies provided valuable insights regarding the role of individuals in helping to move forward with project processes, even if there were no mechanisms in place to facilitate the journey. Experienced higher degree nodes, namely, IBM and SAP consultants, played a key role in spreading relevant project information through the entire network and thus keeping it robust and consolidated regarding overall project goals (Barabási, 2003; Wand and Chen, 2003). In the case of the in-depth case studies, decision-makers and project leaders, as the higher degree nodes, should play such role, but this was not the case. As argued by many (Hardy *et al.*, 2005; Barabási, 2011; Southern, 2015), these nodes should be the first ones to engage in mechanisms aiming for effective collaborative action, if they want the whole team to collaborate well together.

This section has explored the formation of meaning through expressions of individual and shared interests across network links. It showed that collaboration does not depend solely on higher communication feedback cycles. It also depends on variables such as time, experience, organizational culture, leadership and ownership. Moreover, the role that individuals play is as relevant and influential as the superimposition of designed structures' social norms. Having that in mind, researchers, decision-makers and practitioners who acquire the ability to identify beforehand which factors are hindering or harnessing project processes, are better fit to enjoy the advantages of the iteration processes of their ICT4D initiatives' social networks.

6.3.2 Monitoring and evaluation processes

The proxy *Monitoring and evaluation processes* refer to new information circulating among stakeholders about the project, documentation processes and project assessment (Capra, 2002; Jackson, 2003). It is generally assumed that the lack of proper documentation and assessments hinder the collaboration process because people are unable to acquire relevant knowledge to act on a well-informed basis (Benkler, 2006; Germani, 2012). Moreover, these are time-consuming tasks that require discipline and organization, which are features not easily found in emergent networks (Capra, 2002). There was one main finding from my field research regarding this proxy. Stakeholders from the in-depth case studies usually underestimated the value of monitoring and evaluation. This is in line with many similar initiatives, and it is interesting to note that stakeholders in the case studies I examined saw it as impairment to immediate action, since they already had too many things to do. It seems that monitoring and evaluation processes had low priority within the partnership mechanisms because they do not have immediate tangible benefits and only show their relevancy and efficacy in the long run.

Metaprojeto, for instance, had no official documentation or evaluation processes at the time this research was conducted.

> *Project Main Coordinator*: '(...) one can see on a daily basis how well the project does; for instance, when workshops get fully booked in the blink of an eye.' [59]
>
> (*Informal Conversation, Metaprojeto, 13.04.2010*)

Meanwhile, in DEPROTEC, some educators and students complained that general information about the project was unsatisfactory, especially regarding the second module of the course:

> *Student*: '(...) That's the thing, it's something that was very unexplained (...)yeah, we will develop projects, then everything has a specific project(...)And that, they

[59] Original:
Coordenador de Projeto: '(...) tu pode ver diariamente como o projeto está indo bem; por exemplo, as oficinas ficam cheias num piscar de olhos (...) '

did not say how it goes (...)it will be only software, there will not be English anymore, there will not be electronics anymore (...)'[60]

(*Focus Group Discussion, DEPROTEC, 05.07.2012*)

FS: 'Have you talked to him (*Project Director*)?'
Educator 7: '(…) I said, "Man, we have to read the project well, because we could not understand the project yet."' [61]

(*Individual Interview, DEPROTEC, 26.06.2012*)

The only formal report to be written for DEPROTEC was an expense account to be delivered to the Ministry that was funding the project. Other aspects of the project were not clear regarding what should be reported.

FS: 'Do you document the project? '

Pedagogical Coordinator 1: 'No, I think that will start to do that, but on accountability level (…) Now, the educational performance, pedagogical, we are not clear what has to be presented.'[62]

(Individual Interview, DEPROTEC, 08.08.2012)

Evaluation mechanisms were usually used only for statistics purposes; the only qualitative assessment was regarding students' behaviours and not about the overall project:

FS: 'And monitoring and evaluation mechanisms?'

Pedagogical Coordinator 1: 'Yes, there are, for the students and also for educators. We did not have a monthly plan, only a general one. Some educators systematically adopted one instrument or another, then we standardized this planning instrument, so each educator is invited to do a weekly planning,

[60] Original: '(…) Ai que tá, é uma coisa que ficou muito sem explicação...tá, a gente vai desenvolver projetos, ai cada coisa tem seu projeto especifico (…) e so isso, nao disseram ainda como vai ficar (…) e vai ser so software, nao vai ter mais singles, nao vai ter mais electronica (…)'

[61] Original: *FS*: 'Já conversou com ele (*Diretor do Projeto*)?'
Educador 7: '(…) já falei "cara, a gente tem que ler o projeto direitinho, pq a gente nao conseguiu entender o projeto ainda' "

[62] Original:
FS: 'Vocês documentam o projeto?'
Coordenadora Pedagógica 1: Não, me parece que vai começar a ter, mas anivel de prestação de contas mesmo (...)agora do desempenho educativo, pedagogico não tá claro o que tem que apresentar.

writing their content, hourly load, resources to be used(...) for the individual students there is a tracking record both for the frequency and regarding behaviour(...) where the student will fit, to advance the proposal for the second module (...) This we thought on time, there is no defined frequency, to define the second module (...) (*of DEPROTEC*)'[63]

(Individual Interview, DEPROTEC, 08.08.2012)

FS: Are there monitoring and evaluation mechanisms?

Pedagogical Coordinator 2: 'Yes. For the teaching there is. Students control spreadsheets, from the classes, and the weekly schedule, to assure that the class was given and the resources needed were used. And if you need resources that are not there, we have time to get it. So, there are these educators and student monitoring spreadsheets.'

(Individual Interview, DEPROTEC, 26.06.2012)[64]

In Redes Livres, the situation was much worse. The quality of communication processes happening regarding project evolution was not satisfactory despite the implementation cluster high cohesiveness (see Chapter 4, Section 4.3, p. 134). Only a fifth of the initial milestones set had been accomplished after 6 months. Stakeholders knew that internal communication and lack of documentation was an issue, but no one was taking action. The project structure was so loose with no coherent plan of action that there was little opportunity for formal planned meetings to happen; if there were enough stakeholders around, they would just decide to have a meeting.

As emergent networks are more chaotic and dynamic, monitoring and evaluation processes do not appeal as being a relevant mechanism, despite all of the recommendations in the literature that they are essential for successful projects; some

[63] Original:
FS: 'E mecanismos de monitoramento e avaliação?'
Coordenadora Pedagógica 1: 'Sim, existe, pros jovens no caso e pros educadores tb. Até nao tinha plano mensal, só o geral. Alguns educandos por sistematica pessoal adotaram um instrumento que outro, ai padronizamos esse instrumento de planejamento, entao cada educador esta convidade a fazer o planejamento semanalmente, escrevendo seu conteudo, carga horaria, recurso a ser utilizado..pros jovens tem uma ficha de acompanhamento individual, tanto pela frequencia quanto com relação ao modo comportamental (...)onde vai se encaixar, pra adiantar a proposta do 2 modulo (...):Esse pensamos pontualmente, nao tem uma frequencia definida, pra definir a questao do modulo 2'

[64] Original:
FS: 'Existem mecanismos de monitoramento e avaliação?'
Coordenadora Pedagógica 2: 'Sim. Pedagógico tem. Planilhas de controle de educandos, das aulas, do cronograma seminal, pra podermos ter a garantia que a aula foi dada e foi usado os recursos pedidos. E se precisar algum recurso que não tem, podermos ter tempo de correr atrás. Então temos essas planilhas deacompanhamento de educador e educando.'

stakeholders even noted that such processes might hinder productivity during informal conversations. On the other hand, in the short term case studies, documentation was the main outcome. The experienced consultants knew the importance of a well-documented project, especially because they were *in loco* for a short period of time. They needed to make sure that a proper legacy was left after they were gone, so stakeholders could move further.

6.3.3 Collective identity

The proxy *sense of collective identity* refers to mental models that are shared among stakeholders, translated into a collective sense of meaning and purpose (Checkland, 2000; Figueroa et al, 2002; Hardy et al., 2005; Southern, 2015; Centola, 2015). It is usually argued that if the sense of collective identity is high, this means that the system's boundaries of meaning are well defined. The proxys of the systemic view of life analysed in this research served the purpose of providing an overview of the sense of collective identity within the initiatives observed. Stakeholder collaboration was more effective in the initiatives where roles, responsibilities and an action plans were clear. Metaprojeto, DEPROTEC and the SAP short-term case studies followed this pattern. IBM Smarter Cities took a little longer to define stakeholder roles and the action plan, but after such issues were resolved, collaboration took a boost (see Chapter 5, Sub-section 5.3.1, p. 202). On the other hand, Redes Livres' stakeholders never acted on these issues. Moreover, there are two characteristics that I found to be relevant in creating a sense of collective identity among stakeholders besides the proxys analysed. The first was literacy and the second was sense of ownership.

Literacy concerns the expertise of stakeholders to achieve a project's desired goals and is considered a catalyst in effective collaborative action (Figueroa *et al.*, 2002).People have a greater feeling that they can contribute when they have knowledge about the issue (Germani, 2012).In the case studies where literacy was high, namely Metaprojeto, DEPROTEC and the short-term studies, project processes were evolving more effectively. Redes Livres, on the other hand, relied on an implementation cluster that was only partly skilled. It was an experimental initiative and volunteers frequently needed to undertake research in order to solve problems. This lack of knowledge hindered the creation of a sense of collective identity, as volunteers increasingly lost focus and hence,

a collective sense of purpose (see Chapter 5, Sub-section 5.3.2, p. 204). However, a positive impact of this was that the volunteers undoubtedly learned new skills and gained valuable experiences as a result of such learning.

Ownership concerns the extent to which stakeholders feel the initiative belongs to them (Figueroa *et al.*, 2002). The sense of ownership is higher when stakeholders are involved in the process since the planning stages which in turn gives a greater sense of commitment to project goals (Checkland, 2000). At its beginning, Redes Livres implementation cluster was treated as the owners of the initiative. However, management changes within the organizational network shifted the objectives of the project and this led to a decrease in the sense of ownership by volunteers (see Chapter 5, Sub-sections 5.2.2 and 5.2.3, p. 189).

Meanwhile in DEPROTEC, educators showed a high sense of ownership in terms of their course modules, but not towards the entire project. This confirms Figueroa *et al.*'s (2002) argument, that since educators were not involved in project planning, they never took action regarding the project as a whole, even after acknowledging general problems during the focus group discussions. Only the coordination cluster possessed a holistic view of the project; a usual feature of control in conventional project management processes (Jackson, 2003). This left educators at the grassroots level in the initiative without knowing why things were one way or another.

> FS: 'How do you seek consensus in a group? '
>
> *Pedagogical Coordinator 1*: 'It depends on the decision (...) many things we talk (...) and *Manager 1* says(...) wait, I have to talk to the *Director*1(...) then sometimes we do not have the return of that situation and we do not participate in the definition, the definition just comes. [65]
>
> *(Individual Interview, DEPROTEC, 08.08.2012*)

It is important that project managers and decision-makers understand that literacy and ownership contribute to a high sense of collective identity of stakeholders. If a team see itself as a team, it is then able to learn as a team (Checkland, 2000; Southern, 2015). This

[65] Original:
FS: 'Como vocês buscar consenso em grupo?'
Coordenadora Pedagógica 1: 'Depende do tipo de decisão, da instância. Muitas coisas a gente conversa ali, e o *Manager 1* diz, pera, tenho que ver com o *Diretor 1* (...) ai as vezes a gente nao tem o retorno daquela situação e nos não participamos da definição, se chega aqui a definição.'

is a particularly relevant finding since one of the main goals of this research was to start a collective learning process (Chamber, 1997; Tacchi, 2003). Moreover, the proxys of the systemic dimension *content: knowledge production and exchange* should not be considered isolated, but rather concomitantly. It is important to look at the relationships between all proxys so as to acquire a systemic view and draw relevant insights for useful guidelines on effective collaborative action. Table 43, Table 44 and Table 45 below summarize the findings of this dimension.

Expressions of Individual and Shared Interests *(p.231)*		
Main Fidings	***Case study specifics***	
Collaborative action was not necessarily an inherent feature of initiatives with higher communication feedback cycles, namely a higher level of repeated iteration among stakeholders as otherwise expected. *The analysis supports the idea that these communication processes need to be considered in combination with other factors, such as the presence of well-connected and more experienced nodes.*	Pilot Metaprojeto	Less expression of shared understanding in this more formal setting, but situational context and individual behaviour also played a role on collaboration. Metaprojeto network clusters were further apart than the other initiatives.
	In-Depth Redes Livres	Network clusters expressed shared understandings at a greater level than the other more formal initiatives, but collaborative action was NOT present. Situational context and individual behaviour influenced this.
	In-Depth DEPROTEC	Less expression of shared understanding in this more formal setting, but situational context and individual behaviour also played a role on collaboratoin. DEPROTEC's greater cohesion did not mean more effective collaboration. The behavioural pattern was that of not sharing and discussing problems, as data revealed (see Chapter 5, Sub-section 5.4.2, p. 211).
	Short Term initiatives	The more informal short term SAP 4th District network clusters expressed shared understandings at a greater level than other more formal initiatives, and collaborative action WAS present. In the short term initiatives IBM Smarter Cities and SAP Fala 156, the public sector organizational culture influenced the project's needs assessment, as they struggled to synthesize the demands of the various secretaries in their set of recommendations. Individual behaviour influenced this fact.
The level of shared understanding regarding project goals was usually high, whereas regarding individuals' interests and feelings was not.	Pilot Metaprojeto	No relevant data.
	In-Depth Redes Livres	Individuals did not express their feelings towards the project to stakeholders belonging to the coordinator's cluster (Chapter 5, Sub-section 5.3.2, p. 204).
	In-Depth DEPROTEC	DEPROTEC's stakeholders desired to change project processes that they considered were constraints. However, these feelings were not openly shared from one cluster to another and sometimes not even within the own cluster (See Chapter 5, sub-section 5.2.2, p.189).
	Short Term initiatives	Valuable insights regarding the role of individuals in helping to move forward with project processes, even if there were no mechanisms in place to facilitate the journey. Experienced higher degree nodes, namely, IBM and SAP consultants, played a key role in spreading relevant project information through the entire network and thus keeping it robust and consolidated regarding overall project goals (Barabási, 2003; Wand and Chen, 2003).

Table 43: Main findings for Expressions of Individual and Shared Interests

Monitoring and Evaluation Processes *(p.235)*		
Main Findings	***Case study specific data***	
Stakeholders from the in-depth case studies usually underestimated the value of monitoring and evaluation.	Pilot Metaprojeto	No official documentation or evaluation processes at the time this research was conducted.
	In-Depth Redes Livres	The quality of communication processes happening regarding project evolution was not satisfactory despite the implementation cluster high cohesiveness (see Chapter 4, Section 4.3, p. 134). Stakeholders knew that internal communication and lack of documentation was an issue, but no one was taking action.
	In-Depth DEPROTEC	Educators and students complained that general information about the project was unsatisfactory
	Short Term initiatives	Documentation was the main outcome.

