Real-time foresight : preparedness for dynamic innovation networks
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Preface

My intention to write this thesis was born during a speech at the ‘Global Entrepreneurial Summer School’ in Munich in 2009. It sprung from inspiring discussions with the audience consisting of entrepreneurial students and professors. My talk was on innovation in crisis management and my mind was still occupied by a professional experience after the 2004 Tsunami. At that time, 2009, I was still collecting material on real-time procedures for ongoing crisis management, recovery and reconstruction in Tamil Nadu, South-India. The most intriguing questions were raised by Prof. Dr. Bernhard Katzy and Dr. Bernward Joopen. We debated the staggering discovery that so many professional humanitarian, governmental and private actors had been unable to collaborate more directly towards sustainable ends. In consequence, I asked myself about ways of real-time collaboration for more successful and for more innovative rehabilitation processes. Given the magnitude of the international donations and the technological support after Tsunami 2004 it seemed obvious that there were problems, other than financial, that blocked sustainable global relief. But why was successful ad hoc and long-term collaboration so difficult? What were the obstacles that had to be managed?

In 2010, I started to work academically on these questions as an external PhD candidate at the Leiden Institute of Advanced Computer Science (LIACS) at Leiden University. My employer, the Strascheg Center for Entrepreneurship (SCE) at the Munich University of Applied Sciences (MUAS), supported my interdisciplinary research project.

In this thesis, I took an interest in discovering entrepreneurial solutions for handling the obstacles to ad hoc collaboration in dynamic and unpredictable processes. In brief, the research deals with preparedness to engage in dynamic innovation networks (DINs). The main assumption is that successful ad hoc collaboration meets underlying dynamic patterns of network emergence. To investigate this assumption and to explore the network patterns of successful dynamic innovation processes, a process study on sustainable long-term relief was conducted. Thus, in the thesis, three different examples of collaborative global-local disaster management after the 2004 Tsunami serve as case studies of collaborative innovation management. These three DINs emerged around coastal villages in Tamil Nadu between Chennai and Kanyakumari, namely the villages of Ayam, Keniparam, and Kanni.

The thesis at hand has five main results of different scientific scope. First, it identifies (1) *five dynamic network patterns* that facilitate ad hoc collaboration in innovation networks. From those, it develops (2) *a new method of foresight* that prepares for real-time collaboration in innovation networks, and (3) *a process evaluation tool* - or indicator catalogue - that allows for identification of emerging DINs in mass collaboration instead of adding to standard end-of-pipe evaluations. As a further finding, it proposes (4) *a network typology of innovation strategies* and (5) a *robust taxonomic tool* for rapid matching in global-local relief.

In summary, the research explores how network emergence unfolds in dynamic multi-sector collaboration and how network evolution is part of successful, sustainable innovation processes. The *co-evolution* of DINs and local sustainable outcomes of complex crisis response leads to vital global-local partnerships and to viable solutions to ad hoc challenges with unpredictable ends.

Now, many years after my personal involvement in global-local disaster management, an increasing digitalisation challenges actors in the field, and in politics, economics and everyday life. My intuition is that digital societies need more sustainable entrepreneurship activities, more networked foresight and more collaborative mindsets to initiate the change necessary to manage shifts (cf. Dicken, 2003) towards a global sustainable future.

In its final form, the thesis aims to learn from the intercultural, asymmetric and unpredictable collaboration of global disaster management. From understanding innovation management in this complex and often chaotic situation, we may learn about entrepreneurial processes and ad hoc management in general – and about local sustainable entrepreneurship in particular. Dynamic network approaches can seize the plurality and the contingency of our seemingly ‘individual’ activities. The results of this research contribute to improvement of managerial practice in uncertain *collaborative* processes - with a complementary real-time and collaborative foresight.

I express my deepest thanks to my parents, my brother and my three children Mia, Anton and Leo. They have always supported my work, and here I would like to thank them. I thank old and new friends for all their interest in my research. I am aware that I have mastered this long-term challenge due to a truly dynamic and beautiful network of family and friends.

“There is no universal solution,

but there is a universal process to find appropriate local solutions.”

Carl Taylor, key contributor to the 1978 Alma Ata Declaration (WHO)

“Without any foresight we are like logs adrift in a river.”

Tuomo Kuosa (Kuosa, 2016)

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List of Abbreviations

ACT	Actor
ANT	Actor-network theory
CI	Critical incident
CIT	Critical incident technique
DIMA	Disaster management
CONCORD	Confédération Européenne des ONG d’urgence et de développement
DIN	Dynamic innovation network
ECSB	European Conference on Small Businesses
EMON	Emerging organisational network
GHA	Global Humanitarian Assistance
GIN	Global innovation network
GTM	Grounded theory method
HRO	High reliability organisation
HU	Hermeneutic unit
ICSB	International Conference on Small Businesses
IFA	International foresight academy
INGO	Intermediary NGO

INNOACT	Innovative activity
ISCRAM	Information Systems for Crises Response and Management
ISPIM	International Society for Professional Innovation Management
KPI	Key Performance Indicator
LCDS	Leiden Centre of Data Science
LNGO	Local NGO
MSF	Médecins Sans Frontières
NCRC	NGO Coordination and Resource Center
NETDYN	Network dynamics
NGO	Non-governmental organisation
NITIM	Network of IT and Innovation Management
OPP	Obligatory point of passage (moment of interest alignment)
LP	Local panchayat, elder group that governs in Indian villages
PD	Primary document (reference to ATLAS.ti classification)
RTET	Real-time evaluation tool
RTF	Real-time foresight

SHG	Self-help group
SIKS	School for Information and Knowledge Systems
SM	Strategic management
SME	Small and medium entreprise
SNA	Social network analysis
STS	Science and technology studies
SRDS	Society of rural development services
TF	Technological foresight
TFS	Technological foresight and Social Change
TNGO	Transnational NGO
TNTRC	Tamil Nadu Tsunami Relief Center
TSM	Traditional strategic management
UN	United Nations
UNISDR	United Nations International Strategy of Disaster Reduction

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1 The challenge of managing real-time collaboration

In our 'global age' (cf. Albrow, 1996, 2014), many governmental and industrial actors are facing rising uncertainty, increasing complexity, and a degree of acceleration that portends disruptive change. Lost in 'big data' and in inconsistent information, actors tend to withhold decision-making and to postpone cooperation in opaque situations. Frequently, actors are blocked when the clear 'road to the future' seems too obscure. What they need in order to move is foresight. Foresight methods prepare for uncertain futures and help us to cope with unpredictability (cf. Comfort, 2007; Cook, Inayatullah, Burgman, Sutherland, & Wintle, 2014). There are many different types of foresight (see, e.g., Georghiou, Harper, Keenan, Miles, & Popper, 2008; Kuosa, 2016) but among them, technological foresight (TF) is the most well-known. It is used by public and by private actors worldwide. To accommodate to temporal dynamics, our research will focus on *real-time foresight (RTF)*, and the thesis will guide the reader towards this new collaborative concept.

Technological foresight (TF) uses selected expert knowledge to extrapolate technological trends into different scenarios of the future (cf. Linstone, 2011). Roughly, it works as follows: after cycles of expert information gathering and collection of opinions, leadership has to make a decision and then turns to strategic management to pursue the identified goal. TF has thus become a successful means of support for decision-making under conditions of uncertainty in political and economic fields (cf. Daheim & Uerz, 2008). Actors can, however, face a misfit between the projected procedure and the more volatile societal reality (cf.

Battistella & De Toni, 2011; Könnölä, Scapolo, Desruelle, & Mu, 2011). This misfit increasingly hampers them in situations of real-time collaboration. To illustrate such situations, two example cases are given, one from a governmental realm and one from an industrial realm.

1.1 Two example cases

Real-time collaboration is difficult to start and even more difficult to continue successfully. This holds for public actors and for private actors alike. The text below provides two examples: the first concerning a tsunami and the second a disruptive market scenario. Both cases illustrate an urgent response situation, one multi-sectoral (1.1.1) and the other business related (1.1.2). In the examples, the thesis looks at collaborative leadership (1.1.3) and shows that in both cases leadership is poorly prepared. All three subsections end with a question that will guide the research.

1.1.1 *Global relief*

In a tsunami, hundreds of people are killed and their villages are washed away. TV screens and social media repeatedly show pictures and videos of multiple forms of devastation. As a global public, we have seen such disasters before (cf. Donini, 2012). We are used to the rational explanation of vulnerability, and we expect international institutions and local leadership to respond quickly and effectively. After all, information technologies (ITs) advanced so that we now receive information in real-time. Transnational aid organisations can fall back on high technology equipment (cf. Miller & Rivera, 2016). Even in the Philippines or Haiti, both disaster prone and weak economic areas, Internet platforms and media services are accessible and the most remote villages can be reached, albeit sometimes only in principle (cf. Van Wassenhove, 2006).

Immediately after a large scale disaster, hundreds of organisations, both smaller ones and global professionals, rush in to help the affected people. Locally, however, there is an obstinate problem that needs to be overcome. The established and planned processes of experienced organisations are mired in the turmoil of mass collaboration, divergent customs and fragile state administration (cf. Kaplan, 2009). Governmental agencies and other central administrations are not able to match and manage the technological capacities of competing independent actors in real-time. In expectation of an integrated solution, actors lose precious time and information exchange remains scarce. Local and global media coverage reaches a peak and ends after a few weeks, while the local problems persist. The rehabilitation process slackens. Foreign NGOs leave or erect their own safety compounds. Locals arrange their lives in temporary shelters. In the end, too often, global relief outcomes are disappointing and leave satellites of donor dependant foreign infrastructure (see, e.g., Fazarmand, 2007; Landry, O'Connell, Tardif, & Burns, 2010). The recurring question is: (1) how can we improve the very start of real-time collaboration so that it can lead to successful long-term processes?