Table 44: Main findings for Monitoring and Evaluation Processes

Collective Identity *(p.238)*			
Main Finding	***Case study specific data***		**General issues**
Stakeholder collaboration was more effective in the initiatives where roles, responsibilities and an action plans were clear.	Pilot Metaprojeto	Followed the pattern.	
	In-Depth Redes Livres	Never acted on such issues.	
	In-Depth DEPROTEC	Followed the pattern.	
	Short Term initiatives	Only the IBM Smarter Cities took a little longer to define stakeholder roles and an action plan, but collaboration took a boots after this (see Chapter 5, Sub-section 5.3.1, p. 202).	
Two characteristics showed to be relevant in creating a sense of collective identity among stakeholders besides the proxys analysed. The first was literacy and the second was sense of ownership.	Pilot Metaprojeto	Literacy was high, project processes were evolving more effectively.	It is important that project managers and decision-makers understand that literacy and ownership contribute to a high sense of collective identity of stakeholders.
	In-Depth Redes Livres	Literacy was NOT high, project processes were facing problems. Also, At its beginning, Redes Livres implementation cluster was treated as the owners of the initiative. However, management changes within the organizational network shifted the objectives of the project and this led to a decrease in the sense of ownership by volunteers (see Chapter 5, Sub-sections 5.2.2 and 5.2.3, p. 189).	
	In-Depth DEPROTEC	Literacy was high, project processes were evolving more effectively. Educators showed a high sense of ownership in terms of their course modules, but not towards the entire project. This confirms Figueroa *et al.*'s (2002) argument, that since educators were not involved in project planning, they never took action regarding the project as a whole, even after acknowledging general problems during the focus group discussions.	
	Short Term initiatives	Literacy was high, project processes were evolving more effectively.	

Table 45: Main Findings for Collective Identity

6.4 Envisioning useful guidelines for effective collaborative action

Many scholars agree that collaboration issues of ICT4D partnerships are, above all, a communication challenge (Tennyson, 2003; Hardy et al., 2005; McManus and Tennyson, 2008; Southern, 2015; see Chapter 1, Section 1.4.2, p.38). This research observed the case studies from this perspective in an attempt to contribute to the debate. The communication processes of the initiatives were explored as the mechanism that shapes the social networks observed through the situational contexts formed by them (Section 2.2, p.43). One of the goals was to explore if stakeholders could benefit from a better understanding of the specific network patterns they were inserted for more effective collaborative action. If individual stakeholders could identify recurrent patterns that were harming or harnessing the project processes and the collectively agreed goals, they should be able to tackle these communication issues and act on it autonomously, thus consciously directing the system's self-organization accordingly. Hence the research question:

> *What role do individual actions play in forwarding or hindering effective collaboration at the unfolding network interaction patterns of ICT4D initiatives?*

As a researcher I would have liked to act as a facilitator or catalyst in guiding the above, but in the scenarios where I worked this was not agreed upon. Thus I only observed the processes that were triggered by the focus group discussions and interviews. Sub-section 6.4.1 explores the characteristics of the networks observed that might have hindered or forward collaboration from an emergent perspective. Sub-section 6.4.2 explores the characteristics of the networks that might have hindered or forward collaboration from a designed and more rigid perspective. The concluding section of this chapter sums up what has been learned throughout this research and sets the stage for the contributions of this research to be explored in Chapter 7 (p. 259), which resulted in the assemblage of a set of useful guidelines for effective collaborative action (see Sub-section 7.4, p.273).

6.4.1 Emergent networks and collaborative action

Barabási (2009) suggests that humans, as individuals, are impossible to predict; it is only as a group that we follow strict patterns (see also Bateson, 1979). This was reinforced by the analysis of the case studies in this research; network dynamics presented similar organizational patterns, but individuals' contexts and relationships also influenced network dynamics in ways that made it impossible to predict the behaviour of the whole system even with knowledge around similar specific patterns, such as Redes Livres and IBM Smarter cities informal agreements. On the one hand, IBM consultants' experience overcame organizational constraints; on the other hand, the inexperience of Redes Livres volunteers did not help the loose format of the initiative (Chapter 5, Sub-section 5.2.2, p. 189). This individual aspect of emergent networks creates unpredictable communication feedback cycles that in turn bring unpredictable outcomes. Such unpredictable processes and outcomes will happen, even with careful planning and experienced project managers (Jackson, 2003). In fact, the more experienced a project manager is, the more he/she has to be careful not to base decision-making on previous assumptions before seeking other perspectives (Kapsali, 2011).The good news is that unpredictability is also an opportunity for creativity and innovation to emerge (Capra, 2002).

Within the social perspective of this research's systemic approach, creativity concerns issues of appropriation, exchange and remixing of ideas (Rasch and Wolfe, 2000; Capra, 2002). In other words, it regards the openness of the systems to new information and most importantly, how well they learn from new information in order to re-structure their processes (Bateson, 1979, Capra and Luisi, 2014). A relevant finding was that the implementation clusters were usually the more open and creative towards project processes. However, information does not spread as effectively across the network if decision-makers are not involved. Since decision-makers are usually the higher degree nodes that spread new information to all clusters, thus keeping its robustness regarding specific social norms, faulty cluster-to-cluster communication limits the spread of innovation (Barabási, 2009; Centola, 2015).

For instance, the Metaprojeto implementation cluster (educators and volunteers) and end users were highly creative, despite the project being managed through a rigorous

structure (São Paulo Data Processing Company).The core goal of the initiative fostered appropriation of technology and the remixing of ideas (Chapter 4, Section 4.2, p. 126). Metaprojeto feedback cycles were recurrent; end users felt comfortable suggesting ideas for new workshops directly at the coordinating office, which was a managing node physically close to the implementation cluster, and thus more directly involved:

> *Acessa SP Manager:'* (…) without the community, the workshops wouldn't exist (…) I believe they are successful, by what I hear from them, their necessities, including about what to teach, they ask me: "hey, why there isn't a workshop about that", then I bring this to Coordinator 1(…) to see if (…) if possible to do it.'[66]
>
> *(Individual Interview, Metaprojeto, 15.04.2010)*

The Redes Livres and DEPROTEC implementation clusters were also inserted in a context that fostered creativity. The Marist Technological Training Complex provided a suitable environment for appropriation of technology and remixing of ideas and technological equipment (Chapter 4, Section 4.3, p. 134). Figure 67: Reconditioning process at the Marist Technological Training Complex. The first photo shows the unaltered slot machines; the second shows the students cleaning and refurbishing a slot machine. The last image shows an internet totem at a local grocery store (2011, photos taken by author). below illustrates this process. First, the Technological Training Complex received seized illegal slot machines through the Federal Project Alquimia (Alchemy Project, 2012) and then the students clean, refurbish, paint and prepare them to receive reconditioned computers. Finally, these old slot machines become internet Totems in the public spaces in the community.

[66] Original:

Gerente Acessa SP: '(…) sem a comunidade não existiriam as oficinas (…) Eu acredito que estejam dando resultados pelo que eu converso com o pessoal, as necessidades deles, inclusive a respeito do que dar nas oficinas, o que eles me pedem: 'ó, porque não tem oficina disso' e ai eu vou conversar com o Coordenador 1 (…) pra eles (…) ver se poderia ser (…) '

Figure 67: Reconditioning process at the Marist Technological Training Complex. The first photo shows the unaltered slot machines; the second shows the students cleaning and refurbishing a slot machine. The last image shows an internet totem at a local grocery store (2011, photos taken by author).

The examples above reinforce Barabási's (2011) argument that the probability that the most involved nodes comes up with innovation is greater, as it was usually individuals from implementation clusters who generally brought new ideas into the projects' scope (see also Capra and Luisi, 2014 and Centola, 2015). The level of innovation of the implementation clusters also depended on a combination of other aspects, such as situational context or individual experience. Thus, the possibility for innovating, discussing or implementing new ideas was not the same in the initiatives observed (See Chapter 5, Sub-section 5.4, p. 207 on behavioural patterns). The implementation clusters of all case studies showed great innovative potential, when given the opportunity.

> 'They were having a meeting with PRODESP to discuss financial support to renovate Metaprojeto surroundings. I see the whole team moving quickly in order to present a document of what the new room could look like. Everyone pitches in, with *Project Manager* in charge. Quickly they had a whole new room planned, I was surprised how much more productive the space was looking.'
>
> (*Metaprojeto, notes from my diary, 14.04.2010)*
>
> 'First formal group discussion: I arranged the post-its in the board, *Project Coordinator 1*and *Project Technical Coordinator 1* didn't stop adding people! I was just writing everything and putting it up there. The kids were either working or paying attention at the same time. (...) By the middle of the conversation they were all pitching in, very excited.'
>
> (*Redes Livres, notes from my diary, 28.10.2011*)

Figure 68: Redes Livres first Focus Group Discussion. Post-its with individual's names, added by participants (Photo by author, 28.10.2011).

This was also the case in DEPROTEC:

> '*Educator 8*: (...) Educator 7 commented how they motivate the students' competitiveness (...) I love that, I am going to take it to the communication class (...) also, how they tell the kids to organize everything, so when they come back the next day everything is already in place to start working. And I brought a basic thing that I do, which is (to screen) motivational videos (...)'
>
> (*DEPROTEC, Focus Group Discussion with educators, talking about things they do in their own disciplines, 13.06.2012*)[67]

[67] Original:

' Educadora: (...) o nederson colocou como uma coisa que eles fazem, incitar a competitividade (...) adorei isso, vou levar para a oficina de comunicação (...) organização dos materiais, ele procura manter tudo organizadinho, para quando eles chegarem já ter tudo ali para o que eles vão fazer e poder trabalhar e retomar isso no final, eles tb deixando o ambiente organizado. Eu trouxe uma coisas basica que eu faço, que é a motivação por video (...) '

However, the fact that the most emergent clusters were creative did not mean that such creativity was channelled specifically towards the desired outcomes of the project. I observed many times, for example, that the volunteers in Redes Livres had great creative potential when they were brainstorming (see above), but they were 80% behind the milestones that they had initially set for the timeframe of 6 months due mainly to lack of leadership, action plan, skills and experience.

> *Volunteer 2*: 'Our goal was to have 8 antennas, we have only 2. I think we are not going to do anything; this week is already dead (...)'
>
> *FS*: 'But it is only Tuesday, how is it dead? (Laughs)'
>
> *Volunteer 2*: 'Dude, it is not so easy to set up an antenna. We have to get the person's authorization, their documents, think where we will put the antenna, it is a bureaucracy (...) we take around 2-3 days to do that, then you go to the person's house to talk about it, and they are not home (...)'[68]
>
> (*Redes Livres, Individual Interview, 13.12.2011*)

Almost a year later, not much seemed to have changed:

> *FS*: 'Who is thinking about the plan of action?'
>
> *Volunteer 8*: 'Ah, to say no one is thinking about it I won't (...) but there isn't anything defined yet.'
>
> *FS*: 'Why isn't there anything defined? '
>
> *Volunteer 8*: 'Ah because of this entire crisis (...) I think you are the one pushing us more to do this planning and all.'
>
> *FS*: 'But has it never occurred to you to just act on it, all right, let's do this?'
>
> *Volunteer 8*: 'Yep. Today in the morning. (...)'
>
> *FS*: 'But why does it stay just on thoughts?'
>
> *Volunteer 8*: 'To be honest, I think it is not happening because we are not going for it. '
>
> *FS*: 'And why is that'
>
> *Volunteer 8*: 'Because there is that whole deal of laziness, of f**** around. When I decided to get out of that room to come here, it was because I wanted

[68] Original:
Volunteer 2: 'A nossa meta era 8 pontos e temos só dois, e acho que nao vamos conseguir fazer mais nenhum, essa semana tá morta, sexta (...)'
FS: 'Mas nós estamos na terça-feira,como assim tá morta? (risos)'
Volunteer 2: 'Cara, é que não é bem assim colocar uma antenna, tem que ter uma autorização da pessoa, os documentos da pessoa, onde vai colocar a antenna, é toda uma burocracia, tu leva em media 2 a 3 dias pra fazer isso, dai tu vai falar com a epssoa responsavel e nao tae m casa(...)'

> silence (…) because I know that it is the same that working from home. It does not work for me. Ah, I will do it later (...) we have to wait for this, and that…it is the immaturity of the group.'[69]
>
> (*Redes Livres, Individual Interview, 12.10.2012*)

Metaprojeto, in turn, enjoyed a good infrastructure and experienced project managers (see Chapter 4, Section 4.2, p. 126). However, the state bureaucracy and hierarchical structures seemed to be hindering agreement on action (see Chapter 5, Sub-section 5.2.2 on perceived constraints, p.189). In the case of DEPROTEC, the experienced educators had to find ways to move on with their classes despite their initial difficulties. Individual interviews suggested that educators kept innovative ideas within their own modules. Despite the highly cohesive implementation cluster depicted in Chapter 4 (see Section 4.4, p. 144), the level of collaboration across modules was low. During focus group discussions, most of them agreed that it would be positive if they interacted more. In short, findings showed that emergence, although it opens the path, does not necessarily lead to innovation, and even less to effective collaborative action. Moreover, it reinforced Barabási's (2011) argument that the focus should turn to the most connected individuals in the network.

6.4.2 Designed networks and collaborative action

This section explores the characteristics of the networks that might have hindered or forward collaboration from a designed and more rigid perspective. According to Capra (2002), structural arrangements with clear behavioural rules and social norms bring stability, but they also provide stricter rules to be followed as the relationships of power in these social systems are clearer when in contrast with more emergent networks (see

[69] Original:
FS: 'Quem pensa o plano de ação?'
Volunteer 8: 'Ah, dizer que ninguém ta pensando nisso tb não...mas nao tem uma coisa definida ainda'
FS: 'Pq não tem nada definido ainda?'
Volunteer 8: 'Ah porque teve todas essas crises...acho que tu é a que mais tá puxando a gente pra esse planejamento e tal'
FS:' Nunca te ocorreu de tu pegar e tá, vamos fazer?'
Volunteer 8: 'Já. Hoje de manhã. (...)'
FS: 'Pq fica só no pensamento?'
Volunteer 8: 'Pra ser sincero acho que não acontece pq a gente nao vai atras'
FS: 'Pq nao vai atras?'
Volunteer: Pq tem todo aquele lance da preguiça, do arreganho. Quando eu decidi sair daquela sala pra vir pra ca, foi mais pra ficar no silencio (...) pq eu sei que é a mesma coisa que trabalhar em casa. Pra mim isso nao dá certo...ah, vou fazer depois. Antes de vir pra ca, ate pensava, vamos fazer isso e isso...daí ah, tem que esperar isso, aquilo...Imaturidade do grupo

also Giddens, 1990; Chapter 2, Sub-section 2.3.2, p. 64, Chapter 4, Section 4.8, p. 161 and Chapter 5, Section 5.4, p. 207). The challenge is to learn how processes of collaborative action might benefit from the stability these structures bring. As argued by Jackson (2003), such organizational structures have used hard systems thinking to keep control of the system as a whole (see also Chapter 2, Section 2.2, p.43) and to shift to an open systems thinking approach comes from a desire to let go of control, by recognizing the openness of these systems and thus boosting creativity and innovation processes. This shift has only been considered metaphorically so far (Jackson, 2003) and my research intends to contribute to develop the debate further.

The ICT4D initiatives observed in my research are all part of wider and more structured organizational networks, such as the Public Management Secretariat of the State of São Paulo, the Marist Province of Rio Grande do Sul, or multinationals such as IBM and SAP. Therefore, the set of values and behavioural rules pertaining to the context of the case studies is not as clearly defined as those from the more structured networks in which they are embedded. There are two relevant aspects that can be drawn from this for my research. First, the more structured organizational networks have a clear resistance to change, even though they do provide technical, financial or human support for the initiatives to thrive. Paradoxically, these mechanisms do not motivate creativity and innovation (see Chapter 5, Sub-section 5.4.2, p. 211). Second, individual stakeholders have great difficulty in overcoming such arrangements and innovate, but if they persist, they can be successful.

Projects with stronger and more structured organizational leadership cultures present greater inflexibility in adapting to changes that could have represented improvements in processes or project goals. This is consistent with the views explored in Chapter 2 (Section 2.3.3, p. 67), that these networks embed consolidated mechanisms of trust that maintain a dynamic of control over the entire system. Giddens (1990) argues that one of the reasons for this is the homogeneity of shared beliefs, norms and practices coming from the designed systems. Individuals embedded in these contexts do not very often question these mechanisms, which supports the configuration of these homogenous collective mental images, as illustrated in Figure 65: Loop of mental images reconfiguration based on notions from Bateson, 1979; Giddens, 1990 and Capra, 2002 (Illustration by Author). (p.227; see also Chapter 2, Section 2.3.3, p.67; Bateson, 1979;

Liu *et al.*, 2011; Centola, 2015).

Understanding and recognizing that such patterns exist (Bateson, 1979) can be used to predict the probability of certain difficulties that might surface along with project processes and thus, one is able to plan accordingly (Figueroa *et al.*, 2002; Barabási, 2009).

The project dynamics in Metaprojeto and DEPROTEC were similar, although the organizational culture of Metaprojeto was that of the public sector and DEPROTEC of the civil society sector. However, DEPROTEC was financed by the Federal Ministry of Science, Technology and Innovation and as such there were specific bureaucratic rules to follow; a hint of how powerful the superimposition of the public sector network dynamics is. Even though DEPROTEC was not planned, implemented or managed by individuals pertaining to the public sector, the rules required to receive the financing had a profound influence on project dynamics. Educators could not get the material needed to conduct classes due primarily to the bureaucracy required to do so. Budget requests could only be made above U$1.500 and there was also a formal process to select the provider of the material. However, most material was needed in small amounts and it was cheap too, such as screws or duct tape. More than once educators bought what they needed from their own pockets, as a means to overcome this bureaucratic difficulty.

> *Educator 3*: '(...) the problem is the buying (...) many basic things are inflexible (...) for instance, duct tape, that I use everyday, I can't buy (...) because I need to close an R$5400 budget (*approx. U$1350*) (...) I need a lot of things (...) there won't be a company that will have everything I need, and I can't buy just in one place. And it has to be a one-time buy.[70]
>
> *(Individual Interview, DEPROTEC, 22.07.2012)*
>
> *FS*: 'Equipment now, how is it?'
>
> *Educator 4*:' It not quite good yet, it can get better (...) these markers, there should be more (...) actually I had to buy some from my own pocket (...) it is such

[70] Original:

Educador 3:(...) o problema são as compras, demorou bastante pra montar os computadores (...) muita coisa basica que tá engessada (...) por exemplo, fita isolante que eu uso todos os dias e u nao consigo comprar (...) pq preciso fechar uma compra de R$5400 (...). Eu preciso de muitas coisas. (...) nao vai ter uma empresa que vai ter tudo isso e não o consigo comprar num lugar só, tem que ser uma compra.

a difficulty (...)'[71]

(Individual Interview, DEPROTEC, 24.07.2012)

A similar pattern was observed in the short term case studies in which the organizational structure was predominantly from the public sector, such as IBM Smarter Cities and SAP 4th District. Those were corporate volunteering projects and there was generally little money involved, although due to hierarchical reasons some of their ideas could not be implemented. They well realized that communication was an issue among stakeholders due to the bureaucracy involved:

> '(*Volunteer 2*) was astonished today with the lack of productivity of the Secretary of Environment due to problems that were very easy to solve, such as having all computers and printers connected to a network. In order to print something, he had to go down two stair flights. He was shouting: "so simple, so simple!! Very little cost! Can you imagine how much time they would save??"'
>
> (*Diary Notes, SAP Fala 156 Phase 2, 17.04.2014*)

Sub-section 5.2.1 on *view of project goals* (p. 182) explored how some individuals overcame the constraints imposed by organizational behavioural rules. As an example, in the IBM Smarter Cities project, volunteers foresaw the difficulties the City Hall would have in implementing their macro-level recommendations. After assessing the resources available, they decided to re-arrange the recommendations into a milestone proposal. They called them 'PEBBELS', that ultimately would have long-term and systemic demanding solutions, but they were themselves tangible short-term solutions that would appeal to the City Hall bureaucrats. To this day, this approach has proved useful and some recommendations were implemented and are evolving, such as the open data platform for the city of Porto Alegre (http://www.datapoa.com.br/ in Portuguese, accessed December, 14th, 2015). Porto Alegre has gained over 20 mobile applications developed by third-party companies that help to improve citizens' lives, in areas such as

[71] Original:

FS: De equipamento agora, como está?

Educador 4: Ainda não ta legal, pode melhorar. O wi-fi e a rede aqui do polo é muito precario. (...) (...) acho que deveria ter um armario na sala para guardar o material(...) esses pinceis atomicos, deveria ter mais. (...) inclusive alguns eu comprei do bolso (...)é uma dificuldade, as maquinas não tem até o leitor (de CD), algumas falham...entao até pegar no CRC é uma burocracia (...) ás vezes tu chegava 'eu quero só emprestado só , pra resolver o problema do momento...juro que daqui a uma hora eu te devolvo'...então tem essas burocracias (...)

transportation, health, education and culture[72], which were only developed because of the data made available by the City Hall, through IBM volunteers' recommendations. This reinforces the power that individuals have when critically thinking about the processes they are inserted in, acquiring a view of the whole and then focusing on feasible solutions after a proper assessment of resources, structures and especially, organizational mechanisms available (Capra, 2002, Barabási, 2009).

Emergent networks and Collaborative Action *(p. 245)*		
Main Finding	***Case study specific data***	
Emergence, although it opens the path, does not necessarily lead to innovation, and even less to effective collaborative action. It reinforced Barabási's (2011) argument that the focus should turn to the most connected individuals in the network.	Pilot Metaprojeto	The implementation cluster (educators and volunteers) and end users were highly creative, despite the project being managed through a rigorous structure; feedback cycles were recurrent (Chapter 4, Section 4.2, p. 126). However, the state bureaucracy and hierarchical structures seemed to be hindering agreement on action (see Chapter 5, Sub-section 5.2.2, p.189).
	In-Depth Redes Livres	The Marist Technological Training Complex provided a suitable environment for appropriation of technology and remixing of ideas and technological equipment (Chapter 4, Section 4.3, p. 134). Although similar to IBM Smarter cities in terms of informal agreement, the inexperience of Redes Livres volunteers did not help the loose format of the initiative (Chapter 5, Sub-section 5.2.2, p. 189). They were 80% behind the milestones that they had initially set for the timeframe of 6 months due mainly to lack of leadership, action plan, skills and experience.
	In-Depth DEPROTEC	The Marist Technological Training Complex provided a suitable environment for appropriation of technology and remixing of ideas and technological equipment (Chapter 4, Section 4.3, p. 134). The experienced educators had to find ways to move on with their classes despite their initial difficulties on their own. Despite the highly cohesive implementation cluster depicted in Chapter 4 (see Section 4.4, p. 144), the level of collaboration across modules was low.
	Short Term initiatives	IBM consultants' experience overcame organizational constraints.

Table 46: Main Findings for Emergent Networks and Collaborative Action

[72] For a complete list of the applications developed, access http://www.datapoa.com.br/apps

Designed networks and Collaborative Action *(p 251.)*		
Main Finding	***Case study specific data***	
Stricter behavioural rules bring more stability and at the same time rigidity; even so, Individuals are empowered if they critically think about these processes, acquiring a view of the whole and then focusing on feasible solutions after a proper assessment of resources, structures and especially, organizational mechanisms available (Capra, 2002, Barabási, 2009).	Pilot Metaprojeto	The set of values and behavioural rules pertaining to Metaprojeto's context was not as clearly defined as those from the more structured organizational structure in which the project was embedded; there were specific bureaucratic rules to follow that did not match the project's context.
	In-Depth Redes Livres	The set of values and behavioural rules pertaining to Rede Livres' context was not as clearly defined as those from the more structured organizational structure in which the project was embedded; there were specific bureaucratic rules to follow that did not match the project's context.
	In-Depth DEPROTEC	The set of values and behavioural rules pertaining to DEPROTEC' context was not as clearly defined as those from the more structured organizational structure in which the project was embedded; there were specific bureaucratic rules to follow that did not match the project's context and individuals overcame constraints on their own (e.g. educator's cluster acquiring material from their own pocket).
	Short Term initiatives	The set of values and behavioural rules pertaining to short term initiatives' context was not as clearly defined as those from the more structured organizational structure in which the projects were inserted; especially in the short term case studies in which the organizational structure was predominantly from the public sector, such as IBM Smarter Cities and SAP 4th District, there were specific bureaucratic rules to follow. IBM Smarter Cities overcame this by acquiring a view of the whole and then focusing on feasible solutions after a proper assessment of resources, structures and especially, organizational mechanisms available.

Table 47: Main Findings for Designed Networks and Collaborative Action

6.5 Conclusion

Section 6.2 has argued that active and independent collaboration between nodes of the network is considered positive for a system's survival, if a systemic view is embraced by top decision-makers. Section 6.3 has explored the formation of meaning within the initiatives observed. It attested that if the qualitative approaches are used to bring the communication feedback cycles to the surface, such knowledge can positively influence stakeholders and the dialectical movement of *network structure* and *communication level*. Section 6.4 explored whether stakeholders' understanding of the context they were inserted assisted in a more effective collaboration. It was found that emergency is a good start, but it does not necessary leads to innovation or effective collaborative action and that strict behavioural rules although bring more stability; at the same time bring rigidity. However, if individual stakeholders could identify recurrent patterns that were harming or harnessing the project processes and the collectively agreed goals, they should be able to tackle these communication issues and act on it autonomously, thus consciously directing the system's self-organization accordingly (see IBM Smarter Cities solution, p. 251). As such, this chapter has addressed the second of this research's main questions:

> *What role do individual actions play in forwarding or hindering effective collaboration at the unfolding network interaction patterns of ICT4D initiatives?*

Hardy *et al*. (2005) argue that to construct such a collective identity and translate that into synergistic action is such a challenge because it requires a big shift in our frame of reference. Furthermore, it requires a change in conventional mental models usually present in many organizational structures. In my case studies, for example, I realized now that what I was really asking from project managers was such transformational changes; hence some of the tensions I ended up facing while in the field (See Chapter 4, Sub-section 4.4.2, p. 145). Moreover, as argued by Southern (2015), transformational change is a creative process.

Having the above in mind, the next chapter concludes with an overview of the main theoretical, methodological and empirical contributions that this research has made. These contributions have led to a four stage set of useful guidelines supported by the findings of this research (p. 273). I also proffer some personal reflections regarding my own development as a researcher and the main challenges and constraints of dealing with such subjective and complex themes. The chapter ends with an account of my recommendations for future research and the epilogue.

7 A systems approach to understanding ICT4D partnerships in Brazil: Contributions and Final Reflections

The main goal of this research was to contribute to the work of practitioners, researchers and decision-makers within ICT4D initiatives who are interested in creating effective collaborative environments between project stakeholders. If on the one hand, technology offers the opportunity for better and improved communication, on the other hand it has also meant that many people are losing the ability to connect and communicate with each other in a meaningful way, leading to an increasing decline in trust between individuals (Southern, 2015). The perspective adopted here has been that if ICTs are to be used to help reduce poverty, they should be developed within a framework that takes into consideration how complex and unpredictable the interactions are between the diverse stakeholders involved in such processes, and at the same time, integrates sustainability and on-going critical assessment approaches together within a systems framework (Capra, 2002; Chambers, 1997; Pamlin, 2002; Slater *et al;* 2003; Lenni *et al.*, 2015).

This research began with an interest in the power of ICTs to act as catalysts for effective collaborative action between ICT4D stakeholders. However, the action research character of this thesis brought to surface the need to focus on the core of communication as dialogue, before focusing on ICTs as a means to improve communication for effective collaborative action. The conceptual framework laid out in Chapter 2 (p. 41) remained the same throughout this research and minor adjustments were made on methodology after an initial assessment of its efficacy on the ground. The adjustments concerned mainly the number of network maps that were developed throughout the projects' life cycles and a shift to a heavier focus on the *communication level* dimension of the systemic view (Chapter 4, Section 4.8, p. 161).These adjustments have amplified the reach of the set of useful guidelines I suggest on Sub-section 7.4 (p. 273), and it is hoped that they can also be used in contexts other than ICT4D initiatives.

Nevertheless, ICT4D initiatives should have the potential to act as benchmarks for guidelines in effective collaboration. It is because of communication technologies that the networked society has seen such an expansion (Castells, 1996; Benkler, 2006) and so has the advocacy of a new collaborative and creative economy that takes into account

the need for a more meaningful life connected to a greater whole (Varela *et al.*, 1992; Capra and Luisi, 2014). ICTs have been fostering the newest of such developments, as exemplified by the increase in cloud services government transparency tools and the efficacy of peer-to-peer collaboration (see Sub-section 7.5, p. 282). ICT4D initiatives have the advantage that they can benefit from these developments in order to take collaboration to another level.

This thesis began in Chapter 1 (p. 16) by highlighting the core focus of the research, namely communication within Brazilian ICT4D partnerships. Chapter 2 (p. 41) then described the conceptual approach, a combination of a systemic approach and complex network theories, focusing on the emergence of behavioural patterns of interaction and the effect of individual actions on these interactions. Chapter 3 (p.76) operationalized this research's conceptual systemic approach and explored the qualitative methods used to generate empirical evidence. Chapter 4 (p. 125) focused on the first dimension of this research, namely the *Network Structure*. It provided the context of the case studies and described their respective organizational and individual networks. Chapter 5 (p. 181) analysed the *communication level* dimension and directly addressed the first fundamental question of this research:

> *What are the relationships between network topologies and communication processes within Brazilian multi-stakeholder ICT4D initiatives, and why do they function as they do?*

Drawing from the findings of the previous chapters, Chapter 6 (p. 225) focused on the *Content: Knowledge and Information Exchange* dimension as processes of formation of meaning and context. It further analysed mechanisms that individual stakeholders embraced that assisted in forwarding effective collaborative action within the case studies observed, thus addressing the second main research question:

> *What role do individual actions play in forwarding or hindering effective collaboration at the unfolding network interaction patterns of ICT4D initiatives?*

This chapter addresses the main theoretical (Sub-section 7.1,p. 261), methodological (Sub-section 7.2, p. 267) and practical (Sub-section 7.3, p. 270) contributions of this

research, leading to a four stage set of suggested guidelines for effective collaborative action (Sub-section 7.4, p. 273). These sections are followed by an account of the main overall challenges and constraints faced during the research process, as well as recommendations for future research and an epilogue.

7.1 Theoretical contributions

'The ability to perceive or think differently is more important than the knowledge gained.' (David Bohm)

As argued by Checkland (2000:19), 'the core systems image is that of the whole entity which can adapt and survive in a changing environment'. As such, there were two main objectives for drawing on systemic approaches to address the issues of this research: first and foremost, the 'sense-making' of the relationships observed; second, the gathering of insights for action -taking. The analysis within this thesis illustrated five main theoretical contributions that I would like to address in this section.