1.1.2 *Disruptive markets*

The second case is a market situation. A company has to restructure its core business. Many decisions are pending, many agents are waiting, and there is a need for immediate communication and crisis management. Clients, suppliers and customers hear suspicious rumours from many sides. The leadership has to step into parallel response activities without a concrete new goal. There is an increased need for partnerships that add new assets to the former business. However, the company is not ready to cater for such assets by itself (cf. Prahalad & Krishnan, 2008; Schaltegger & Wagner, 2011). A collaboration with new partners for radical innovative products or services provides possibilities to regain a position in the fast changing market (cf. Block, Thurik, & Zhou, 2013). Here, the problems are (a) how to find the *right* partners, and (b) how to create an enduring collaboration in a regional or global innovation network (Barnard & Chaminade, 2011b) which will weather the disturbances of the business environment. The repeated question in both fields is: (2) how can we optimise collaborations for success in a dynamic and unpredictable process?

1.1.3 ***Leadership is poorly prepared***

Both cases confront the actors with unexpected and unintended changes in real-time. Critical incidents induce unpredictable developments (cf. Weick & Sutcliffe, 2007) and precipitate unfamiliar multi-stakeholder situations (cf. Parmar et al., 2010). An approach to heterogeneous actors, even from different sectors, seems necessary, but even more necessary is a burst into immediate action. Of course, in both cases, such collaboration is not intended and planned for, initial goals are lacking and most information remains confusing. Established management routines of the leadership creak in such circumstances, and challenged actors stumble in many societal fields: from education to health care, and from academic fields to sports, what ad hoc collaboration really needs *at this stage* is new procedures that support management, without central decision-making, yet, leadership has no management concepts to hand. Organisational management still means executing a process of linear control with key performance indicators (KPIs) and stage-gate models (cf. Greenberg, 2013). Obviously, leadership is poorly prepared to manage dynamic and open collaboration. The question therefore is: (3) how can we compose collaborative modes of management to execute successful real-time processes?

1.2 Thesis motivation

The three questions above are no longer peculiar to highly reliable organisations (HROs) such as fire brigades (Weick & Sutcliffe, 2007), and have to be recognised as direct consequences of technological development. Globally, technology enters all human places, from city markets to the human body. So, my motivation is the fact that we have begun to live in digital societies. Global markets and real-time data erode the former boundaries of time and space (cf. Katzy, Bondar, & Mason, 2012) in established institutions and accelerate our communication. Therefore, we need to invent and use more collaborative management methods and infrastructures to keep pace with the complexity and volatility of our societal reality.

As the principle of 'normal accidents' (Perrow, 2007) is innate to complex organisations but not sufficiently embedded in technological practices, organisational management needs new strategies and foresight tools for rapid response and for dynamic long-term collaboration (cf. Kuosa, 2016). My limited personal experiences in global relief have only confirmed what the literature suggests (see, e.g., Schulz, 2009; Graham, 2010): real-time collaboration fails at least as often as it leads to success.

So, many organisational actors in disaster management avoid collaboration in the face of multiple uncertainties, but as a consequence, they avoid innovation processes that would quite adequately answer the rising challenge of accelerated unpredictability.

The research interest here is certainly not limited to innovations in the market place. It is directed at *value creating innovation processes* of all kinds. Collaborative innovation processes are marked by uncertainty as "what is needed to perform well is unknown *a priori*, rather it is constructed over a project's course" (Deken & Lauche, 2014, p.3). Below is a short definition of innovation (Definition 1-1) for use in this study.

Definition 1-1: Innovation

Innovation is the process of putting new ideas or technologies into commercial or organisational practice (Tatnall, 2011).

Since this study's interest is in spontanously starting and cascading innovation processes it is necessary to narrow down the definition a little further. In contrast to delimited R&D in corporate departments, the innovation processes dealt with in this study are: processes that unfold in real-time collaboration under conditions of unpredictability. Moreover, they include heterogeneous actors and unknown factors. Owing to their uncontrollable and accelerated character, such innovation processes are referred to as *dynamic* (see Definition 1-2).

Definition 1-2: Dynamic innovation processes

Dynamic innovation processes are real-time collaborations by heterogeneous actors in which new ideas or technologies are put into practice (adapted from Okhuysen & Bechky, 2009).

Real-time innovation processes with unplanned starts and ends display multiple parallel and iterative ad hoc activities. The collaboration challenges the existing organisational management and the technical infrastructure. In innovation processes, unexpected incidents repeatedly interrupt the course of the expected interaction (cf. Van de Ven, Polley, Garud, & Venkataraman, 1999). This thesis will investigate in which ways the existing management concepts are inconsistent with a dynamic network method of governance. In addition, it will examine the patterns of successful collaboration in volatile processes. The thesis is motivated by the aim of better understanding and changing the misfit between individual and central actor approaches toward inherently networked solutions. In response to pressing and “wicked problems” (cf. Peterson, 2009), this research proposes a form of *real-time foresight* which will better prepare individual actors for the management of network dynamics.

Scientifically, the author is inspired by research in two specific domains of social science: research into collaborative action (cf. Arendt, 2013) and co-production (see, e.g., Ostrom, 2010; Sennett, 2012); and research into fast and slow modes of thinking (Scarry, 2012; Shleifer, 2012) and foresight (see, e.g., Van der Helm, 2007; Kuosa, 2016). The research domains overlap in the emergence of dynamic innovation networks.

The author’s research interest led her back to the *origins* of management and innovation theory. Innovation and social change initially were attributed to men of ‘heroic’ entrepreneurial character (cf. Schumpeter, 1934; Weber, 1992), and an understanding of researchers of such outstanding charismatic personality or ‘genius’ was considered sufficient. Later, the lens of technology management and innovation theory has shifted from the ‘individual’ to a plurality of innovation actors. Scholars have adopted a “new innovation paradigm” (Baldwin & von Hippel, 2011), discovering open innovation (Chesbrough, 2003; Ries, 2011), innovation networks and cluster approaches (e.g., Powell, White, Koput, & Owen-Smith, 2005). Following the demise of the powerful individual, the second traditional management attribute - the ‘rational’ – also began to falter, as seen in the more recent academic literature. Strategic management in traditions of economic behaviourism (Sen, 1977) and rational choice is confronted by questions of contingency and serendipity (cf. Read, Sarasvathy, Dew, Wiltbank, & Ohlsson, 2010; Harmeling, 2011). In the literature, the ‘effects’ of deliberate action are seen as ambiguous in studies that deal with actor-network theory (ANT), the effectuation approach (Sarasvathy & Venkataraman, 2011) and information systems research (cf. Tatnall, 2011; Gregory & Muntermann, 2014). Producing and selecting the multiple effects of an action can thus be described as an entrepreneurial and effective approach towards uncertain futures, strikingly explained by effectuation pioneers (Sarasvathy, 2001) in innovation management.

Although rational choice and linear progress have recently been contested, so far, no new *methods* have been developed to redefine strategic management for innovative co-production (see, e.g., Gloor, 2005; Blomqvist & Levy, 2006; Weber, Sailer, Holzmann, & Katzy, 2014) or collective management (see, e.g., Kaplan, 2009; Ostrom, 2010); especially not for *real-time* processes (see Weigand, Flanagan, Dye, & Jones, 2014).

1.3 Foresight *or* ad hoc management?

Why do classic foresight methods misfire in uncertain and suddenly ‘open’ collaboration settings? After all, it is their merit to induce the perspective on different futures; and the long-term perspective is what management needs for successful innovation collaborations. Whatever the case, there is no fit with dynamic and networked situations.

Considering a broadening scope from forecasts to foresight, and to future studies, foresight is a ‘medium range’ method. It encompasses both, actor and process. It is “a process by which one comes to a fuller understanding of forces shaping the long-term future” (Coates, 1985, p.343) and it provides “at least in principle, a systematic mechanism for coping with complexity” (cf. Martin & Johnston, 1999; Butter, Brandes, Keenan, & Popper, 2008). After three generations of foresight research (cf. Coates, Durance, & Godet, 2010; Linstone, 2011) the method is in fact established in literature and practice, in the policies of industrialised and of developing countries. This research will focus on technological foresight (TF) as explained in definition 1-3.

Definition 1-3: Technological foresight

Technological foresight is a ‘future looking method’ to reduce uncertainty and to support management in planning and decision making. Technological trends are extrapolated into different futures (scenarios) in terms of their respective resource allocations (Miles, 2010).

Three attributes of hierarchical governance hamper the use of technological foresight in real-time mass collaboration. Foresight methods are based: (1) on central decision making, (2) on time consuming, iterative planning cycles, and (3) on technical expert knowledge at the expense of local knowledge. In a so-called "fourth research era into foresight" (Linstone, 2011), new research progresses from hierarchic to networked procedures (Koschatzky, 2005; Nelson, 2010; Linstone, 2011; Tuomi, 2012; Cook et al., 2014; Heger & Boman, 2014; Weber, Sailer, & Katzy, 2015). More recent studies have incorporated improvisation and ad hoc collaboration into the method (Cunha, Clegg, & Kamoche, 2012). The driver is that foresight methods need to fit a globally networked, digital and fast changing planning environment.

The intriguing question is: are there disciplines that already offer contributions to such a "foresight 2.0" for successful process management of ad hoc collaboration? So far, this has not been the case. In innovation management, process studies result in publications that "investigate antecedents and consequences of collaboration processes instead of their dynamics" (Poole, Dooley, Holmes, & Van de Ven, 2000). Potentially, a collective action which is seen as a formal behaviourist approach allows for simulation of complex interactions, but it offers a forecast instead of real-world evidence of successful dynamic management. Formal research relies on laboratory environments and yet results in "equations that are not transferable into practice" (e.g., Langley, Smallman, Tsoukas, & Van de Ven, 2013). In order to instruct managerial practice, it is necessary for engaged scholarship approaches to combine empirical evidence and exploration of *how* dynamic processes unfold and are governed successfully (cf. Langley, 1999; Van de Ven, 2007; Slotte-Kock & Coviello, 2010). Empirical evidence is gained from natural settings.