First and more broadly, this research has reinforced the value of a systemic approach that supports more participatory and inclusive models of social organization (Hammond, 2002; Jackson, 2003; Kapsali, 2011). At the *2001 Annual Conference of the International Society for the Systems Sciences*, Hammond (2002) asked participants through which theoretical context they have been introduced to systems thinking and also which thinkers were most influential in the evolution of their understanding of the discipline. The answers were so rich and diverse that, although it is far from becoming a consolidated discipline, the fact that the concepts and ideas are pulverized through so many disciplines, approached by so many influential thinkers and have, time after time, led to new insights, is a testament to its complexity, vitality and perhaps the reason why it is has not been abandoned (Checkland, 2000; Hammond, 2002).

Contemporary systemic thinkers argue that within systems thinking, one should pick a system model according to one's own views and purposes (Checkland, 2000; Hammond, 2002; Jackson, 2003). Following this premise, I assembled my theoretical framework by combining the systemic view of Maturana and Varela's (1992) biological systemic dimensions of structure, process and form with Capra's (2002) subjective and social dimension of meaning. Bateson's (1979) emphasis on the relevance of context within

systems thinking and Luhmann's (1995) concept of communication as the basic building block within social systems, have complemented the approach to ICT4D partnerships in which I was interested (see Figure 69 for reminder purposes).

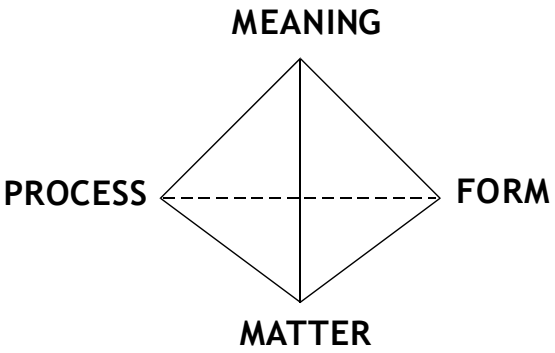

Figure 69: Capra's systemic understanding of life in the social domain (2002, p. 74)

This systemic view of life in the social domain assisted in the systematization of the process of analysis by bringing the subjective issues with which this research is concerned to a more objective level, by identifying structure, process, content and meaning during the data coding process. Such focus on different systemic dimensions could have been translated into a hard systemic theoretical framework. However, the context of human behaviour as a component left these dimensions in the background as guiding principles, since the liquidity of the communication processes made it difficult to grasp empirical evidence in such separated components. These concepts then guided me throughout the research process even if the subjects of this research were realities continuously and socially constructed and reconstructed by individuals and groups (Bateson, 1979; Checkland, 2000; Capra, 2002). As such, I am certain that things are different today and the particular analysis of each case study would have to be updated. This reinforces the relevance of continuous and conjoined iterations and evaluations of ICT4D initiatives, as argued by Lennie *et al.* (2015).

Second, the combination of approaches used in this research reinforced the relevance of a conceptual holistic framework to deal with issues of communication (Lennie *et al.*, 2015). For instance, complex network theory concepts supported the views drawn from the systemic approach. The emergence of the scale-free properties in network

structures of biological mechanisms, in the internet or in large social network sets (Barabási, 2003; Centola, 2015) provided evidence of common patterns found in social networks, such as the clustering effect. The systemic view combined with the emergence of the clustering effect allowed for a more objective observation of social network configurations and components tending to a state of self-organization, as a result of their communication feedback cycles (Von Bertalannfy, 1977; Luhmann, 1995; Capra, 2002). These recurrent communication feedback cycles reinforced patterns of behaviour which in turn suggested that it might be possible to redirect such communication feedback cycles. This has contributed to the relevance of communication as the interaction element for analysing network formation and processes outcomes as discussed by Luhmann (1995). It also confirms that there is a need to address such issues especially in a world that is working increasingly in a networked fashion (Benkler, 2006). Figure 70 below highlights two stages of the emergence process of new meaning through collective creativity advocated as the systemic approach of this thesis (see Chapter 2, Section 2.2.1, p.50), updated according to findings. The feedback loops of the system become a more conscious process as there is more iteration among stakeholders regarding project goals. As stakeholders acquire a more conscious view of the system as a whole, the new information which will change the form of the system is more meaningful to stakeholders, allowing for more conscious feedback loops.

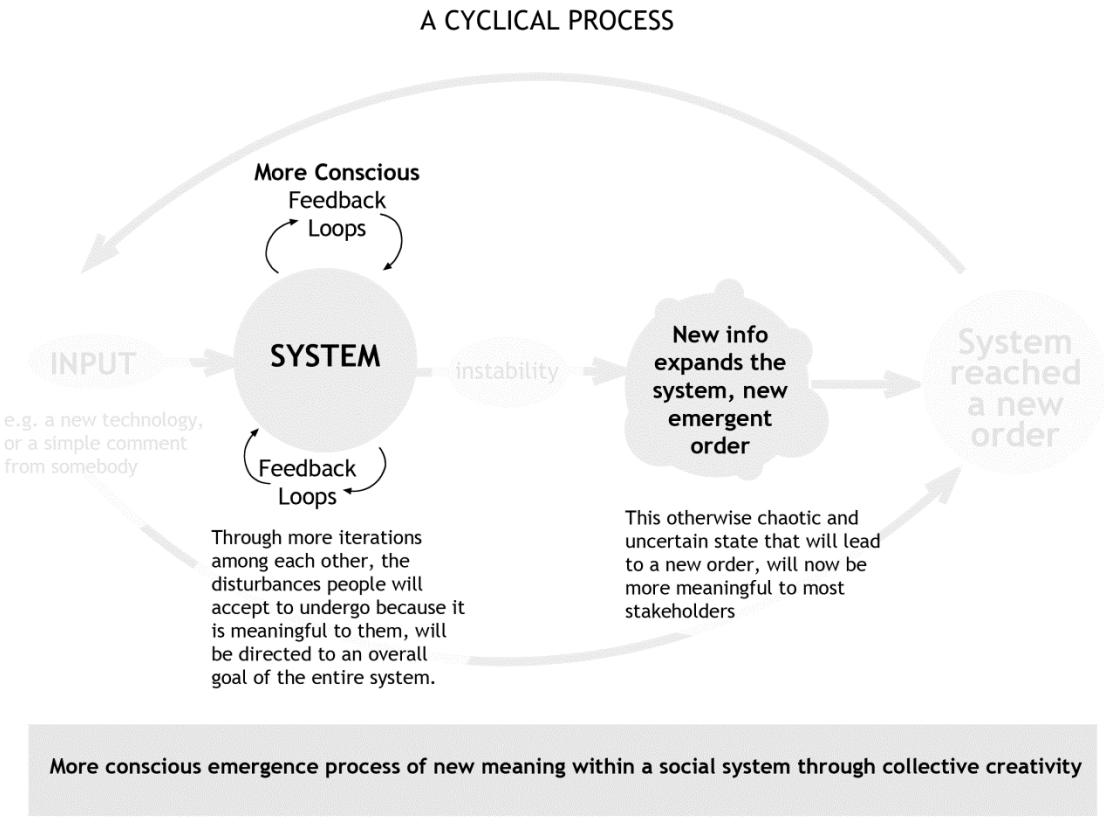

Figure 70: Updated *emergence process of new meaning* desired, according to the findings of this research.

The hope is that the process above will create a more democratic logical typing calibration feedback ladder (Bateson, 1979), in which both realms (organizational and individual) influence each other. Figure 71 below illustrates the process of mental images looping updated according to this process. In this new vision, individuals both from the emergent process and individual pertaining to the realm of the disembedding mechanism (e.g. main decision-maker) iterate so, that trust now is mutual, and not unidirectional; that is, from the individual pertaining to the emergent process to the disembedding mechanism. Mental images and symbolisms created within all layers of these systems would influence each other mutually.

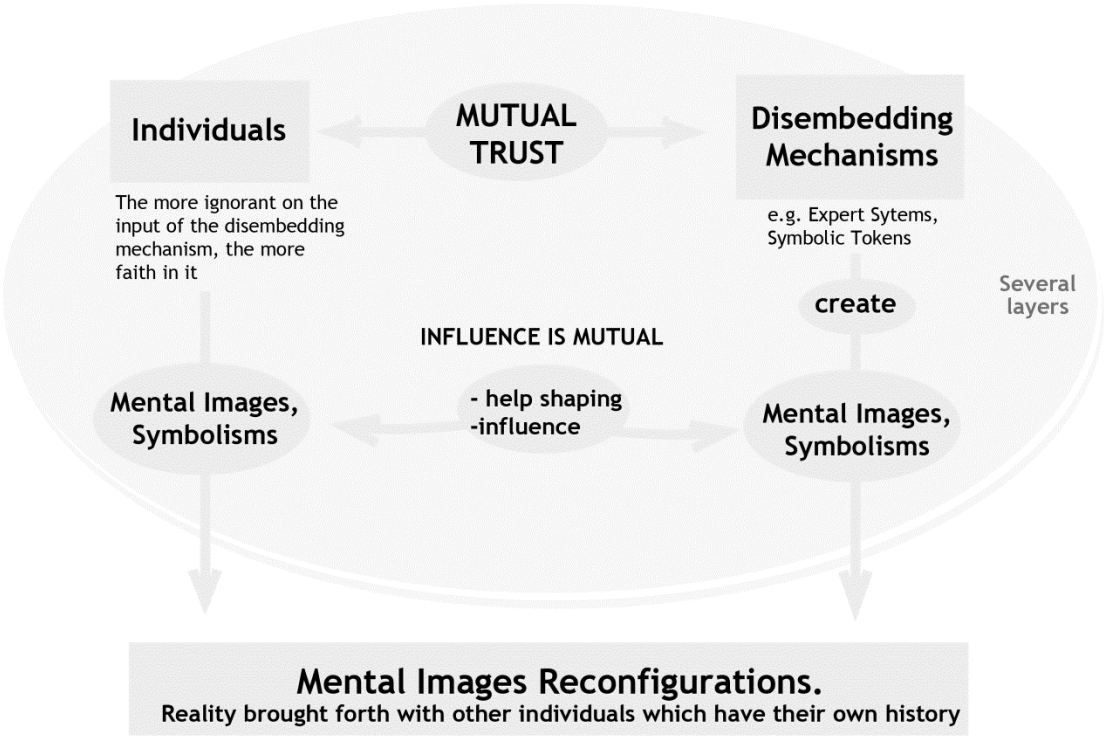

Figure 71: Updated *loop of mental images reconfiguration* desired, according to the findings of this research.

The main new understanding of the systemic approach that is emphasized here is the necessity of the decision-maker to become a connector. Hard systemic approaches and methodologies aimed at offering control to the manager over the system and later developments advocated the necessity of multi-stakeholder views and the messy nature of ICT projects (See Chapter 2, Section 2, p. 41 and Chapter 3, Section 3.3, p.85). The data analysed here suggested the need for an articulator who does not play the role of controlling the system, but to offer the necessary flexibility and understanding that unpredictability is part of the process. In regards to collaboration on ICT4D initiatives, data has highlighted the need for constant iteration and reinforced the importance of enabling individual's sense of purpose. Another point is to consider literacy and ownership as key, so to avoid that disembedding mechanisms influence the system at such a high level, hindering individual's autonomy, which is a key factor for innovation and creativity.

Third, as argued by Southern (2015), not much research regarding communication has yet been done in the field of collaboration. My research has therefore been an endeavour to synthesize the effects of the human interactions on the initiatives' processes and to embrace the multiple perspectives held by different stakeholders. The

latest developments in systemic approaches within ICT4D initiatives (Turpin and Alexander, 2014) embrace many of the issues with which this thesis has been concerned, namely a focus on the relationships of the parts and how these relationships affect the result of the whole, as well as the relevance of context and of multiple-perspectives. This conceptual framework was assembled so as to allow for individuals to influence the communication processes or at least be aware of them and help forward the fundamental structural changes needed, provided the objective is to forward collaboration. There are project managers, though, who embrace competitiveness as a means to reach more productivity instead of embracing team learning approaches (Southern, 2015), and in such contexts, the conceptual approach suggested here is not suited.

Fourth, one recurrent critique with systems thinking approaches has been that it ignores the observation that parts can have an effect on system's outcomes by focusing on the relationships as the causes of the results seen in the whole. My research reinforces an interplay that should be considered between acknowledging the influence of the relationships on outcomes and the transformational roles that individual nodes can also play. As Bateson (1979) argued, it matters which individual acted as the nucleus for change.

Last and from a more personal perspective, this theoretical framework has allowed me to gain perspective of the whole, which is what I was primarily interested in. It allowed me to see the dialectical movement of the three systemic dimensions of form, process and content shaping each other recurrently. This continuous process led to the realization that it is not an issue of which approach is more adequate, or whether flat or hierarchical network is more effective, or indeed if a collaborative or competitive culture is more effective. Rather, it is a matter of being transparent on what the rules actually are. If such processes are indeed clear for stakeholders involved, then the chances for better decision-making and action are greater.

7.2 Methodological contributions

According to Checkland (2000), the methodological principles of an open systemic approach consists of social inquiries which aim to bring about improvement in areas of concern by articulating a learning cycle (based on systems concepts) that can lead to action. The core idea is not to produce answers, but to enable better outcomes than would be the case without these methodological principles. According to him, if such methodological principles are clearly expressed, then it is easier to pick which methods are needed. Following this premise, my process of inquiry was drawn from the systemic view expressed in the conceptual framework and the proxys used within that process were embedded within that systemic view. There are four main methodological contributions of this approach that I address in this section.

First, the combination of a variety of qualitative methods used throughout this research provided different views and perspectives on the systemic aspects of the initiatives. I was able to explore behaviours and opinions both at an individual and collective level, through individual semi-structured interviews and focus group discussions respectively. This reinforces Kapsali's (2011) argument that systemic methodological principles can complement conventional methods for project management, since they suggest different levels of analysis.

However, soft systems and critical systems thinking methods are usually applied in an action research fashion involving a plurality of methodologies coming from the discipline itself and also borrowed from other disciplines. Specific soft systems and critical systems methodologies are very detailed and complex to apply, and research undertaken has usually employed a whole team for data collection and analysis, due to the complexity of the endeavour (see for instance Andrew and Petkov, 2003; Petkov *et al.*, 2007; Gunawardena and Brown, 2007; Turpin, 2012; Turpin and Alexander, 2014).Checkland (2000) also argues that there is a need for experienced researchers to employ these methods. In this light, a second contribution of my research was to employ standard participatory ethnographical methodologies, but following the systemic methodological principles assembled through the conceptual and methodological chapters of this research. The research methods used proved to be adequate to the purposes of this research, as they are simpler and individuals pertaining to the initiatives themselves can

be easily trained in such methodologies in order to incorporate them in future project processes.

Third, this research has contributed to the methodological debate that advocates holistic premises. Systemic approach critics claim that the discipline is not mature yet. However, many advocates claim that fragmentation is at the core of holistic and creative enterprises (Varela et al., 1992; Capra, 2002; Hammond, 2002; Barabási, 2013). I do not argue with any of these claims, because my intention was never to claim that systems' thinking is the 'right' methodological approach. Indeed, many other approaches are increasingly claiming the same systemic premises as I did throughout my research and reaching deep into more qualitative aspects of project processes (Lennie *et al.*, 2015). I was happy to see for instance the recent work of Lennie and Tacchi (2013) on the framework for evaluating C4D (Communication for change), depicted in Figure 72 below. Their framework is a combination of related methodologies that rely on concepts also embraced by systems thinking, such as participation, emergency, complexity, learning and context. Perhaps ICT4D initiatives and systems thinking can follow the same path. Soft systems methodologies are too complex to be applied by non-experienced researchers (Checkland, 2000), but these methodological principles can be combined with simpler and already established methods of action research and participatory evaluation. During my in-depth case studies, the focus group discussions were always welcomed by participants, for two main reasons as expressed. First, the discussions were inclusive, and people who would not normally interact, did. Such an approach extended the objective of gathering data for my research only. In many cases the method encouraged participants to discuss things further and take the interactions beyond my intervention. Even if some stakeholders were sceptic at first, many of them also mentioned that it was a fantastic convergence, which reinforced the relevance of building an evaluation culture together with all stakeholders (Hardy *et al.*, 2005; Lennie *et al.*, 2015; Southern, 2015)

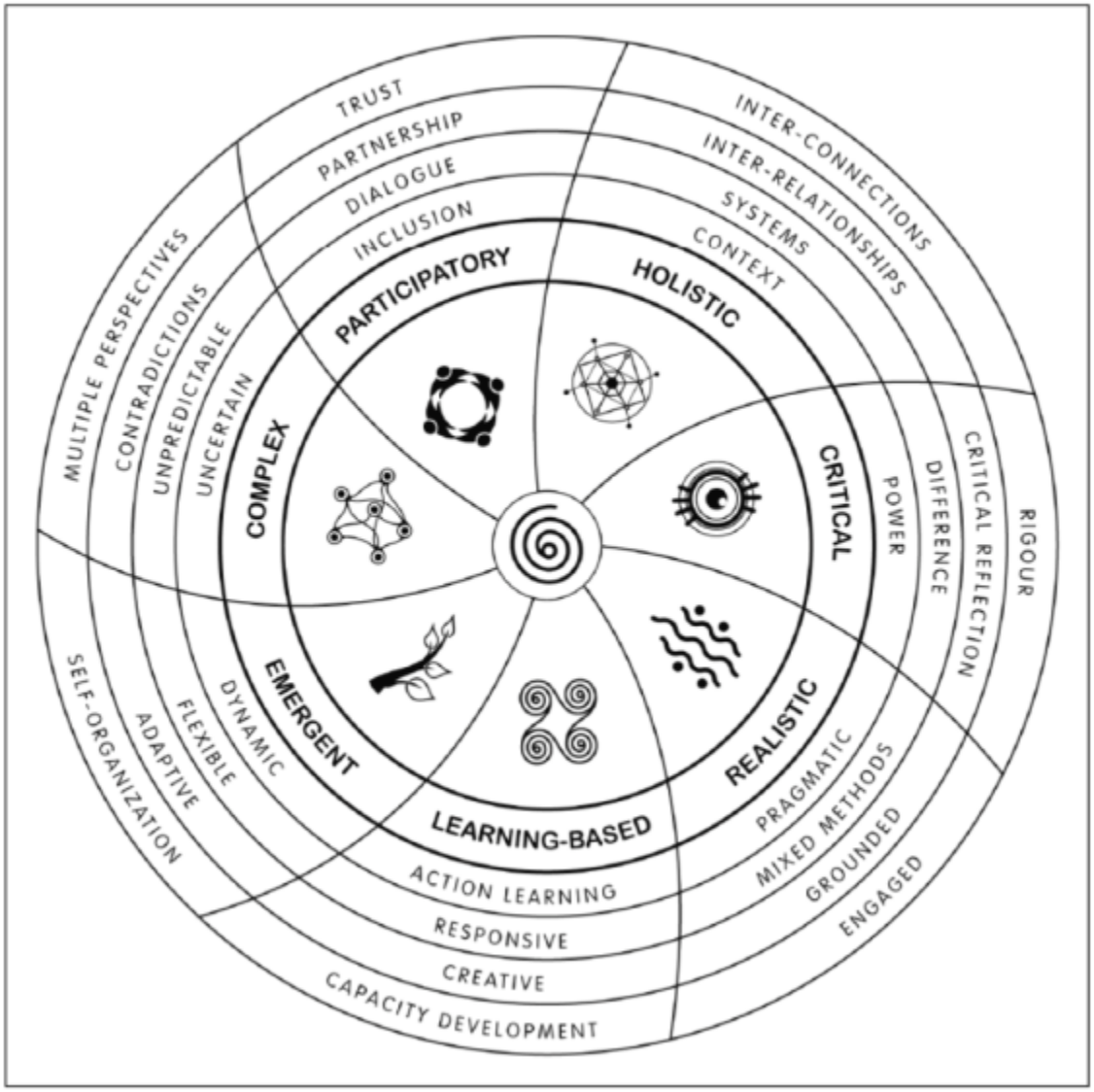

Figure 72: Key components and concepts in the framework for evaluating C4D (from Lennie and Tacchi, 2013: 143)

Stakeholders who were responsible for making things happen agreed on the importance of understanding both the connections and contexts in which they were inserted. Over and above this, they agreed on the value of understanding the reality of the other. This is about creating of a culture of empathy. In order to be empathetic, it is necessary that we are receptive, predisposed to know and understand the other, his/her ideas and convictions. My research showed that emergence alone does not lead to innovation. Therefore, to be empathetic is relevant in the process of innovation, as it allows us to be free from our rigid and repetitive patterns. Empathy does not necessarily mean being similar to the other, but it is rather the opposite. It is to stimulate our curiosity to understand and be receptive to differences. This methodological framework has allowed me to be more empathetic towards the realities I observed and hopefully it did the same for the stakeholders involved in the participatory methods.

A last methodological contribution of this research concerns the use of SNA methods to map existing organization structures, a 'primary task' of such models (Checkland, 2000). Most complex network models will produce 'photographs' of the networks at a given time in space and as such it is difficult to measure relationships and behavioural formation qualitatively (Recuero, 2005; Barabási, 2011; Centola, 2015). The combination of this method with the three systemic dimensions observed through a dialectical mechanism and not as isolated entities, revealed organizational patterns which facilitated replication of the analysis across case studies (Clark 2006).Moreover, as a part-time researcher I could take a much longer term perspective during my in-depth case studies than if I had just been in Brazil for 6-12 months. This has provided me with a very special and deep perspective of the case studies observed which have contributed enormously to my analysis.

7.3 Practical contributions

> 'Coming along with a process which challenges world-views and shifts previously taken-as-given assumptions, we should remember that this can hurt (...)'
>
> (Checkland, 2000:35)

> '(...) organizational capacity building is a process that "evolves over a number of years [and] the development and maintenance of good working relationships between the various parties involved (...) is crucial to its overall success". This stresses the communicative and relational aspects of evaluation and (...) effective dialogue and interaction is a key feature of the process. (Lennie *et al.*, 2015)

The main practical contribution of this thesis has been to fill the gap noted by Southern (2015) with respect to evidence regarding communication processes within ICT4D initiatives. This thesis has therefore for the first time provided detailed empirical evidence about such processes within Brazilian ICT4D partnerships. The focus has been to improve such communication processes, so that organizations are able to leverage differences and aim for innovative and synergistic solutions that they could not otherwise achieve on their own (Hardy *et al.*, 2005). My initial intention was to focus both at the organizational and individual levels (Chapter 3, Section 3.2, p. 76). However, as data reinforced some of the usual mechanisms within Brazilian management practices in ICT4D partnerships (see Chapter 1, Section 1.3, p. 25 and Chapter 5, Section 5.4, p.

207), this showed that transformational change has to come first from within organizations, before it can focus on the organizational partnership.

A second relevant contribution concerns the boundaries of the social systems observed. Network mapping structured the organizational boundaries and showed that networks were usually 'divided' by clusters regarding their role within the project (see Chapter 4, p. 125), reflecting the clustering effect principle of scale-free network topologies (Barabási, 2003; Wang and Chen, 2003; Centola, 2015). This depiction, when discussed with participants, was helpful in stimulating discussion and debate, and participants often questioned the existing situations (Checkland, 2000). At this moment, boundaries of meaning cut across the more rigid organizational boundaries, and more meaningful discussions started taking place, such as the possibility for module interaction at DEPROTEC (see Chapter 6, Sub-section 6.4.1, p. 245).In many of the networks observed, the quality of communication was uneven even if the links were there, and this boundary-crossing was a shy movement towards a more balanced network. It is undeniable that in such interventions, resources and interests, as well as different philosophies, power and politics will have a significant impact on the systems. Therefore, according to Checkland (2000), instead of trying to optimize the system toward a fixed goal, the intention is to discover, and learn how to build in design features necessary for the survival of these systems. This brings then a third practical contribution of this thesis, which is its emphasis on the crucial importance of the decision-maker, the owner of the process. These actors have to step down, connect, listen and communicate.

Table 48 below summarizes the contributions of this thesis in the three realms:

Main Contributions of this Research	
Theoretical	- Reinforcement of the value of a systemic approach that supports more participatory and inclusive models of social organization; - The combination of approaches used in this research (systemic and complex network theories) reinforced the relevance of a conceptual holistic framework to deal with issues of communication; - As argued by Southern (2015), not much research regarding communication has yet been done in the field of collaboration. This research contributed to synthesize the effects of the human interactions on the initiatives' processes and to embrace the multiple perspectives held by different stakeholders - Reinforcement of the need for interplay between acknowledging the influence of the relationships on outcomes and the transformational roles that individual node can also play. - The theoretical framework assembled allowed me to see the dialectical movement of the three systemic dimensions of form, process and content shaping each other recurrently and it reinforced that there is no right way, but it is a matter of being transparent on what the rules actually are.
Methodological	- The combination of a variety of qualitative methods used provided different views and perspectives on the systemic aspects of the initiatives; - Standard participatory ethnographical methodologies that follow the systemic approach presented here can be more productive than complex soft or critical systemic methodologies that are hard to implement and require experienced researchers; - The methodological debate that advocates holistic premises has been reinforced; - The combination of Social Network Analysis with the three systemic dimensions observed through a dialectical mechanism and not as isolated entities, revealed organizational patterns which facilitated replication of the analysis across case studies.
Practical	- This thesis has provided for the first time detailed empirical evidence about communication processes within Brazilian ICT4D partnerships, addressing the gap noted by Southern (2015); - Boundaries of meaning were cut across the more rigid organizational boundaries, and more meaningful discussions started taking place as a result of participatory methodologies employed; - The crucial importance of the decision-maker, as the owner of the process, in instead focus on the system's fixed goal, focus on learning how to build in design features necessary for the survival of these systems.

Table 48: Summary of the main contributions of this research

Based on the findings and contributions discussed so far, Section 7.4 assembles a set of useful guidelines for effective collaborative action, supported by a process which embeds constant learning as a *sine qua non* condition.

7.4 Starting a learning process

This research's findings and contributions have led to the assemblage of a set of useful guidelines for effective collaboration, as envisioned at the start of this research. This thesis has explored the network dynamics of Brazilian ICT4D initiatives through an open systemic approach, focusing on communication as the driving force of these dynamics. In Chapter 2 (Section 2.3, p.59), a dualistic categorization was made for simplification purposes. The networks observed were either considered to be *emergent* or *designed*. Behavioural patterns influencing one or other structural arrangements were explored through the analytical chapters. Moreover, it was acknowledged that organizational and individual network structures overlap and this complexity made it difficult to uncover pattern similarities among the initiatives observed. The findings exposed in Chapter 5 (p.181) and Chapter 6 (p.225) mostly reinforced established views on communication processes that hinder or forward collaboration.

The relevance of the individual nodes was a key element that stood out across all of the case studies, regardless of what organizational patterns were there. The networks I was able to build together with stakeholders were the most accurate ones, showing a higher number of nodes and more truthful linkages among them (Chapter 4, p. 125). It was possible to see in these networks, namely Metaprojeto, DEPROTEC and Redes Livres, the presence a scale-free topology property: the emergence of clusters (Barabási, Wang and Liu, 2011). Moreover, my qualitative data collection showed that the communication between clusters was not satisfactory through (see Chapter 5, Section 5.4, p. 207) and that there is an important need to work on the quality of the communication between network clusters.

In order to continuously exercise mutual empathy and mutual understanding of each other's contexts and mental models, a key mechanism that should be embraced is sharing individual aspirations, as well as individual interpretations of project processes. This argument is reinforced by the increasing acceptance of focus group discussions by the stakeholders in my research. Despite some initial concerns, ultimately they viewed them as something positive that broadened their views of the whole, improved mutual understanding and provided an energy boost. Most of the times there was initial resistance to the method, but the aftermath was an increasing sense of mutual

understanding regarding the individual reasons behind people's efforts. This increased mutual trust, which was then translated into a sense of collective purpose that motivated people to dedicate more of their energy into collaborating together. Unfortunately, these learning processes were not embedded in the culture of the projects I observed. The energy boost would generally fade away as conventional processes took over after my research interventions.

Bateson (1979) argued that changes within systems are stochastic in nature. It is up to individuals to make the effort to understand the partnership mechanisms so as to achieve autonomy toward these processes, despite internal or external factors influencing them (see also Barabási, 2009; Kapsali, 2011). The focus should be to empower stakeholders to learn as a team and collaborate together, rather than finding an optimal partnership format or mechanism, as proposed by Checkland (2000). Within this perspective, my research suggests that there were four main aspects that could be useful if the objective is to foster collaborative action.

First, individual's views should be assessed at the beginning of project implementation (see also Figueroa *et al.*, 2002). This helps to diminish potential interest conflicts. Second, it was clear that organizational partners have a strong influence on an initiative's processes, reinforcing the discussion on designed networks made earlier (Chapter 2, Sub-section 2.3.2, p. 64; see also Giddens, 1990; Capra 2002). Thus, it is crucial to clarify organizational partners' roles to all individuals, as well as to be clear and transparent regarding established social norms (Figueroa *et al.,* 2002; Capra, 2002; Vaccaro and Madsen, 2009). Stakeholders feel empowered when they understand the institutional relationships into which they are inserted. Third, it is important to have mechanisms that improve collective self-awareness as this boosts motivation. However, it is also crucial to provide clear steps for action (Germani, 2011; Capra and Luisi, 2014). Last, setting short time milestones within the greater and overall goal of the project creates a sense of tangible realization that also motivates stakeholders.

Useful Guidelines to foster collaborative action
• **Individual's views should be assessed at the beginning of project implementation**
• **Clarify organizational partners' roles to all individuals, as well as to be clear and transparent regarding established social norms**
• **Mechanisms that improve collective self-awareness and clear steps for action**
• **Setting short time milestones within the greater and overall goal**

Table 49: Useful Guidelines to foster collaborative action drawn from the findings of this research

The above aspects concern a deep transformational change that many organizations and individuals are not prepared to embrace (Southern, 2015). One important objective during my field research was to apply participatory methodologies to assist in initiating such cultural change from conventional and closed project management to an open learning cycle. As argued by Kapsali (2011:399), 'the purpose of a measurement system (...) should be to help the team cope with, rather than just to help top managers monitor the progress of the processes'. Therefore, instead of using complex soft systems methodology tools, I used simpler action research tools that individuals pertaining to the initiatives themselves can easily be trained so as to incorporate them in project processes. The methodologies used in this research can complement conventional methods for project management, providing a systems thinking approach that suggests different levels of analysis, as discussed by Kapsali (2011:399):

> '(...) first, it (*systems thinking*) suggests different levels of analysis and synthesis for different problems — from the activity to the supra-systemic (hierarchy). Second, systems thinking complements reductionism (the belief that everything can be reduced to individual parts), analysis (breaking down a system to its smallest components), cause and effect thinking (environment-free, linear without circular feedback loops, closed boundaries), and determinism (delusion of complete control) with complexity (a sub-system of a larger plan), synthesis (explaining the whole system in terms of the functions and the relations between parts), circular causal effects (explaining environmental influences, enactment and feedback- open boundaries) and indeterminism (emergence and probabilistic thinking) (Pourdehnad, 2007; Söderlund, 2004;Capra, 1996; Yeo, 1995). Third, systems thinking is a conceptual framework which can utilize different theories, tools and techniques to help construct holistic, contingent perspectives and practices (Joham et al., 2009; Pourdehnad, 2007).'