A highly dynamic and therefore very instructive setting for collaborative innovation processes is transnational relief. Global disaster management offers textbook examples of multi-actor collaboration in conditions of great uncertainty. The typical partners in such ad hoc collaboration are as varied as it is possible to be, including: vulnerable local communities, local governments, supranational institutions, foreign state actors, humanitarian aid organisations, private companies and private donors. As repeated by observers, actors and crisis researchers (Quarantelli, 2006; Comfort, 2007; Nadarajah, 2011), first and foremost, cooperation in the field needs to be improved. Although we know that sustainable disaster management is more a process than an event (cf. Quarantelli, 1988), the initial stage of crisis management still dominates the media and the academic world. Yet, it takes years to complete a full crisis management cycle: from first response, through recovery, to disaster preparedness and mitigation (UNISDR, 2009). The effectiveness, innovativeness and sustainability of response depend less on heroic emergency aid than on the collaborative management capabilities of very different actors over time (see, e.g., Donini, 2012; Wamsler & Brink, 2014).

For actors, the challenge of managing transnational relief involves coping with high levels of uncertainty (see, e.g., Bankoff, Frerks, & Hilhorst, 2004; Weick & Sutcliffe, 2007; Kilby, 2008), beginning with a massive influx of new actors on a devastated local site. The allocation of global and local resources during the process is unclear, and so is the future of the destroyed region. NGOs and state actors in the strategic planning phase find themselves in competition for resources, visibility and accountability (cf. Twigg & Steiner, 2002). Successful outcomes for global relief cannot be expected without better understanding of the chaotic initial management situation and the dynamics which unfold between global (donors) and local levels (vulnerable regions).

According to multiple studies (including data from the present thesis) on public administration, private actors and international institutions, most actors in the dynamic relief process

(1) focus on short-term efficiency instead of long-term sustainability (cf. Boin, 2009; Kapucu, Arslan, & Collins, 2010; Turoff, Plotnick, Banuls, Hiltz, & Ramirez, 2015);

(2) underestimate the role of non-human artefacts (infrastructure and routines) in relief that considerably influence dynamic processes (cf. Latour, 1991; Kilduff, Crossland, & Tsai, 2008; Donini, 2012);

(3) are unable to identify emerging dynamic innovation networks during mass collaboration (cf. Wachtendorf, 2004; Quarantelli, 2006);

(4) misunderstand their own part in non-sustainable processes, because of low institutional learning and competition on competences (cf. Beamon, Balcik, Krejci, Miramatsu, & Ramirez, 2008).

Reconstruction and recovery are an ideal setting for innovation, as something old has to be replaced by something new. The opportunity for innovative restoration of afflicted communities, however, is all too often neglected (Boston, 2014). Without proper foresight, too few post-disaster actors recognise sustainable innovation processes. Thus, too few transform a collaborative global response into local sustainable recovery outcomes.

The notion of 'preparedness' which connects the beginning and the end of crisis management, in the literature more than in practice, involves an ‘incognito’ foresight dimension. Inspired by this reference to a (better) future that is always made by us, we see global-local disaster management as an innovative field and instructive setting for the challenge of successful ad hoc collaboration and entrepreneurial foresight.

1.4 Problem statement

To formulate a proper problem statement, we resume the leading thoughts. The challenge of responding to unexpected events and of collaboration in the face of an unpredictable future inhibits actors, so public and corporate agencies have established foresight processes in order to cope with such uncertainty. However, in numerous societal realms and in an increasing number of management situations, central actor perspectives no longer apply. Planning periods and hierarchic decision-making are contradictory to the dynamic plurality of a digital age: what currently happens is that multiple actors are confronted with complex ad hoc processes. For new collaborative management teams, there are neither management styles nor real-time feedback tools available, and both are needed by the actors that have to manage real-time dynamics successfully.

This gap is addressed in the present study. The thesis takes turbulent post-disaster and global-local relief as an exemplary setting of dynamic innovation collaboration, using the opportunity to learn from best practice. The aim is to select cases of collaborative recovery by innovation networks, and from these to gain knowledge about the network patterns of dynamic innovation processes. Pattern knowledge and recognition can prepare actors for situations of collaboration in real-time. Dynamic network patterns can be used to gain a new mode of “foresight 2.0”.

Therefore, the problem statement (PS) of the thesis is as follows.

PS: How is it possible to collaborate for successful dynamic innovation processes?

The problem statement is complex since we have, (1) to investigate a variety of possible collaborations, (2) to determine criteria for the notion of success, and (3) to define dynamic innovation processes.

Item (3) has been settled by definition 1-2. For a proper understanding of the PS, it is necessary to define more precisely what is understood by successful collaboration. Collaboration is a term that applies to increased interaction, as opposed to the coordination and cooperation of actors (cf. Lindblom, 1979; Turoff, Hiltz, Bañuls, & Van Den Eede, 2013). Collaboration includes use of digital infrastructures and crosses organisational boundaries spanning bilateral partnerships to cross-sector activities (cf. Vangen, Hayes, & Cornforth, 2015). Based on the entrepreneurial foundation developed above, it is possible to speak of successful collaboration as outlined in definition 1-4.

Definition 1-4: Successful collaboration

Successful collaboration means a mutual interaction process between several actors over time leading to ends that satisfy these actors by creating value for them and/or their ecosystem. The emergence of dynamic innovation networks (DINs) is an indicator of successful collaboration.

Built on this shared understanding are five research objectives and five research questions (RQs). These address different aspects of the complex problem statement and guide the research carried out in this thesis.

1.5 Research objectives and questions

This section specifies the five research objectives. They guide the research conducted and can be considered as milestones of the study. The research objectives are to be seen as five distinct aims.

(1) To show why traditional management theory hinders ad hoc collaboration.

(2) To design a time-sensitive method to explore non-linear innovation processes.

(3) To analyse dynamic innovation processes in a network perspective.

(4) To identify the innovation strategies of various relief DINs.

(5) To develop a new real-time foresight and real-time evaluation tools.

These research objectives lead to five guiding research questions. The first RQ relates to the conceptual background and reads as follows. **RQ 1: Why do strategic management and foresight fail in ad hoc collaboration?**

This research question is addressed through a focused literature review (Chapter 2). The traditions of strategic management (cf. Martinet, 2010), collective action (see, e.g., Van de Ven & Hargrave, 2006) and foresight (cf. Nelson, 2010) imply hierarchical structures. It is essential to investigate why this is problematic for real-time collaboration and to identify in exactly which points. The thesis seeks to identify the concrete parameters in which a managerial turnaround is required.

Moreover, the study examines wether lateral, non-hierarchic governance is already described in the network literature, especially - on *innovation* networks. The topic is already spearheaded in recent management literature, for example, in entrepreneurship research (cf. Pittaway, Robertson, Munir, Denyer, & Neely, 2004; Graf, 2006; Schaltegger & Wagner, 2011) and disaster management (cf. Kilby, 2008; Kapucu et al., 2010), but so far, network emergence and network governance remain puzzling to strategic management and public administration (cf. Meier & O'Toole, 2005). To improve the management of unexpected real-time collaboration, the evolution of networks and emergence of *dynamic governance structures* have to be understood.

Many dynamic innovation processes are connected with each other. This implies that they form a network. Global innovation networks (GINs) are discussed in parts of the entrepreneurship literature (see, e.g., Ernst, 2002; Sazali, Haslinda, Jegak, & Raduan, 2009; Barnard & Chaminade, 2011a) and variously defined in disaster management (see Varda, Forgette, Banks, & Contractor, 2009; Kapucu, 2015). This study adapts one such basic definition in order to examine the PS. Therefore, it frequently refers to dynamic innovation networks (DINs). The concept is defined in definition 1-5.

Definition 1-5: Dynamic innovation network

A dynamic innovation network (DIN) emerges from the interconnected and integrating practices of actors that engage in innovation activities (adapted from Barnard & Chaminade, 2011b).

DINs comprise heterogeneous regional or global actors including companies and non-firm agencies, human and non-human elements. To answer RQ 1 it can be seen that empirical knowledge must be gathered about *how* networks emerge in real-time and *how* collaboration in DINs unfolds over time. So far, empirical findings are lacking and publications are scarce. Therefore, the study aims to explore the dynamic network evolution, and consequently, RQ 2 is about how to investigate network emergence and evolution in a natural setting.

RQ 2: How is it possible to adequately explore successful ad hoc collaboration in dynamic innovation networks?

Global relief is the chosen exemplary setting for exploring innovation collaboration in the making. In the chaotic post-disaster period, multiple actors join and perform relief activities, but only successful collaboration processes generate local sustainable outcomes. Long-term reconstruction is a non-linear, and in the best of all cases, innovative process. Yet, until now, its governance has escaped the notice of the actors and the standard ex-post evaluation. We have learned from two research mistakes in recent crisis management studies that it is not sufficient when evaluating the outcomes or the plans of implemented measures: (1) to look at only one organisational actor (cf. Lalonde, 2011; Dorasamy, Raman, & Kaliannan, 2013), and (2) to look at only identical organisational actors (cf. Comfort, Ko, & Zagorecki, 2004; Schoenharl, Madey, Szabó, & Barabási, 2006; Schulz, 2009; Hermann et al., 2012; Kapucu, 2015).

To explore successful collaborative dynamics and to detect *emerging network patterns*, the heterogeneous network level has to become a unit of observation, and it has to be observed over time and disruptive evolutions. The reason is straightforward. In mutual interaction between heterogeneous actors only, complex entrepreneurial processes unfold and show their idiosyncratic intricacies (cf. Caliendo, Fossen, & Kritikos, 2012).