Moreover, project managers and decision-makers should be the first to embrace a partnership learning process. Complex network theorists argue that the higher level nodes play a key role in setting the pace and bringing the other nodes of the network close to each other (Barabási, 2003; Wang and Liu, 2003). In the case of the initiatives observed these nodes were usually project managers and coordinators. At the beginning of my field research, I quickly convinced these project managers and coordinators of the usefulness of a systemic research approach. However, as time went by and my research lost momentum , as it demands time and energy from stakeholders (see for instance DEPROTEC's methodological constraints on Chapter 4, Section 4.4, p. 144), project managers quickly disconnected themselves from this line of thinking and focused on conventional project management processes. A suggestion to address this issue if project managers still want to embrace a team learning environment is to have a facilitator at early stages of the initiative to assist project managers with participatory techniques. This facilitator could also capacitate key individuals in applying the methods chosen. This is similar to the role of the *catalyst* in Figueroa *et al.*'s (2002) communication for social change model.

According to my findings, and reinforcing Germani's (2012) arguments, project managers should not employ these methodologies just to be aware of network topologies and communication processes, but they should also provide clear steps for collaboration based on the analysis they make. The effort to create a learning process for effective collaborative action should come from decision-makers. This means that they have to understand the implications of letting go of control (Jackson, 2003), an issue not directly explored in this research (see Chapter 7, p. 282 for further research). A capacitated project leader could truly motivate collaboration by detecting what might forward collective action and project ownership in a particular context, as well as assist stakeholders in the administration of the new knowledge that they are acquiring (Figueroa et. al, 2002; Germani, 2012). Project leaders and decision-makers need to start a process of connecting with the realities of the individuals belonging to the implementation clusters. It is relevant to account for the unpredicted processes and outcomes at the individual levels if the aim is to think critically about how the partnership could be improved.

Moreover, if the nodes of the network are equipped with a deeper knowledge of each other's contexts they can help project managers as they will be better able to engage in collaborative action and acknowledge what combinations of factors could be hindering or forwarding project dynamics (Bateson, 1979; Barabási, 2009; Capra and Luisi, 2014; Southern, 2015). To sum up, suggestions of useful guidelines for effective collaborative action have to consider two pre-requisites that are necessary for greater chances of success. First, project managers or decision-makers should be effectively on board regarding creating a learning environment, and second, a set of useful guidelines has to account for the fact that such initiatives usually do not dispose time to invest in such mechanisms. The challenge is to assemble a set of practical suggestions.

In an attempt to do so, Figure 73 below comprises a four stage process of useful guidelines for effective collaborative action based on the findings of this research.

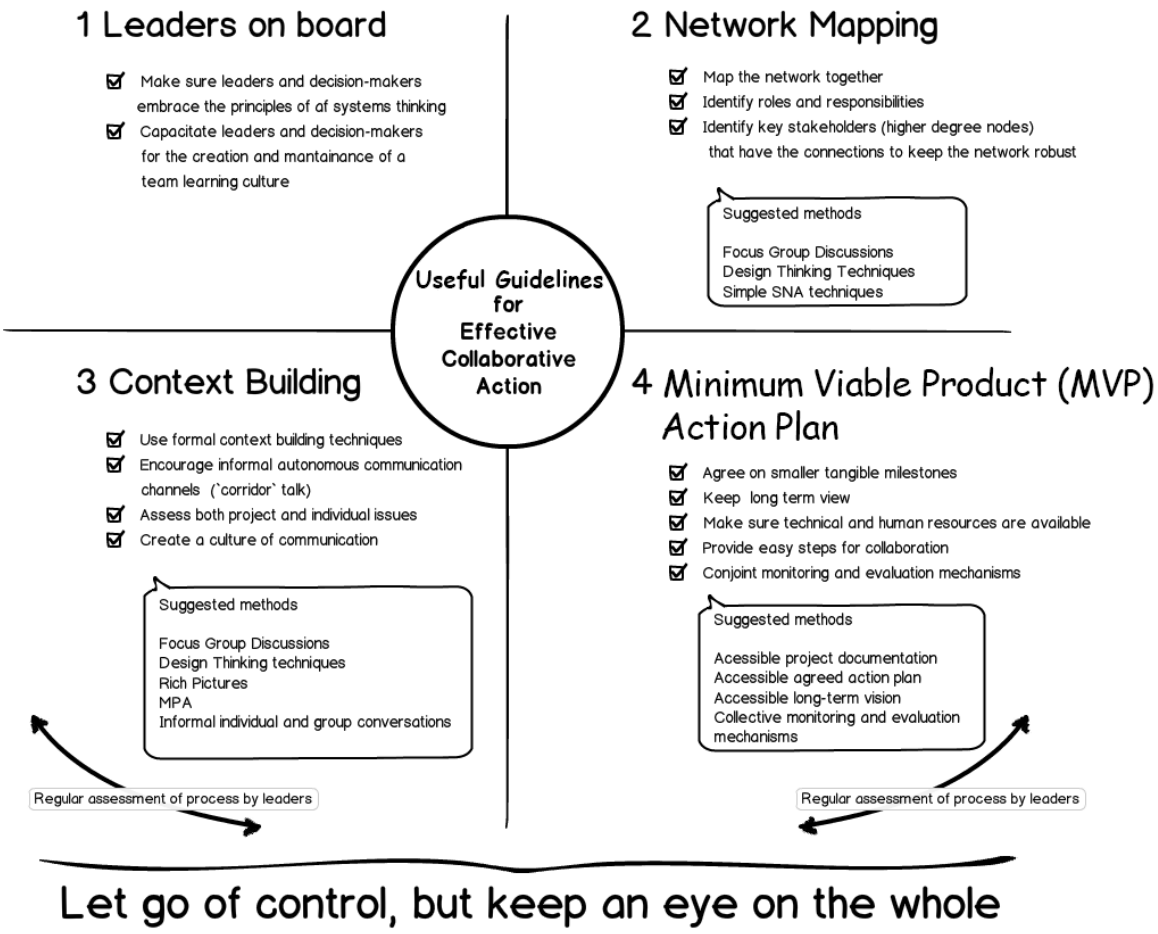

Figure 73: Set of useful guidelines for effective collaboration generated from the contributions of this research.

At Stage 1, efforts are directed in bringing to surface to decision-makers the relevancy of a systemic approach for creating collaborative environments. A common pattern found in all case studies was that decision-makers are usually the highest degree nodes (see Chapter 4, Section 4.8.3, p.172). As such, they have the privileged position of acquiring the most holistic view of the system and consciously act as a *connector node* (Barabasi, 2002). However, the quality of the communication between these nodes and implementation clusters was usually not satisfactory. To bring back an example, data collected from interviews and focus group discussions showed that the quality of the communication between one of the coordinators of Metaprojeto, a crucial decision-maker, and Metaprojeto's most active nodes was not satisfactory, despite being depicted as the most connected node (see Chapter 5, p. 181). Project coordinators, educators and volunteers were struggling to emerge in the dense organizational structure of the project and suggest or implement their ideas; the main coordinator was not acknowledging nor acting on this. Also, perceived project constraints differ according to the position of the nodes in the network, as illustrated well by Redes Livres and DEPROTEC (Chapter 5, Sub-section 5.2.2, p.189). The further a stakeholder was from the implementation cluster, the easier it was to smooth problems over. If a project coordinator consciously acknowledges perceived constraints across network clusters, this might assist better decision-making regarding necessary action to improve project processes as he/she is able to leverage different levels of understanding of the same issues, a trait from the logical typing argument from Bateson (1979). At this stage it is important to bring to surface to these high degree nodes that being highly connected alone does not mean that the quality of communication with the implementation stakeholders is satisfactory. If they choose to embrace a systemic approach to start and maintain a creative team learning culture, by leveraging perceptions, it will require much effort from these nodes in terms of their communication skills.

At Stage 2, stakeholders should map the network together, identifying roles and responsibilities. Findings showed that none of the initiatives invested officially in mechanisms for the clarification of organizational and individual stakeholder roles in the networks (see Chapter 5, Sub-section 5.3.1, p. 202), a common trait of ICT4D Partnerships (Tennyson, 2003; Unwin et al., 2011). Project managers should identify key

stakeholders who are experienced and well-connected so these nodes can assist them in qualifying the communication processes among nodes and clusters. Project managers should keep an eye on network configuration and roles from time to time, and iterate with the whole group regarding the network structure only when substantial changes occur. This was an adjustment I made in my own methodological framework (See Chapter 4, Section 4.9, p. 175). Even though Metaprojeto, DEPROTEC and the short term initiatives showed a regular level of the knowledge of stakeholder's roles (see Chapter 5, Sub-section 5.3.1, p. 202), as time went by the tendency was for these roles to become blurry, or new changes not being communicated at a proper pace so the network could adjust and thus creating confusion (e.g. Metaprojeto, Redes Livres and DEPROTEC). A suggestion is to access roles and responsibilities of all stakeholders from time to time, especially on longer-term projects.

At Stage 3, efforts should be directed in common context building, addressing views of the project but also individual interests. This a key stage for a truly collective emergency of new meaning that will generated re-ordering the system recursively, as illustrated by Figure 64: Based on Capra's (2002) description of a system's self-regulation (recursiveness) (Illustration by the author)(Sub-Section 7.1, p. 261). The research findings from proxys regarding the *communication level* dimension showed that in all case studies, common interests, perceptions of the other and of the project, or constraints, are usually trapped within network clusters (see Chapter 5, Sub-section 5.2.2, p.189). A suggestion is that project managers could to ensure that informal communication channels among nodes are present and being used, to allow for the emergence of autonomy (Griffin et al., 1998; Centola, 2015). This could help in accommodating different views among stakeholders from different clusters, and it was well illustrated by the weekly checkpoints of the short term initiatives. This stage is to be constantly assessed by project managers and iterated with stakeholders. Every stakeholder should have the chance to gain knowledge on the communication feedback cycles that are shaping the system's self-organization, thus keeping an eye on the whole. This is a way of dealing with the non-linear character of complex systems that needs as much iteration as possible so boundaries of meaning are clearer to individuals at a more subjective level, as a way of transposing the consolidated social norms of expert systems, illustrated by Figure 65: Loop of mental images reconfiguration based on

notions from Bateson, 1979; Giddens, 1990 and Capra, 2002 (Illustration by Author). (Sub-Section 7.1, p. 261) and thus opening the channels for nodes to come up with innovative solutions and most importantly, being able to implement them, where otherwise processes were too inflexible, such as illustrated by Metaprojeto and DEPROTEC case studies.

Stage 4 concerns the setting of tangible milestones. It is often necessary to resort to a set of shorter milestones rather than a long term overall goal, since this can increase individual motivation, as was seen in Redes Livres at the new state of the project, with the development of the community radio (Chapter 5, Sub-section 5.2.3, p. 198) and IBM Smarter Cities, in which the executives suggested such a plan after they saw that City Hall needed short term actions to keep the momentum of the project (Chapter 5, Sub-section 5.2.1, p. 182). Based on these examples, the suggestion is to create a collaborative action plan that resembles a minimum viable product (MVP) action plan, with the overall final vision, but with a set of MVPs throughout the project life cycle. In accordance with the previous stages and in the interest of maintaining an overall sense of purpose, it is suggested that this action plan is created in a conjoined fashion, is well documented and available to all stakeholders. As an example, Redes Livres and DEPROTEC processes showed that a lack of individual purpose and meaning within the overall goals of the projects can be harmful to the initiative as a whole. In the first, roles were not clear and lack of literacy became a big obstacle. In the second, educators, the main implementers of the project, were not involved in the overall planning, harming their feeling of autonomy towards the project as a whole. Also, it is suggested that stakeholders should engage in monitoring and evaluation mechanisms (Kapsali, 2011) as part of this ownership process.

The four stage process suggested above is directed to project managers and decision-makers, and it is intended to help these important and powerful stakeholders to become leaders in the true sense of the word. Leaders are articulators; they can let go of control, while keeping an eye on the whole, if they know how to ‘connect the dots’ and have a good overview of the processes. Metaphorically, project managers are like steersmen; they do not control the sea, waves are unpredictable. However, they know how to navigate through the waves, steering the boat. An ideal scenario would be an initiative where stakeholders have a high sense of collective identity combined with open

communication channels, clear steps for collaboration and a clear action plan. This would forward what I call an 'interdependence of autonomies'. Such autonomies are the network clusters within which stakeholders own realities, but they are also well articulated with the other clusters, which in my research, findings showed that they are not. If it is possible to achieve such dynamics, this could be translated into effective collaborative action in a very organic way, and the emergency of highly creative systems can be consciously tackled by all nodes.

If the set of useful guidelines above is embraced by project managers it is likely to lead to enhanced delivery of ICT4D initiatives. However, it would be even more positive if stakeholders were to adopt this mental model and have autonomy to act within an organizational environment that fosters transparency regarding its rules and social norms and have their individual interests assessed. This is a close-to-ideal scenario according to findings in this research, but it is not realistic in many settings. Nevertheless, if it is possible to identify the status of these features, the iterations might be adjusted accordingly and purposefully, thus at least optimizing the process. According to Centola (2015), if clusters overlap social contacts, these can create patterns of reinforcement of social norms. In the case here, this could be a learning culture that is successfully accepted and embraced by all, and the mental models generated by the system's dynamics could be a result of a more democratic and dialectic exchange of information among clusters; and the disembedding character of many expert systems (see Figure 65 on Sub-section 7.1 above) could be transposed and the emergence of new meaning can be generated with a more equal input from all nodes belonging to the overall system (see Figure 64 on Sub-section 7.1 above).

7.5 Challenges and constraints

The greatest challenge of this research was persuading decision-makers to embrace the approach. It is an approach that takes time and energy to acquire and synthesize multiple views in order to create synergy for collaborative action (Chambers, 1997; Checkland, 2000; Petkov *et al.*, 2007; Lennie et al, 2015). This requires a serious change to usual management mental models. Soft systems thinking is much more complex to embrace than for instance previous hard systems thinking approaches, based on engineering processes mainly concerned with outcomes, and not so much with process (Jackson, 2003).This remains a challenge and it is not possible to endure the set of useful guidelines suggested in Chapter 6 (p. 225) if this constraint is not overcome. As argued by many, these individuals (nodes) should be the first ones to engage in mechanisms aiming for effective collaborative action, if they desire their team to collaborate well together (Hardy *et al.*, 2005; Barabási, 2011; Southern, 2015). Again, I do not think the approaches suggested here are a 'one-size-fits-all' solution. As stressed above, it is first important to evaluate whether the organizational culture is more collaborative or competitive. For instance, at the Marist technological complex, the main manager promoted competitiveness. In his mind, perhaps such approach works better as far as productivity is concerned, and maybe this was the main reason for the tension that increased between us towards the end of the research period. The approach I suggest requests that a collaborative environment is embraced at all levels of the network equally, project managers included. It is a difficult approach for three main reasons. First, it deals with power relationships; second, it is subjective as it deals with peoples multiple views; last, the benefits might not always appear in the short term. This is why the four stage set of useful guidelines is based on a framework that offers flexibility and focuses on the importance of the decision-maker being clear on what the approach is, as this is one of the most powerful nodes of the network. The reason for this is that the discourse should be consistent with the reality of the organizational social norms of the networks, which in many cases was not the case (see Figure 74).

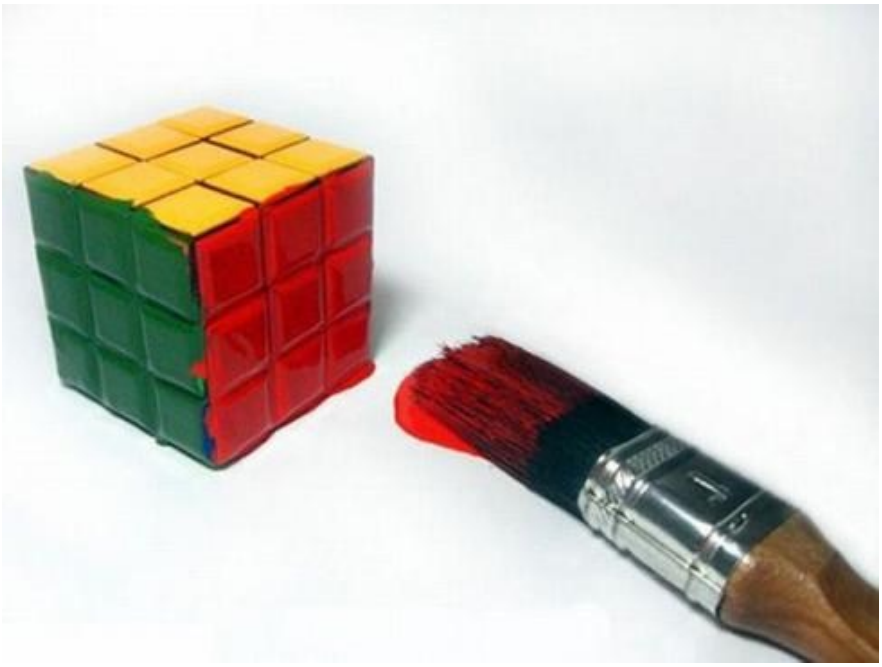

Figure 74: For illustrative purposes, when discourse does not match the reality, problems are not properly addressed (Source: 11even, 2010).

A second challenge was that my role as a researcher and practitioner was not always properly explained to stakeholders. I was able to explain what I was doing in private encounters, and later I realized how mistaken people often were about my role. This had serious implications on the credibility of my work, as I went on conducting focus group discussions and interviews. Some stakeholders saw the focus group discussions initially as a waste of time. It was only after I conducted a highly structured discussion with a clear goal to be achieved at the end that I was then taken seriously. Then again, shortly after, without proper support from decision-makers my work would again start to be taken for granted. Also, such lack of clarity on my role caused people to think that I was there to judge them, when I was not interested if someone or something was to blame for poor project outcomes, but rather I concentrated on analysing processes and different combinations. A challenge many project managers face is to understand what really motivates or demotivates a team. A systems approach helps to look closer at the different mental models, perspectives, aspirations and realities. From this knowledge, a project manager can then help people decide which approach is better suited for the scenario. It is important to connect with stakeholders during the process and realize if the approach is working or not.

A second constraint was that these initiatives did not usually follow or report on any specific partnership models and mechanisms (Unwin, 2005; Unwin *et al*, 2011). It

remains a challenge to account for the difficulties of focusing both on the partnership mechanisms and the initiative itself, as well as to balance both respective organizational and individual layers.

A third challenge was to build a context-based collective identity of the partnership aimed at the initiative's common goals. This was related to the systems boundaries as being recognized first as boundaries of meaning and not as boundaries of function (as in hard systems approaches). The organizational networks are usually structured by functions, but to allow for the creation of boundaries of meaning, where there is flexibility for people to collaborate together by affinity and common interests, is another task. As argued by Southern (2015:39):

> 'Even when we want to collaborate, we often find ourselves crossing boundaries we did not realize would create tensions, having our ego bruised when others offer a different perspective on our work, or having our intentions questioned based on erroneous assumptions. Collaboration requires that we prepare ourselves and our organizations to engage in ways that are unfamiliar and uncomfortable.'

This is a tension that needs to be addressed, as these distinctions between boundaries are not absolute. Section 7.3 above has addressed how this issue was dealt with in my research. However, it was a small step that deserves further research (see below). This is not to say that I advocate for an absence of rigorous control. Rather, as argued by Kapsali (2011), I advocate the complementarity of control with instruments that will provide more flexibility required for innovation to occur.

There were two main methodological constraints. The first was the use of a plurality of methods which brings a holistic view but along with it a complexity and a multi-layered reality, translated into collective and individual views, and the differences between my observation and those of the participants. It was quite common for people's behaviours to change depending on whether they were speaking privately or in a group, and it was difficult to understand and categorize my interpretations of such situations so as to achieve methodological rigour. The problem was not so much in the codification, but in what to do with the results of such contrasting behaviours. Individuals behaved differently depending on the type of interaction, whether in individual interviews or focus group discussions. In practice, I understood the individual expressions as being

more truthful because there were less interactions present and thus I felt that interviewees were more comfortable to speak up when on a one to one basis.

Moreover, the methodology initially envisioned, in which I was going to analyse the recurrent feedback cycles through an analogy of Bateson's logical typing ladder (1979), was shown to be not feasible in my in-depth case studies, where it was intended to be applied. As such, I had to adjust to the reality encountered in the field (Chapter 4, Section 4.8, p. 161). The first and most important reason for this was the organizational maturity level which in most cases was very low. If I had synthesized in a more systematic way what was intended in my methodology, I could have made clearer that the decision-makers role was critical in order to achieve a certain level of credibility and I could have worked harder to bring them on board. However, the truth is that the methodology itself was not as mature in order to do so, so I could not convince them sufficiently.

7.6 Recommendations for future research

Research at the interface between ICT4D and systems thinking in the past has been focused mainly on management processes and definition of messy problems (Andrew and Petkov, 2003; Petkov *et al.*, 2007; Gunawardena and Brown, 2007; Turpin *et al.*, 2009; Kapsali, 2011; Turpin, 2012; Turpin and Alexander, 2014). There is little declared systems thinking research concerned directly with the communication mechanisms of ICT4D partnerships. However, as mentioned in Section 7.3 above, other approaches are increasingly concerned with the same systemic principles of my research (Lennie *et al.*, 2015). In such research, the process is usually a long term one, as it is concerned with relationship building. A recommendation for future research would be concerned with shorter term research processes embracing systemic principles, such as using focus group discussions at the very beginning of the process addressing specific issues of collaboration and team learning.

Another general recommendation for future research is for ICT4D research to learn from the emergent collaborative economic principles that are rising as a consequence of the networked society. There are so many good examples from both civil society and the private sector in which the creative economy is central to the structural shift society

needs[73]. Such collaborative movements have at their core the systemic principles that have been advocated throughout this research such as adaptation, flexibility, resilience, multiple perspectives, context-based and action-learning.

Two methodological recommendations within this research's framework could be developed further. First, researchers should access beforehand whether the main organizational culture of an ICT4D initiative is competitive or collaboratively oriented, by observing shared assumptions, group norms and unwritten rules. It would be only after this initial assessment that an appropriate approach for analysis should be assembled. I started off with the assumption that collaboration was inherently desired and there was some tension regarding my approach. A second recommendation is that future research should be conducted in teams, or at least by two people. A systems thinking approach embracing multiple views can also benefit from multiple views from researchers. I felt at times overwhelmed and it would have been important to gather second opinions regarding the directions of my analysis.

Moreover, I am personally interested in understanding more deeply the concept of self-generating networks that I came across while doing this research. This concerns the potential of meaningful collaborative practices (Capra and Luisi, 2014). This concept treats informal networks of the initiatives as partners, instead of maintaining the usual conditioned existing relationships of power (see Chapter 5, Section 5.4, p. 207). I firmly believe that we can enjoy the process of collaboration, by trying out and experimenting with peers. Perhaps this is why a systems thinking approach is so attractive to me, as it allows me to experiment and to be flexible throughout the research process. A flexible and emergent approach that is open to change and continuous adjustment based on regular feedback and critique from those involved is desired.

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[73] For illustrative purposes, see for instance the great transition initiative (http://www.greattransition.org/publication/worker-cooperatives accessed February 18th, 2016); the Neotribes course (http://www.neotribes.co accessed February 18th, 2016); the conscious innovation consultancy agency Mandalah (http://www.mandalah.com/ accessed February 18th, 2016), the thoughts of the Peer-to-peer Foundation on the Networked Society and Future Scenarios for a Collaborative Economy (http://p2pfoundation.net/Network_Society_and_Future_Scenarios_for_a_Collaborative_Economy accessed February 18th, 2016) and The Next System Project (http://www.thenextsystem.org/ accessed February 18th, 2016).

7.7 Epilogue

This research started with a main focus of trying to help the poorest through my knowledge from technology. As time went by, my interests became broader as I realized that our whole system is in need of a serious change if we aim for a society that respects the other and the planet (Capra, 2002; Chambers, 1997; Meadows *et al.,* 2004; Kothari, 2005; Mansell and Wehn, 1998; Pamlin, 2002). I firmly believe that we need a systemic shift to a more collaborative society. This is about letting go of the necessity of 'control in order to succeed' and not about recognizing generic social patterns so that we can control them. It is about awakening sensitivity in practitioners, researchers and decision-makers for the possibilities of the network in order to empower the nodes for positive change. It is about acquiring the view of the whole to understand that one small shift can make all the difference. After this research, I am convinced that without this, the 'system' will not change.

As a final remark, I would like to narrate very briefly an empirical experiment not directly related to ICT4D initiatives but to the use of systemic principles to forward effective collaborative action. In this experiment, I pursued to break the consolidation of social norms so to support a broader mobilization of segregated social groups with interest in the same cause (Centola, 2015). As suggested by Checkland (2000), a possible way to find innovation within a consolidated system is to identify and work with emergent behaviour, maintaining a concern for the impact on total system; in order words, maintaining the focus on the overall objective.

On January 29th 2016, the city of Porto Alegre where I live was hit by a hurricane level 1. This is an extreme weather even that never happened in this region. More than 300 thousand people had no electricity for over 72 hours, myself included. There was a lot of damage in the streets, as illustrated by Figures 67, 68 and 69 below.

Figure 75: Fallen trees, squashed power lines. (G1, 2016)

Figure 76: Fallen trees, squashed power lines. (G1, 2016)

Figure 77: Destroyed gas station. (G1, 2016)

Shortly after this event, groups concerned with rebuilding the city and especially trying to save the fallen trees, created several separate movements calling civil society organisations to volunteer and help the city. However, these movements were unable to act without support from the public sector. Moreover, only two days before the storm hit the city, Porto Alegre had launched its 'Resilient Strategic Proposal' (Porto Alegre Resiliente, 2016) and one of the strategies was exactly to collaborate with civil society organisations. Being aware of that, I called the Secretary of Governance and gave him the idea of gathering all of these social movements together with the electricity department and the Environmental Secretary in order to articulate a public-civic partnership (a task force) to create together a strategy for cooperation to replant the trees. My idea was to connect the dots and take advantage of City Hall's recent resilient strategic proposal. Until February 20th, 2016, we have had two meetings to articulate a plan of action, which is in a public space for anyone to pitch in (Porto Alegre Local Governance, 2016). There were already two actions for saving fallen trees by volunteers with support from the City Hall (Jornal do Comércio, 2016). These trees would have otherwise been cut down by the City Hall had the volunteers not evaluated the real need for it. The dialogue continues as the next step after cleaning and saving trees is to create

a strategy for replanting trees. Of course there are political interests involved as this is an election year and the City Hall has been using this process to self-promote the sitting candidate. This has caused discomfort among the people involved as it was extremely difficult to get real support from the City Hall to save the trees in the first place. Nevertheless, I wanted to show how I used my favourable position in this network as I was connected to several relevant nodes concerning this particular cause. As suggested by Checkland (2000), I have identified positive emergent behaviours and consciously tackled my connections aiming for effective collaborative action regarding saving the trees.

Figure 78: Citizens of Porto Alegre in an action to mark the trees that should be cut down and can be re-erected (Jornal do Comércio, 2016).

'Never doubt that a small group of thoughtful committed citizens can change the world; indeed, it's the only thing that ever has.' (Margaret Mead[74])

[74] Date unknown

Appendix I: Focus Group Discussion Guide

Topic Guide Discussion (Adapted from Debus, 1987)

Purpose: Network Mapping.

Type of group (functionality): Phenomenological

Methods: Projective

This phase of the focus group will be composed of key individuals previously identified in the project documentation analysis and individual conversations. These individuals will make up the group that will participate actively throughout research.

I. Warming-up Section

A. Introduction

1. Thank you all for coming.

2. Your presence is very important.

3. (Description of what a focus group discussion is and how it will be conducted)

B. Purpose

1. Explain the purpose of research

2. Previously, through analysis of documents and personal interviews with some of you, I have identified which organizations and who are some of the key individuals (you) that belong to the project.

3. I would like to discuss the above with this group; I am interested to hear your opinions as a group and together reach a consensus where there are differences that may be preventing the proper performance of the project itself.

4. There is no right or wrong here.

5. All comments, ideas and opinions, whether negatives or positives are welcome.

6. And please feel welcome to disagree with each other. The more points of view are expressed, the better.

C. Procedure

1. Explain the use of video or audio recording. All comments are confidential and used only for research purposes.

2. I want this to be a discussion group, you do not need to wait for me to tell who can speak or not. Please speak one at a time, so the recorder can pick everything up.

3. We have a lot to cover, so I may have to change the subject so we can go ahead. Please let me know if you would like to add something.

D. Presentations

Ask participants to present themselves. Most will already know probably. (Tell us your name, what you do and how long you are involved in this particular project.)

II. Mapping of partners as organizations

A. Presentation of the classification used in the research of the types of institutional partners

1. Cards with the kinds of partners

2. Explain why I have this particular classification

3. How do you feel about that particular classification? Why?

4. Compliance with the final classification of the types of partners to be employed through the research process.

B. Presentation of partners as previously identified organizations

1. Cards with the organizations. Spread them on the table, along with the cards of the types of organizations.

2. These are the organizations identified previously.

3. Are there any missing organizations? If so, please add the card on the board.

4. How do you combine these cards with the types of organization? Feel free to go to the board and move the cards, or add others if necessary.

4. Compliance with the final composition of partners as organizations.

III. Role of partners as organizations

A. Presentation of partners and organizations as classified in the foregoing discussion.

1. What are the roles of each of these organizations? (Give examples such as donor coordinator, instructor, etc.)

2. Write in the cards the roles that you are identifying now.

3. What roles would you say belong to the organizations you have identified within this project? You can move the cards to match them. You can repeat roles for different organizations, if necessary.