For a proper understanding of non-linear and disruptive collaboration over time, this thesis adopts the critical incident technique (CIT) as a method of observation. It relies on Flanagan's definition of a CI as given in definition 1-6.

Definition 1-6: Critical incident

A critical incident (CI) is an event that changes the ongoing activities or project plans (adapted from Flanagan, 1954).

CIs may have positive or negative effects for different actors in a dynamic innovation process. Heterogeneous actors, innovation networks and CIs are the conceptual parts of the research design that the thesis develops in answer to RQ 2.

We are now ready to focus on RQ 3 that reads as follows.

RQ 3: Which network patterns facilitate real-time innovation processes?

In social network analysis (SNA), networks are first and foremost described as structures. These structures, though, have a potential to change over time. By taking changes into account, static network models could take a dynamic turn, but most studies still are based on homogeneous ties and nodes. SNA neither accounts for actors' heterogeneity in complex collaboration, nor for unfolding disruptive changes in a dynamic real-time process. Therefore, only a few insights can be obtained for *leadership* in real-time collaborative innovation processes.

Thus, to advance network models to an inclusion of heterogeneous actor's perspectives and to ad hoc collaboration facilitation over time, it is necessary to use an actor-network lens. The dynamic network perspective (see Chapter 2) is chosen to explore the practices, interests and collaborative network patterns of different socio-technical actors. Actor-network theory (ANT) talks of network-actors and actor-networks, to emphasise their original conglomeration.

According to the actor-network theory (ANT) literature, the relationship between network and actor is defined as follows.

Definition 1-7: Actor-network

An actor-network emerges from the heterogeneous *interests of socio-technical actors*. It evolves as a hybrid of human and non-human actors in a so-called *translation process* of interests (adapted from Latour, 1999).

This study argues that a constructivist ANT does not start from isolated agents that deliberately relate to others. Therefore, social practices are followed and observed in perspectives of heterogeneous, hybrid network-actors. These socio-technical actors are retraceable as they are involved in the translation processes of an emerging network, as defined in definition 1-8.

Definition 1-8: Network-actor

A network-actor is an "element which bends space around itself, makes other elements depend upon itself and translates their will into a language of its own" (Callon & Latour, 1981:286).

RQ 4 steps consciously from the abstract level into the practice of network management in the field of disaster relief. The aim here is to find out how a strategy emerges from collaboration. It will be interesting and important to discover whether DINs use the same innovation strategy in successful real-time collaboration. If not, then it will be relevant (for science and for practice) to explore how the available network patterns lead to different strategies, and to ask which major dimensions influence and shape the emergence of different DIN strategies. RQ 4 is formulated to investigate such questions.

RQ 4: Which innovation strategies are used by DINs in global relief?

One of the dynamic patterns identified by this study's process analysis is the double-sided network-function of focal actors for (a) network governance and (b) local sustainable impact. In post-disaster settings, local NGOs (LNGOs) are such focal actors which initiate the ad hoc process and stay to the end. The DINs in the study sample revolve and build strategies around their profiles. A focal actor role is defined according to ANT in definition 1-9.

Definition 1-9: Focal actor

A focal actor is a network-actor which aligns the heterogeneous interests of the other actors (Tatnall, 2011).

A classic multisided notion of strategy (Mintzberg, 1987) includes two dimensions: a deliberate part (plan) and an emergent part (pattern). For both strategic dimensions, this thesis selects relevant management codes from its codebook (see Appendix D). Finally, it will explore, with both kinds of codes, the differences between network strategies, CIs and focal actors.

In asymmetric and multivalent partnerships (cf. Ekbia & Kling, 2005), the typical shape of DINs in global relief, resources and management capacities, information, technical and local knowledge are unequally distributed. The dynamics between small local and professional global actors are decisive in sustainable relief (cf. McGilvray & Gamburd, 2010). The network strategies employed by LNGO actors in this study's sample reveal polar profiles, although which dimensions of those profiles are generally so significant that they are relevant to the matching processes which take place is not clear. This research sets out to determine the most adverse collaboration dimensions.

As a sequel to RQ 3 and RQ 4, the last RQ turns away from leadership practices in global relief and back towards the generic research interest: the challenge of ad hoc collaboration, management and foresight for dynamic innovation processes.

RQ 5: How should a well-qualified management team plan and manage dynamic innovation processes?

The last research question aims to develop a new managerial method that uses real-time concepts and digital infrastructure to direct attention towards network emergence. The underlying question is whether such a new style is designable and controllable. To investigate this question, the study splits the search for an answer into two parts. First, it designs a new real-time foresight version, and second, aims to make it measurable by adding process evaluation tools to identify and measure the collaborative performance of DINs.

The next section describes the methodologies employed to achieve each of the research objectives and answer the five RQs.

1.6 Research methodologies

For social research that aims to generate new knowledge on little known phenomena, an explorative approach and qualitative research methods are best (cf. Crabtree & Miller, 1999; Creswell, 2013). Management scholars recommend a pragmatic process (cf. Onwuegbuzie & Leech, 2005) and a combination of different methods. With this in mind, this study was designed to find the best fit between (a) research question, (b) research context, and (c) research methods (cf. Edmondson & McManus, 2007).

The proccessual qualitative study in hand is based on grounded theory methods, or GTM (Strauss & Corbin, 1998; Bryant & Charmaz, 2007). It explores a dynamic, non-linear collaboration process (Pettigrew, 1997) in a dynamic network framework. To compare and confirm successful DIN patterns, a cross-case comparison (see Eisenhardt, 1989; Yin, 2009) was conducted. Grounded in narrative interviews and on rich secondary data, *codes and categories* for network-actors, CI and network dynamics were assigned. The comparison of CIs and the other significant categories was achieved by coding and further analytical procedures conducted using the software ATLAS.ti.

The research is based on three principles that are criteria of solid GTM studies (Peters, 2014): (1) careful ‘theoretic sampling’, (2) deep grounding of concepts and categories in codes and *data*, and (3) hand-in-hand advancement of data *collection* and data *analysis*. The thesis abides by all of them. To achieve the research objectives (see Section 1.5) it addresses the five RQs derived from the PS by following the five methodologies:

(1) Literature review (focused on management approaches, see Chapter 2)
(2) Conceptualisation (for research design and CIT, see Chapter 3)
(3) Analysis and coding (in ATLAS.ti, see Chapter 4)
(4) Cross-case comparison and central code operationalisation (see Chapter 5)
(5) Transformation of patterns and operationalisation (see Chapter 6)

1.7 Structure of the thesis

The thesis contains seven chapters which guide the reader from a theoretical appreciation into a larger empirical section.

Figure 1-1 depicts the sequence of the chapters and the structure of the study. Each chapter finishes with a chapter summary which is short and index oriented.

Chapter 1 introduces the problem of real-time collaboration and explains the motivation behind this research. The research topic is embedded in the empirical field of disaster management. The PS is discussed and divided into five RQs that are addressed by distinct thesis chapters. The main theoretical constructs are defined and the methodologies to address the research questions are listed. The chapter ends with a table that shows which chapter addresses which RQs.

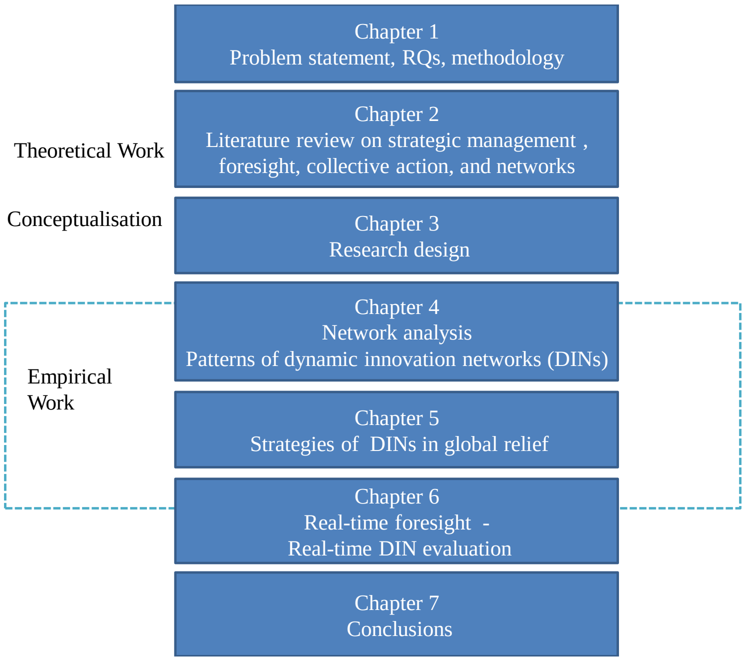

Figure 1-1: Structure of the thesis

Chapter 2 establishes a theoretical framework for ad hoc collaboration. The chapter contains a focused literature review on theoretical traditions of strategic management, collective action and foresight. The theoretical traditions cause problems for successful real-time collaboration. The chapter addresses RQ 1 and ends by establishing the research rationale, which is to understand successful ad hoc collaboration and to explore the patterns of dynamic innovation networks.

Chapter 3 constructs a research design that fills the identified research gap concerning successful real-time collaboration. It shows how to explore the management of dynamic innovation networks and so addresses RQ 2. The answer consists in a method mix designed to retrace the evolution of non-linear processes, adding concrete time-stamps (CIT) to abstract network formation steps of ANT. Naturally, chapter 3 describes sampling, data collection and data analysis in a context of global relief dynamic innovation processes. It ends with a methodological rigour check.

Chapter 4 is the beginning of the empirical part of the thesis. It presents an actor-network analysis. RQ 3 is addressed by the stepwise reconstruction of network emergence, first by analysis of mobilised actors and CI occurrence, then by collaborative management and unfolding dynamics. Patterns that facilitate innovative collaboration within one network are identified and confirmed by the other success cases. Chapter 4 starts by presenting three global-local relief processes; it ends with cross-case evidence on five dynamic innovation patterns.

Chapter 5 aims to identify innovation strategies, so, it deals with the impact of the identified dynamic network patterns in the empirical field. The chapter searches for managerial answers to RQ 4: which innovation strategies were used by different NGO networks in relief? From a comparison of network strategies around a focal actor, the other actors enroled, and CIs, three different network strategies become visible. It turns out that ‘media alertness’ and ‘readiness to scale up’ are polar LNGO dimensions that matter for network management. In a matrix form, the finding becomes a tool that helps the user to adopt appropriate actions in asymmetric partnerships.

Chapter 6 aims to answer RQ 5 on how well-qualified management teams should plan and manage dynamic innovation processes. Based on the results obtained by the process analysis, the answer consists of two elements for real-time foresight, one to prepare for ad hoc collaboration and one for measuring real-time network emergence. To give this answer, the study proposes a new foresight method and discusses its incorporation in public and corporate practices. Thereafter, an indicator tool for real-time evaluation of DINs is derived and spelled out for both business incubation and disaster management settings.

Chapter 7 answers the PS. It considers the merits and limitations of the study. Theoretical and practical impacts are reviewed and suggestions for future research projects are given. This empirical study is positioned in the interdisciplinary field of disaster management, and its results open up new prospects for numerous academic disciplines. Testing and validation of the five dynamic innovation patterns needs further research engagement. In addition, the findings on CIs in global-local relief offer promising new material for disaster research and successful reconstruction processes. The innovative potential of reconstruction processes was, for a long time, neglected. In the light of the results, it should no longer remain unrelated to research on sustainable entrepreneurship.

Table 1-1 illustrates the order of the thesis chapters. The flow of the RQs provides a clear reading and also allows the reader to go directly to those chapters which interest them most.

Table 1-1: Overview of addressed RQs and thesis chapters

	Ch 1	**Ch 2**	**Ch 3**	**Ch 4**	**Ch 5**	**Ch 6**	**Ch 7**
PS	X	X	X	X	X	X	X
RQ 1	X	X					X
RQ 2	X		X				X
RQ 3	X			X			X
RQ 4	X				X		X
RQ 5	X					X	X

2 From traditional management to dynamic collaboration

The aim of this chapter is to better understand the conceptual problems of collaborative management in real-time by way of a focused literature review. From this investigation, it will be possible to identify those strategic management traditions and conceptual key elements that counteract successful dynamic innovation processes. The goal here is to answer RQ 1: why do strategic management and foresight fail in ad hoc collaboration?

Managing ad hoc collaboration with multiple independent actors causes problems even for highly professional actors. In the following, we retrace traditions of management theory and foresight to better understand why this is the case. Then we focus on conglomerations of classic management and collaboration approaches, namely in collective action theory and network studies. In recent literature on innovation processes (cf. Manzini, 2014) and global relief (cf. Lalonde, 2011) innovation networks are recognised as successful methods of coping with uncertainty. Although an increasing number of scholars attribute to networks a facilitating role in collaborative governance, the mismatch with managerial concepts still persists. According to the reviewed literature, collaboration to build dynamic innovation networks (DINs) is somewhat puzzling to management and there are no concepts which might lead to a leadership turnaround. This observation provides the research rationale for a process study on alternative dynamic management structures - network patterns.

The chapter is structured as follows. Section 2.1 reviews traditions of strategic management and foresight literature. Section 2.2 investigates collective action and network studies. In section 2.3, the chapter reviews central opposites in an interim conclusion to consolidate the elements in theory traditions that inhibit ad hoc collaboration. Section 2.4 screens recent literature on innovation networks and considers the use case of disaster management. Global relief showcases existing management problems of ad hoc collaboration and real-time foresight: collaborative recovery has innovative impact but also planning limits (cf. Ordóñez, Schweitzer, Galinsky, & Bazerman, 2009; Sachs, 2012). In this challenging management perspective, the ambivalent legacy of theory traditions is confirmed. In section 2.5, therefore, the need for a turnaround of managerial practice in dynamic innovation processes is depicted as a conceptual mismatch and empirical need. The end of the chapter builds the research rationale for a real-time foresight study.

2.1 Traditions in strategic management and foresight

Planning and foresight belong to the academic field of strategic management. In this section, the study sheds light on traditions of strategic management (2.1.1) and foresight approaches (2.1.2). Technological foresight (TF) is a process for planning into open futures. Subsection 2.1.3 ends the section by contrasting strategic planning with real-time readiness.

2.1.1 *Strategic management tradition*

Strategic management traditions can be retraced from military philosophy (see, e.g., Machiavelli, Codevilla, Allen, Arkes, & Lord, 1997) to recent microeconomics and organisation theory (cf. Hill, Jones, &

Schilling, 2014). The managerial role in strategic management is to calculate goals and risks for a company (cf. Ansoff, 1991; Eisenhardt & Zbaracki, 1992; Martinet, 2010), to target goals, and to allocate and control available resources. Individual interest is at its core; it was first formulated for powerful individual *persons*, and then became a *national*, and finally a *corporate* interest (cf. Hodgson, 2007). From its origins to the present day, planning, goal achievement and resource allocation are three basic operations of strategic management.

Some twenty years ago, strategic management absorbed a strong heritage of economic theory in its mainstream. Four issues were instrumental to this heritage in mainstream theory. First, the transaction cost approach (cf. Williamson, 1979; Ghoshal & Moran, 1996) was linked up with market and organisation theory. Second, the resource-based view (cf. Barney, 2001; Priem & Butler, 2001) contributed to showing how tangible *and* intangible resources are competitive strategic assets. Third, with the dynamic capabilities approach (cf. Teece, Pisano, & Shuen, 1997; Eisenhardt & Martin, 2000; Barreto, 2010) flexible assets for fast changing markets were introduced. Fourth, institutional capabilities were recognised as an advantage over market competitors (see, e.g., Scharpf, 2000; Ferrera & Sacchi, 2005) in national and global digital contexts.

With regard to ad hoc collaboration, the four brightening contributions to the strategic management domain still share a common denominator. The reasoning is as follows. Individual actors (firms) plan resource allocation to compete and realise their interests in markets. *Collaborative* activity seems to be a feature of single firms' portfolios. In management theory, the capacity of a firm to cooperate and to exchange parts of production with global partners is discussed under various terms. Here, we mention three of them: (1) collaboration capability (cf. Teece et al., 1997; Blomqvist & Levy, 2006), (2) strategic alliances (cf. Hitt, Ahlstrom, Dacin, Levitas, & Svobodina, 2004), and (3) portfolio of strategic networks (cf. Partanen & Möller, 2012). Still, in all three discussions, collaboration does not appear as a plural quality, not as different from individual achievement, and not as emerging from *multiple* actors' action. In this tradition, collaboration as a managerial capacity remains an attribute of a single actor. It thus becomes one of many attributes of central actor planning and management.

Strategic management is a composite academic field to which different disciplines (economics, sociology, marketing, finance, and psychology) contribute (see also Chapter 5). In contrast to organisational management that focuses on formal organisations, strategic management has a mixed tradition that ten years ago evolved into business policy (Hambrick, 2004). Yet, management scholars struggle with differences between the terms *corporate*, *organisational* and *strategic* management (cf. Hambrick, 2007; Nag, Hambrick, & Chen, 2007). With regard to the research direction, organisational management applies to any organisational actor, while corporate management refers to market corporations (cf. Coelho, McClure, & Spry, 2003; Wajcman, 2013; Gard, 2015), but strategic management applies to an intended and planned development of any unspecified actor by the leadership. And leadership is challenged by ad hoc collaboration in its traditional role.

To understand this we have to go back to older differences in the bases of organisation and management theory. Abandoning more ambivalent recent discussions (cf. Nag et al., 2007; Stacey, 2007) and following Astley and Van de Ven (Astley & Van de Ven, 1983; Van de Ven &

Hargrave, 2006) the approaches are still oriented along the lines of old debates that divide them into four groups (see Figure 2-1).

The groups are distinguished by their approaches. Group 1 has a system structured approach. Group 2 has a natural selection approach. Group 3 has a collective action approach. Group 4 has a strategic choice approach.

The old theories distinguish two axes, viz.

- an x-axis ranging from system voluntarism to individual

voluntarism, and

- a y-axis ranging from micro-oriented to macro-oriented.

This results in the following compartmentalisation.

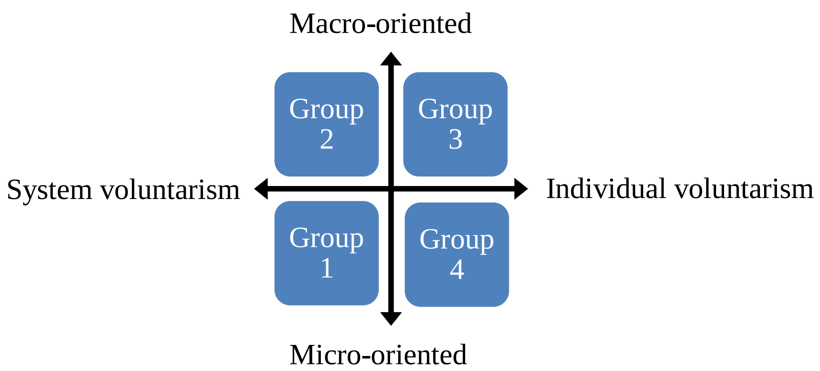

Figure 2-1: Approaches in organisation and management theory

Based on extensive analyses, the analytical outcome of the concepts leads to the following characteristics for each group.