4. Why do you connect this particular group with this role in particular?

5. Compliance with the final composition of the roles of each partner as an organization.

IV. Cohesion of the organizational network

A. Place the cards with only the organizations in the board

1. Which organizations have direct contact with each other? Here is a pen: you can connect them directly to the card.

2. Why do you connect this network in particular with that?

V. Mapping partners as individuals

A. Presentation of individuals partners as identified previously

1. Cards with the names of individuals and organization to which they belong on the board.

2. These are the key individuals identified previously.

3. Is there a person that you see as key to the project missing? If so, please add the card into the board with the person's name and organization to which he/she belongs.

4. Compliance with the final composition of partners as individuals.

VI. Role of partners as individuals

A. Presentation of the partners as individuals as previously decided

1. What are the roles of each of these individuals? Give examples as donors, monitor, coordinator, manager.

2. Type in the identified papers cards. (We can reuse some of the cards used in the discussion of organizations).

3. What would you say are the roles of each of these individuals that we have identified in this project? You can move the cards on the board to match them accordingly. You can repeat roles for different people, if necessary.

4. Why do you see yourself working in this particular role? Who decided that?

4. Why do you connect that person with that particular role?

5. Accordance with the final composition of the role of partners as individuals.

VII. Individual network cohesion

A. Place only the cards with individuals on the board

1. What people have direct contact with each other? Here is a pen: you can connect them directly on the board.

2. Why do you connect this particular individual with that?

3. Accordance with the distribution and connections of individuals

4. Are you satisfied with the way we are all connected now?

5. Would you do change something? Why these in particular? How do you propose that these changes can be implemented?

VIII. Closing

A. Before we finish, I would like to ask each of you if there is anything else you would like to add on these structures we have identified today. These structures will be used by this research, and it is important we feel we arrived at a consensus within the group.

B. Thank you for coming. I really appreciate your collaboration and that was a great discussion...

Appendix II: Semi-structured Interview Guide

English version

Questions concerning *Partners as organizations - (1) Network Structure*:

1. What organization do you belong to?

2. What organizations / institutions are part of this project from planning to implementation? Why these in particular?

3. According to this ranking list (show list of types of partners), where do you think each of these organizations belong to? Why do you classify them as such?

4. What are the specific roles of these organizations within this particular project (eg. Coordination, implementation, donation)? Why is it organized in this particular way?

5. Which of these organizations does your organization / group has direct contact with? Why is that?

Questions concerning *Partners as Individuals - (1) Network Structure*:

1. Who would you say are the key individuals working on this project? (From each of the organizations that you have identified in previous questions). Why these particular people?

2. Describe the process by which the individuals named above have received these key roles. Why did it happen that particular way?

3. What is their specific role in the project?

4. Was anything done to engage these key individuals in the side demands the partnership?

5. Was there any mechanism to promote greater community involvement, in order to discuss the project and thus obtain a representation from the demand side? If so, why this mechanism in particular?

Questions concerning *Network Cohesion - (1) Network Structure*:

1. Name all individuals belonging to the project that you have spoken directly during the past month.

2. Name all the individuals with whom you discussed objectives and implementation of the project in the past month

Questions concerning *(2) Communication Level* and (3) content: Knowledge Production and Exchange

1. Who is / was involved in project planning?
2. Has the community affected by this been involved in planning? How? Do they recognize that this is something useful for them? Were they consulted?
3. Who has access to the action plan?
4. Who are the partners / events that motivated this project?
5. Are there conflicts / dissatisfactions between partners regarding goals? If so, how these conflicts are being resolved?
6. Are there mechanisms to clarify perceptions involving the community that will be affected by this project?
7. What are the results expected?
8. Who is responsible for each activity? Why?
9. How do these responsibilities have been delegated?
10. Are you happy with the responsibilities that have been given to you?
11. What resources are necessary (people and materials)? Why?
12. Are there monitoring and evaluation mechanisms? Which?
13. How do you communicate with other members of the project? What mechanisms / tools do you use?
14. In your opinion, do people express themselves regarding the project (opinions, needs, interests and fears)? Are the channels open for this to happen?
15. Has someone refused to participate in the project? Why?
16. Since its inception, did the team working on the different phases of the project (planning, implementation, evaluation) change?
17. What are the results so far disseminated through the network?
18. Do you think the information flows between project members?
19. Nomeie implecilhos ao projeto que você identificou até agora. Tem alguma coisa sendo feita para resolve-los?

20. Name contraints to the project that you have identified so far. Is there anything being done to solve them?
21. How do you see the fomat of the network that is implementing the project - more hierarchical and more horizontal? Why do you think so?
22. Is the above is influencing the design process? Why?
23. It is given to all participants the opportunity to act as leaders throughout the project? How?
24. Do project leaders belong to different interest groups?
25. Does the leadership scheme change / is changing during the course of the project?
26. Can anyone involved in this project become a leader if they wanted to? How would this process happen?
27. How competent would you say that (*leaders*) are in their activities within the project? Tell us a little about each.
28. How they (above) deal in general when there is a conflict / dissatisfaction or disagreement between the project participants?
29. How do you seek consensus on a particular subject? How is the decision-making process?
30. Are innovative solutions presented by leaders or members of the group?
31. How would you describe the enthusiasm / passion of the leaders already mentioned to strengthen and motivate group members about the project?
32. How reliable would you say that the leaders mentioned are with regard to managing the project resources?
33. How accessible are they?
34. How respectful are the leaders cited in relation to the opinions of others?
35. How they seek to encourage you?
36. From this list of people (list of the most active members) who should participate in that activity - such as manage / administer / run / document?
37. What is the role of leaders in this project?
38. Who can become a leader?
39. What do you see as necessary attributes to become a leader?
40. Name the characteristics of a good leader for this project?
41. If a problem arises with any of the leaders, what do you think can be done?

42. Who are the members should act to solve the problem?
43. When there are problems or conflicts, how do you seek to solve them? (Ability to act as a group)
    a. Everyone is always willing to discuss together
    b. If a problem occurs, the group as a whole is able to solve
    c. Members have problems in dealing with conflicts
44. Do you think that the group is willing to work together until they solve the problems?
    a. Almost everyone is willing to work and do your part for the project
    b. When a problem occurs - I have little confidence that I can solve it
45. Capacity of others
    a. Group members have facility to solve problems we face
    b. Members have weak skills compared to other projects that have been part
    c. I am very confident that people in this project may perform the tasks they are assigned
    d. Members are not effective in dealing with problems we face
46. Ability to solve problems as a group
    a. This group is able to use innovative approaches to solve problems
    b. All are committed to the same collective purposes therefore able to cope with difficult situations
    c. We have the internal skills, knowledge and ability to implement this project
    d. We can mobilize resources to changing situations affecting members

Portuguese version

Questions concerning *Partners as organizations - (1) Network Structure*:

1. A que organização você pertence?
2. Que organizações/instituições fazem parte desse projeto desde seu planejamento à implementação? Por que essas em particular?

3. De acordo com essa lista de classificação (mostrar lista de tipos de parceiros de acordo com to A.i tipos de parceiros), onde você diria que cada uma dessas organizações pertence? Por que você as classifica assim?
4. Qual é o papel específico que cada uma está fazendo dentro desse projeto em particular (ex. Coordenação, implementação, doação)? Porque está organizado dessa maneira em particular?
5. Com qual dessas organizações a sua organização/grupo tem contato direto? Por que é assim?

Questions concerning *Partners as Individuals - (1) Network Structure*:

1. Quem você diria que são os indivíduos chave atuando nesse projeto? (de cada uma das organizações que você identificou nas questões anteriores)? Porque essas pessoas específicas?
2. Descreva o processo através do qual os indivíduos acima nomeados receberam esses papéis chave . Por que aconteceu dessa maneira específica?
3. Qual é o papel específico deles dentro do projeto?
4. Foi feita alguma coisa para envolver esses indivíduos chave no lado de demandas da parceria?
5. Existiu algum mecanismo para promover o envolvimento maior da comunidade, com o objetivo de discutir o projeto e assim obter uma representação desse lado de demanda? Se sim, por que esse mecanismo em particular?

Questions concerning *Network Cohesion - (1) Network Structure*:

1. Nomeie todos os indivíduos que pertencem ao projeto que você tenha conversado diretamente durante o mês que passou.
2. Nomeie todos os indivíduos com os quais você discutiu objetivos e implementação do projeto no mês que passou

Questions concerning *(2) Communication Level* and (3) content: Knowledge Production and Exchange

47. Quem está/esteve envolvido no planejamento desse projeto?
48. A comunidade que irá usufruir dos resultados desse projeto esteve envolvida nesse planejamento? De que forma? Eles reconhecem que isso é algo útil para eles? Eles foram consultados?
49. Quem tem acesso ao plano de ação?
50. Quem são os parceiros/eventos que motivaram esse projeto?
51. Existem conflitos/dissatisfações entre parceiros em relação aos objetivos? Se sim, como esses conflitos estão sendo resolvidos?
52. Existem mecanismos para clarificar percepções que envolveram toda acomunidade que sera afetada por esse projeto?
53. Quais são os resultados que se espera?
54. Quem é responsável por cada atividade? Porque?
55. Como essas responsabilidades foram delegadas?
56. Você está feliz com as responsabilidades que foram dadas a você?
57. Que recursos são necessaries (pessoas e materiais)? Porque?
58. Existem mecanismos de monitoramento e avaliação? Quais?
59. Como você se comunica com outros membros do projeto? Que mecanismos/ferramentas você usa?
60. Na sua opinião, as pessoas se expresssam em relação ao projeto (opiniões, necessidades, interesses e medos)? Os canais estão abertos para que isso aconteça?
61. Alguém se negou a participar do projeto? Porque?
62. Desde seu começo, o time trabalhando nas diferentes fases do projeto (planejamento, implementação,avaliação) mudou?
63. Quais são os resultados disseminados até agora através da rede?
64. Você acha que a informação flui entre os membros do projeto?
65. Nomeie implecilhos ao projeto que você identificou até agora. Tem alguma coisa sendo feita para resolve-los?
66. Nomeie resultados inesperados até agora – aconteceu algo que não estava previsto na fase de planejamento?
67. Como você vê a estrutra da rede que está implementando o projeto – mais hierarquica ou mais horizontal? Porque você pensa assim?
68. Como o acima está influenciando o processo do projeto? Porque?

69. É dada a todos os participantes a oportunidade de agirem como líderes ao longo do projeto? Como?
70. Os líderes do projeto pertencem a diferentes grupos de interesse?
71. O esquema de liderança muda/ está mudando durante a evolução do projeto?
72. Qualquer um involvido neste projeto poderia se tornar um líder se eles quisessem? Como esse processo aconteceria?
73. Quão competente você diria que o (manager) são nas suas atividades dentro do projeto? Fale um pouco sobre cada um.
74. Como os (acima) lidam em geral quando surge algum conflito/dissatisfação ou desentendimento entre os participantes do projeto?
75. Como se busca o consenso sobre um determinado assunto? Como se dá o processo de tomar decisões ?
76. São apresentedas soluções inovadoras pelos líderes ou membros do grupo?
77. Como você descreveria o entusiasmo/paixão dos líderes já citados em reforçar e motivar os membros do grupo em relação ao projeto?
78. Quão confiável você dirir que os líderes citados são no que diz respeito à gerenciar os recursos do projeto?
79. Quão acessível os líderes já citados são?
80. Quão respeitoso é os líderes citados em relação à opinião dos demais?
81. Como eles procuram encorajar vocês?
82. Dessa lista de pessoas (lista dos membros mais ativos) quem deveria participar em que atividades - tais como gerenciar/administrar/executar/documentar?
83. Qual é o papel dos líderes nesse projeto?
84. Quem pode se tornar um líder?
85. O que você vê como os atributos necessaries para se tornar líder?
86. Nomeie características de um bom líder para este projeto?
87. Se surge algum problema com algum dos líderes, o que você acha que pode ser feito?
88. Quem são os membros que deveriam agir para resolver o problema?
89. Quando há problemas ou conflitos, como vocês procuram resolve-los? (capacidade de agir como grupo)
    a. Todos estão sempre dispostos a discutir juntos
    b. Se um problema acontece, o grupo como um todo esta apto a resolver

c. Membros tem problemas em lidar com conflitos
d. Você acha que o grupo tem disposição para trabalhar junto até conseguirem resolver os problemas?
e. Quase todos estão dispostos a trabalhar e fazer sua parte pelo projeto
f. Quando um problema acontece – tenho pouca confiança que poderei resolve-lo

90. Capacidade dos outros
    a. Os membros do grupo tem facilidade de resolver problemas que enfrentamos
    b. Membros tem habilidades fracas comparado com outros projetos que fui parte
    c. Tenho muita confiança que as pessoas nesse projeto podem realizar as tarefas que lhes são designadas
    d. Membros não são eficazes em lidar com problemas que enfrentamos
91. Capacidade de resolver problemas como um grupo:
    a. Esse grupo é capaz de usar abordagens inovativas para resolver problemas encontrados
    b. Somos todos compromissados com os mesmos objetivos coletivos, portanto capazes de lidar com as situações mais dificeis
    c. Temos as habilidades internas, conhecimento e abilidade para implementar esse projeto
    d. Podemos mobilizar recursos para mudar situações que afetam os membros

Appendix III: Ethnoshots Template

Self-positioning

- How do I feel? How disciplined am I? Have I met my targets, and if not why not? Am I self-accountable? Am I on top of things or am I overwhelmed and losing track? What can I leave out? What can I give up? Where I could get help?
- How are the relationships with my main reference persons developing (supervisor, bosses, trainees, and colleagues)? Who have been the main people to influence me in my work?
- Are there any foreshadowed conflicts? Should I try to prevent them/keep out or should I enter and manage them? What are the foreseeable risks in the different scenarios? How could I have avoided challenges / conflicts that did occur?
- To what extent am I delivering on my research aims?
- What has got in the way of my research, if anything? How can I ensure that I remain research
- What have I learnt most this month? Why?
- What has surprised me most? Why?
- What has saddened me most? Why?

Reflections on my understanding of the actual empirical subject matter

- How is my understanding of the "development discourse" changing over the months? Am I doing enough reading, writing and reflecting about it?
- How is my understanding of the Brazilian ICT4D development scene developing? Am I doing enough reading, writing and reflecting about it? Am I gathering new information about this issue on the field?
- How is my understanding of the "ICT4D Multi-stakeholder partnership" theme developed in my literature changing over the months? How is my fieldwork affecting what I have written and reflected about so far? Am I doing enough reading, writing and reflecting about it?
- How is my understanding of the "Systems theory and Networks" theme developed in my literature changing over the months? Am I being rigorous enough in this conceptualization? Am I doing enough reading, writing and

reflecting about it?

Reflections on data generation

- How rigorously am I tracking the process? How systematic am I?
- How valuable is the data I am generating? How usable? How manageable? How fair the amount?
- What have been the main data collection problems this month?
- What have been the main data successes this month?
- How well have I defined the variables I will work with? Is fieldwork affecting what I have written and reflected about so far? How might I be reconfiguring the variables?
- How appropriate is my methodology? Why? How could I improve it?
- How much re-reading, re-listening, re-watching, writing, reflecting am I doing?
- How well am I relating what I'm doing to what I've read in the literature?
- How well have I interacted with respondents/interviewees? How could I improve my research style so as to enhance the quality of what I am doing?

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