Group 1: - deterministic worldview (structural functionalism)

- focus on micro behaviour, actor's role: reactive

Group 2: - strong determinism (natural selection)

- focus on macro phenomena, actor's role: inactive

Group 3: - methodological individualism (collective action)

- extended alliances and networks, actor's role: interactive

Group 4: - individual voluntarism (strategic choice)

- central actor perspective, actor's role: proactive

Group 4 is the traditional place of strategic management concepts. It is relevant to RQ 1. Close to it are different collective action approaches (group 3); both groups are relevant to answer RQ 1. The other two groups deny managerial for evolutionary perspectives. Here, we see system theory and theories of economic history.

Two basic conceptual orientations are important for managerial impacts.

(1) The more the managerial role (actor's role) is understood to be a central actor role (or an independent position of hierarchic command and control), the less it fits into polycentric, non-hierarchical relations, in volatile and ad hoc situations (see, e.g., Mintzberg, 1990; Watson, 1994; Weick & Sutcliffe, 2007).

(2) In voluntaristic oriented approaches, concise external information (on ex-ante given preferences) is a prerogative for strategic choice and collective action (Groups 3 and 4).

In sum, external actors and surrounding ecosystems appear in strategic management traditions as rather competitive and hostile worlds. Planning and foresight are needed in strategic management to become faster than others in the market. In a quotation from strategic management scholars, 25 years ago, but still true today: *"The reason is that when they arrive on a market with a new product/service, such firms find the market pre-empted by more foresightful competitors, who had planned their strategic moves in advance"* (Ansoff, 1991, p.455).

Foresight in this sense (Figure 2-1, Group 4) means the ability to calculate one's own and others' interests as clearly as possible into the future. The managerial role of planning then depends on reliable information on recent trends and environmental structures, and on other actors' activities and priorities. The calculation of these parameters in a linear development allows strategic management to plan into the future: individual actors compete with others in predictable, linear growth processes in markets according to plans. Given fix preferences and a stable environment, speed equates to advantage and effectiveness. The managerial role is to speed toward the defined goal while best marshalling the available resources.

How does this affect managerial attitudes towards ad hoc collaboration? In this framework, collaboration has to consist of inter-organisational cooperation that depends on (1) the actors fix preferences and their set goals, (2) individual power to realise set goals against opposition, and (3) full initial information in decision making, for goal targeting and control.

2.1.2 *Foresight tradition*

Relying on foresight is a management method of systematic expert-based planning and decision support. As *technological foresight* (TF), foresight has become a prominent part of technology and research planning since World War II. Forms of foresight developed from technological forecasting for military purposes in the USA (see, e.g., Miles, Harper, Georghiou, Keenan, & Popper, 2008; Coates et al., 2010; Box, Jenkins, Reinsel, & Ljung, 2015) and gained worldwide momentum, with 'booms' of internationalisation in the 1990s (in the uncertainty of a new millennium). Corporate foresight also developed, as a monitoring and planning method for corporate actors (see, e.g., Daheim & Uerz, 2008; Linstone, 2011; Rohrbeck, 2012).

Foresight practices have been adapted to very different national cultures. While TF originated in the USA, it developed in substantially different ways in France (cf. Godet, 1986), Nordic European countries (see, e.g., Andersen et al., 2007), the UK (cf. Keenan & Miles, 2002) and Japan (cf. Kuwahara, 1999). However, foresight also became a transnational endeavour (cf. Popper, Keenan, Miles, Butter, & Sainz, 2007; Butter et al., 2008). Today, it is an important part of the EU's strategic management (cf. Becker, 2003; Pellegrin, 2007). European foresight activity (cf. Cuhls, 2003) has led to the formulation of 'grand challenges' and gave rise to research programmes such as HORIZON 2020 and diverse platforms for citizen participation[1].

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[1] see http://forlearn.jrc.ec.europa.eu/guide/1_why-foresight/foresight-culture.htm

Forecasting and foresight are often confused. Technological foresight was developed from technological forecasting.[2] Martino defined a technological forecast as *"a prediction of the future characteristics of useful machines, procedures and techniques*" (Martino, 1993:1). Forecasts are calculations, on the basis of available data and technology.

Foresight, however, encompasses a *process* and is a *strategy* for coping with uncertainty. In conceptual traditions of technological forecasting, TF focuses on technological breakthroughs, risks and consequences (Linstone, 2002). TF provides decision makers with scenarios of potential futures to plan and prepare for. It aims to enable actors to decide, shape and make their future (cf. Popper, 2008; Linstone, 2011). As there are many TF designs, defining *the* foresight process is not viable.

Both technological forecasts, seen as calculations, and TF, as part of longer planning and decision making processes, support mindsets of technological progress and linear growth (see, e.g., Könnölä, Brummer, & Salo, 2007; Lin, Luarn, Maa, & Chen, 2012). With regard to planning, both rely on extrapolation of existing and past trends, and both tend to neglect anything other than technological factors, and here, back dropping technological or unpredictable social evolution (cf. Besiou, Stapleton, & van Wassenhove, 2011) did not appear in the calculations.

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[2] Here we note in passing that forecasting is different from predicting. A forecast relies on data from the past and presents an analysis of trends. It is an extrapolation of the past into the future (cf. Armstrong 2001). A prediction is a statement about the way things will happen in the future, often but not always based on experience or knowledge and closely related to uncertainty (Hazem & Mastorakis, 2008).

Only recently, destructive technologies (cf. Ayres, 2000; Van Notten, Sleegers, & van Asselt, 2005; Saffo, 2007) became a planning issue in a new generation of foresight research (cf. Cagnin, Havas, & Saritas, 2013). Debates over ‘foresight 2.0’ have recently revolved around disruption and improvisation (see, e.g., Van der Helm, 2007; Nelson, 2010; Heger & Boman, 2014; Weigand et al., 2014; Weber et al., 2015) and the integration of change and complexity in foresight approaches. These studies aim to adapt planning to the acceleration of societal dynamics.

In sum, turning to foresight for long-term planning and reduction of uncertainty in dynamic collaboration processes is straightforward (Weigand et al., 2014). So far, however, its use for ad hoc collaboration has been limited. TF’s innate central actor perspective (cf. Miles, 2008) and expert-based approaches (cf. Landeta, 2006; Georghiou et al., 2008; Linstone, 2011; Linstone & Turoff, 2011) need time and considerable financial investment to fulfil repetitive expert rounds in reliable scenario development. Foresights are technical methods used to reach an identified audience. This involves high levels of investment. TF standards are too time consuming and resource intensive for use in real-time challenges.

Although foresight *studies* examine and support participative practices and principal agent problems (see, e.g., Cachia, Compañó, & Da Costa, 2007; Nugroho & Saritas, 2009; Lin et al., 2012; Markmann, von der Gracht, Keller, & Kroehl, 2012; Carabias, Moser, Wilhelmer, Kubeczko, & Nelson, 2014), foresight *methods* are guided and sponsored activities (cf. Gordon, Glenn, & Jakil, 2005) in hierarchical decision making and planning processes.

Public and corporate foresights serve a different leadership audience. Public foresights can be conducted in a general or in a special interest.

The aim is to furnish information for strategic planning of concerned actors in in the population. This includes, but is not limited to the support of private companies (see, e.g., Rohrbeck & Gemünden, 2011). In contrast, corporate foresights provide businesses with specific knowledge about their branches, markets and future developments (cf. Wilhelmer & Nagel, 2013). For both domains, scenarios of medium-to-long-term range are produced. Support for planning and decision-making is offered without producing the decision itself.

In our digital age, public administrations and corporate actors struggle with an information abundance, time scarcity and parallel real-time issues. The future seems closer than before as product life cycles as well as the span of a human generation shrink. Technological change is no longer the only acknowledged factor for change: society and ecosystems have also been recognised as change drivers (see, e.g., Bijker, 1997; Welsh & Krueger, 2012; Battilana & Casciaro, 2013).

TF has achieved sound standards, but society has changed and traditional boundaries between public and private sphere, time and space are melting. The complexity of problems triggers public-private and cross-sector partnerships (cf. Rangan, Samii, & Wassenhove, 2006; Schuppert, 2008; Andonova, 2010) in search of tri-sector solutions (see, e.g., Richter, 2004; Gay & Dousset, 2005; Selsky & Parker, 2005). The conclusion is unavoidable: future planning has become impossible without multi-sector collaboration and the inclusion of heterogeneous *affected* and *interested* actors (for new solutions see Chapter 6).

2.1.3 *Initial planning, linear process and methodological individualism*

Here we briefly review the preceeding sections before we move on in search of collaborative management concepts. Methodological individualism influences planning and management far beyond the market place. Strategic management mainstream theory tradition (Group 4) is built on individual choice concepts adverse to ad hoc collaboration and networked situations. Strategic management follows traditions of (1) central actor perspectives, (2) initial information to calculate own and others' preferences, (3) projectable linear processes, and (4) time for ex-ante planning. The managerial role is to allocate resources and to control if not linear then at least predictable processes to meet ex-ante set goals. Planning and management traditions therefore are in conflict in situations involving (1) scarce or overwhelming information, (2) multiple autonomous actors and (3) a need for ad hoc (re-) action.

Foresight approaches have established processes to cope with uncertainty and to look into various medium-to-long-term futures, but so far, foresights have been tailored to support the ex-ante planning of central actors and single corporations. To advance management and decision making to plurality, greater levels of complexity and much greater speed, public and corporate foresights need to change (cf. Tuomi, 2012). Below are three reasons for such a change.

(1) The *central actor* perspective is blind to the diversity of interests in collaboration. The central actor perspective is not useful in dynamic collaboration processes where many activities overlap but do not merge into one task. To enrol independent actors in polycentric co-production

instead requires different interests to be taken into consideration. Therefore, polycentric instead of central actor perspectives have to become the starting point for foresight.

(2) TF extrapolates *expert opinions* relying on past trends in rather stable environments and with present stakeholders. More improvisation, contingent elements, unexpected and deviant incidents have to be expected in dynamic innovation processes (cf. Swan & Scarbrough, 2005; Bakker, 2010). Local realities, unforeseen changes and actor fluctuations should be added to scenario planning.

(3) The most fundamental mismatch, still, regards the foresights' temporal placement in ex-ante planning. *Extensive planning periods* contradict spontaneous interaction, block response speed and hinder readiness to participate in emerging innovation networks.

2.2 From traditional management to real-time collaboration

What follows is an investigation of collective action and network theories to find components for collaborative management in ad hoc situations that surmount the limitations of strategic management and foresight. Networks were long ago positioned as a third mode of governance between market and hierarchy (cf. Powell, 1991), but for leadership, the 'network paradox' is that while networks help to cope with complexity, they also add complexity to managerial activities (see, e.g., Rief, 2008).

The discussion starts (2.2.1) with collective action approaches (see Table 2-1, Group 3) in order to explain *multiple actor* management models, and then turns to network theory (2.2.2). Here, we first distinguish static from dynamic network approaches. Section 2.2.3 discusses social network analysis (SNA) and section 2.2.4 actor-network theory (ANT). Both dynamic network approaches can model change over time. Section 2.2.5 discusses how collective action and network process components contribute to the management of collaborative dynamic processes.

2.2.1 *Collective action approach*

With regard to ad hoc collaboration, collective action theory proffers two streams that are as powerful as they are divergent: (A) the institutional approach, and (B) the more traditional collective action approach that is provided by game theory and the rational choice approach (cf. Flanagin, Stohl, & Bimber, 2006). A combination of these two conceptual streams is (C) Elinor Ostrom's (2005) real-world approach.

A: The institutional approach

The institutional approach is based on the following perspective on collective action (see also Figure 2-1, Group 3). It starts from concepts of an aggregation of single actors' interests in organisations of similar preferences. Astley and van de Ven (1983, p.:251) assumed that "*the collective-action view focuses on (...) interdependent, yet semi-autonomous organisations that interact to construct or modify their collective environment, working rules, and options. The manager's role is an interactive one. He transacts with others through collective bargaining, negotiation, compromise, political maneuver, and so on. Movements toward solutions are guided by norms, customs, and laws, which are the working rules of collective action.*" The managerial role in collaboration here is to mediate a plurality of norms and customs: different practices and 'working rules' hold for different organisations. In more recent literature, economic institutionalism (cf. Williamson, 2000), technology innovation management (cf. Ahuja, 2000), social movement studies (cf. Davis, McAdam, Scott, & Zald, 2005) and the 'Indiana institutionalism' scholars (cf. Kiser & Ostrom, 2000; Janssen, Goldstone, Menczer, & Ostrom, 2008; Powell & DiMaggio, 2012) follow this scientific tradition.

B: The collective action approach

In its more powerful theory tradition, at least for strategic management, collective action draws from formal arguments and game theory. In experimental and formal scientific traditions, the approach established a sceptical view on collective action, based on rational choice and behaviourist arguments (see, e.g., Turner, Maryanski, & Fuchs, 1991, p.356). Collective action here is a *dilemma* for the rational, self-interested individual (and organisation). From Olson (1965) to Hardin's (1971) famous 'prisoner dilemma' this theoretical frame has a peer tradition in Machiavelli's and Hobbes' political concepts (see, e.g., Arendt & Jaspers, 1955): lone individuals are seen as 'wolf-like' to one another, though in a shared world.

From a managerial perspective, if maximising self-interest according to hierarchic preferences is natural, then acting towards a *common* interest just keeps actors from their individual goals. If this is so, it is neither rational nor probable[3] to collaborate, unless forced by external coercion, or unless kinship persons are involved (cf. Hardin, 1971; Sandler, 2004).

[3] The linear utility function, U1=U1 ((E-x1)+AxP (Ex1)) serves to predict outcomes as rational choice standard equation for competitive market situations.

This sceptical position towards collective action spread as a ‘zero contribution thesis’ in strategic management and established distrust in spontaneous collaboration (cf. Caliendo et al., 2012).

The collective action concept of rational choice (cf. Katznelson & Weingast, 2005) allows for complex simulations. Different actors’ preferences can be simulated in various modes. Its formal strength is helpful for scenario planning, but it is of little use to advance real-time collaboration under conditions of uncertainty. For real-time application, formal models need preliminary information. Prioritised interests of single actors in stable environments or linear development are replicated. Collaborative *process and context dynamics* between heterogeneous unfamiliar actors cannot be guided this way. So, it is necessary to look for other approaches.

C: Ostrom’s real-world and institutional approach

Elinor Ostrom, economist and pioneer of the Indiana school of institutionalism, discovered context and process factors that “affect the likelihood of successful collective action” (see, e.g., Ostrom, 1990; Ostrom, 2000) behind the utility functions of individual and collective choice frames (see Table 2-1, group 4 and group 3). Her central findings were that:

(a) in real-world collaboration multiple *types* of individuals do exist. Some individuals are more willing than others to initiate reciprocity and collective action: there are “norm-using players” and “rational egoists”, and a large variety of degrees between them (see, e.g., Ostrom, 1996; Ostrom, Poteete, & Janssen, 2010).

(b) their *ratio* is volatile and *changes* in *collaborative processes* depending on learning over time (Janssen et al., 2008). The evolution of social norms in long-term collaboration is described as a *dynamic structure* (Ostrom, 2000).

Briefly summarised from a central publication (Ostrom, 2000, p.149-154), successful collaboration or co-production depends upon:

(1) the quality of group communication (real-world, or tweets and feeds),

(2) self-imposed sanctions,

(3) believers in others' contribution, as these are most likely to contribute by themselves,

(4) continuous local involvement.

Successful collaboration is hampered by:

(5) migration, in particular, an influx of foreigners and efflux of locals can have negative effects,

(6) global-local encounters, as according to many studies, local successful initiatives often die off in the face of international and global involvements, and of interaction.

Subsection conclusion

From these findings, rich empirical accounts of context and process factors offer evidence-based *principles* for management that confront the older collective action tradition. Real-time and real-world dynamics advance institutional perspectives and re-activate collective action debates. By introducing variables of space and time, locality and temporality, collective action simulations were also improved considerably (Ai, Comfort, Dong, & Znati, 2015). In defence of Hardin's (1971) approach, scholars have also conducted empirical studies (cf. Sandler, 2004; Francisco, 2010) and the collective action debate remains open.

2.2.2 *Network theory*

The ubiquitous Internet experience of "being linked" (cf. Barabasi, 2003) and "living in a small world" (Watts & Strogatz, 1998) brought new attention to network concepts around the millennium. Network analyses stem from very different disciplines including biology, computer sciences and sociology (Turner et al., 1991, p.540-572). The basic assumption is that the position of an element or actor in a *network* of others determines shape, status and future development. In the social sciences, Granovetter's (1973) work, as inspired by Polanyi (1944), paved the way for social network analysis (SNA): he first analysed actors in their "embeddedness" in terms of "strong and weak ties" (Polanyi, 1944; Granovetter, 1973; Granovetter, 1983).

Ties are relationships among actors that provide opportunities and constraints for behaviour. So network theory leaves the pure realms of *the individual: "This perspective differs from traditional perspectives in organisational studies that examine individual actors in isolation. The difference is the focus on relations rather than attributes, on structured patterns of interaction rather than isolated individual actors."* (Brass, Galaskiewicz, Greve, & Tsai, 2004, p.795). This transcends the central actor concepts in strategic management.

Traditional network theory examines structures of homogeneous nodes and ties (see, e.g., Stegbauer, 2010) to describe a networks' size and structure. Structural models, however, do not capture change over time (see, e.g., Trezzini, 1998). This conceptual limitation was early recognised (cf. Granovetter, 1983; Burt, 2004) but remained, for a long time, unsolved.

In recent network literature, adaption, evolution and change of networks are addressed (see, e.g., Day, Junglas, & Silva, 2009; Slotte-Kock & Coviello, 2010; Korsgaard, 2011; Parmigniani & Rivera-Santos, 2011). Different explanations stem from pathway approaches (cf. Sydow, Windeler, & Möllering, 2002; Sydow, Schreyögg, & Koch, 2009), science and technology studies (cf. Law & Callon, 1992; Bijker, 1997; Orlikowski, 2009), diffusion of innovation approaches (cf. Rogers, 2010) and generally, from studies on innovation networks (cf. Gloor, 2005; Koller, Langmann, & Untiedt, 2006).

Two dynamic network approaches stand out as ways to investigate dynamic innovation processes. To study change over time, *social network analysis* (SNA) employs agent based time series (cf. Jun, 2012). Simulating multiple single actors' development in a network is extremely useful for scenario building. *Actor-network theory* (ANT), the second dynamic approach, takes a 'real-world' stake, the method being to analyse the practices of emerging macro-actors (networks). Apart from on rare occassions, these dynamic network approaches are used independently (cf. Peuker, 2008). They offer divergent perspectives on ad hoc collaboration in positivist and constructivist traditions. The network level and individual level influence each other in terms of, for example, inter-personal, inter-unit or inter-organisational ties. Using both analytical methods, dyads, triads, and network sub-regions can be investigated.

2.2.3 *Social Network Analysis*

In social network analysis (SNA), data for network transfers (cf. Singh, Tan, & Mookerjee, 2008) can be obtained: (1) at a network level, measuring size, density and connectivity; (2) at a node level, measuring distance and prominence, closeness and degree of centrality; and (3) at a tie level, measuring directedness, strength or weakness. Abundant network measures in various software applications exist (cf. Huisman & van Duijn, 2011). Ties in an SNA channel quantifiably transfer a *flow* of resources. In this respect, SNA overlaps with dynamic systems approaches (see, e.g., Besiou et al., 2011) where whole ecosystems are modelled. The method provides means for understanding dynamic relations and allows digital visualisation of complex processes. SNA studies advance our understanding of *"how structural properties influence observed characteristics and associations among characteristics"* (Wasserman & Faust, 1994:6-9).

However, SNA needs a large amount of ex-ante input. Information on and definitions of relations (formal or informal) and actors (persons, organisations and others) are indispensable to run a simulation. Nodes and ties remain units of investigation in SNA time series. While changing values for metric units lead to an increase or decrease in parts of the model, the kind of node or tie will not change over time. SNA supports insights into potential futures, but so far, it cannot capture how and why *dynamic* innovation processes succeed. Therefore, simulations cannot advise how unpredictable and non-linear real-time processes should be handled, or how disruptive and emergent properties are kept together over time (Van der Maaten, Postma, & Van den Herik, 2009).

2.2.4 *Actor-network theory*

Actor-network theory (ANT) retraces empirical network operations. Thus it enables the exploration of past collaboration and innovation processes. ANT developed from the ‘science and technology studies’ (STS) by Callon, Latour and Law (see, e.g., Callon & Latour, 1981; Callon, Law, & Rip, 1986), scholars who aimed to investigate the interplay of technology, knowledge and innovation (cf. Scacchi, 2005). Instead of homogeneous nodes and ties, *macro-actors* become the unit of analysis, and ANT analyses volatile nets between *heterogeneous* entities. *Human* and *non-human* actors are analytically included (Avgerou, Ciborra, & Land, 2004); for example, a school class analysis entails interviews with pupils and teachers, but also the investigation of school computers, laboratories, buildings, software used, education policy and teaching practices. In disaster management, interviews with aid organisations, affected people and donors would be obligatory, yet, the examination of affected livelihoods, destroyed infrastructures, governmental disaster acts, fibre glass boats and collaboration practices between all theses actors would also be necessary.

The ANT pioneers rejected dualism (nature-culture, subject-object, et cetera) and focused on practices. Therefore, networks and actors are seen as socio-technical “hybrids” (cf. Callon, 1986; Callon et al., 1986; Latour, 1999; Tatnall, 2011). An actor role is assigned to objects and subjects that *influence* others, in physical or symbolic ways (see, e.g., van Mierlo, Leeuwis, Smits, & Woolthuis, 2010). Thus, in contrast to positivist SNA frames, ANT allows no external, ‘as-from-above’ perspective. Analysts have to “follow the actor” to retrace the different network practices (cf. Dant, 2005).

Furthermore, actor-networks are assumed to be instable. Without continuous mobilisation they fall apart. ANT scholars therefore tried to find out why *some* interactions *"more or less succeed in stabilizing and reproducing themselves"* (Law, 1992, p.380). They found that to exist as an actor-network, a *translation process* between heterogeneous *interests* occurs (cf. Callon, 1986). The term *translation* makes all the difference to the above theory traditions: SNA (cf. Mueller-Prothmann & Finke, 2004), system dynamics (cf. Besiou et al., 2011) and innovation diffusion (Rogers, 2010) all speak of *transfer*. In contrast, ANT scholars hold that there is *no* transfer and input is always *modified* by other actors' interests. The enroled actors alter the translated interests (see, e.g., Pollack, Costello, & Sankaran, 2013). Collaboration and network emergence therefore are *"somewhat uncertain processes of overcoming resistance – rather than a fait accompli or a noun"* (Law, 1992, p.380). Finally, actor-networks are *effects* of social practices, not their causes.

Holding that *"an actor is also, always a network"* (Law, 1992, p.384; Latour, 2012), a network analysis starts with the choice of perspective. Successful network emergence leads to *punctualisation* (see, e.g., Austrin & Farnsworth, 2005): the making of the heterogeneous actor-network becomes invisible behind a successful network. It is *punctualisation* that makes networks and macro-actors real-time effective and powerful.

In sum, ANT enables the examination of ad hoc collaboration and dynamic innovation processes as network emergence and evolution. ANT crosses the boundaries of traditional management and organisation theory domains (see Table 2-1) using a dynamic network perspective. It merges voluntaristic and evolutionary managerial components and micro- and macro perspectives. The translation concept helps to understand collaboration dynamics (cf. Pollack et al., 2013). Translation is defined in definition 2-1.

Definition 2-1: Translation

Translation is the process of network evolution and consists of four basic moments: (1) Problematisation, (2) Interessement, (3) Enrolment and (4) Mobilisation. (Tatnall, 2011)

Table 2-1 contains the four operations of network emergence (left column) and management activities that relate to the network formation moments (right column). It shows how (a) strategic management elements (interests) and (b) more evolutionary, systemic-driven dynamics melt in the approach.

Table 2-1: Actor-network evolution and management activities

ANT operations	**Related management activities and network practices**
Problematisation	Identification of specific problems; identification of actors involved in a problem in real-time (socio-technological hybrids).
Interessement	Practices to identify and attract interest, define and create linkages between actors' interests, translate different interests; heterogeneous actors' interests have to be channeled through an "obligatory point of passage" (OPP) to become a network.
Enrolment	Negotiation of interests; practices to encourage heterogeneous actors' commitment to 'enrol' in common network activities, use of boundary objects.
Mobilisation	Activating old and new allies for the aligned interests; continued practices to stabilise a reversible and dynamic network.

A final *moment* in *interessement* is crucial for a translation process: to become a network, the interests of heterogeneous actors have to be channelled through an OPP, an "obligatory point of passage" (Callon, 1986; Stanforth, 2006). If an OPP (a contractual event, informal meeting or factual agreement) fails in some respect, it becomes unlikely that the actors will enrol in common network activities. The OPP designates a moment that has to happen in order to align interests and to establish a dynamic innovation network. To define the OPP makes network-actors become *focal actors* (see Def. 1-9).

Heterogeneous networks need objects that are "*able to mediate diverse actor worlds"* (Briers & Chua, 2001, p.240), called 'boundary objects'. Such artefacts can be anything from technological devices to consumer goods and symbolic artefacts such as words, claims, events, or pictures.

Ongoing network 'mobilisation' remains necessary to continue the contingent and always reversible collaboration. To stabilise actor-networks over time, the inscription of practices in *materials* and institutional *routines* has to follow (cf. Stanforth, 2006).

2.2.5 *Collective action and network process components*

This section deals with the literature review on collective action and network theory. Central actor planning for individual or collective interests does achieve efficient *coordination.* Thus, it can hinder reciprocity and trustful cooperation (cf. Abdessalem, Cautis, & Souhli, 2010) and it may even mislead people in a more complex *collaboration*. It ultimately inhibits ad hoc collaboration. Strategic management traditions are thus a poor fit with digital networked environments and rather block the processes of emerging "polycentric and dynamic co-production to sustainable ends" (cf. Ostrom, 1996). Dynamic structures or working rules that only emerge from collective action do not exist in advance of, or external to, collaboration, so, they are not available as information in advance. This uncertainty hampers the initiation of collaboration for many actors.

Assessing the impact of collective action and network concepts for the management of real-time collaboration, this study found that static network approaches and individual choice approaches remain without an adequate answer. Although they are arguably better than management and foresight traditions because they include multiple actors and a lateral management structure, dynamic governance elements are still absent from the literature.

However, positivist SNA and constructivist ANT offer ways to examine the collaborative management of non-linear ad hoc processes over time: positivist SNA allows us to simulate future changes of nodes and ties, whilst constructivist ANT allows us to reconstruct the emergence of real actor-networks.

Regarding *planning and management* of real-time collaboration, the first approach supports forecasting (cf. Hahn, Meyer-Nieberg, & Pickl, 2009; Jun, 2012) while the second can inform foresight processes. The two dynamic network approaches diverge considerably (cf. Peuker, 2011) in terms of: (a) focus on structure or process (b) narrow (homogeneous) or open (heterogeneous) actor definitions, and (c) external or follow-the-actor perspectives.

When seeking to advance traditional management concepts to dynamic real-time collaboration in digital societies, ANT has more to offer: (1) the open actor definition allows us to assess socio-technical actors' roles (for example IT infrastructures) in collaboration; (2) components for the evolution of dynamic innovation networks (DINs) are offered (see Table 2-1); (3) the interests of actors are conceptualised and bring the management perspective into the network process.

2.3 A different management for ad hoc collaboration

This section draws an interim conclusion concerning traditional management and ad hoc collaboration concepts. So far, the study has reviewed strategic management (2.1.1) and foresight traditions (2.1.2), and investigated components of collective action (2.2.1) and network theory (2.2.2, 2.2.3, 2.2.4) that have a bearing on collaborative management. It has distinguished static and traditional collaboration concepts (2.1.3) from dynamic ad hoc ones (2.2.5), and through this examination it has become clear where strategic management traditions and spontaneous ad hoc collaboration are opposed, highlighting precisely where ad hoc collaboration challenges traditional management.

Traditional Strategic Management
Actor: central actor
Orientation: initial goal
Managerial role: voluntaristic, hierarchic
Information: available
Planning: in advance, linear development

Ad hoc Collaboration
Actor: multiple actors, polycentric
Orientation: goal initially not clear
Managerial role: pragmatic, networked
Information: missing
Planning: real-time, dynamic process

Figure 2-2: Opposing items of traditional strategic management and ad hoc collaboration

Figure 2-2 points to the differences between hierarchic management and networked reality. Traditional management fails where uncertainty and time pressure play important roles, because of the conceptual bias inherited from opposite demands. Finally, this section has pointed out that traditional strategic management concepts can not instruct leadership when faced with a practical challenge.

2.4 Ad hoc collaboration in dynamic innovation networks

Recent entrepreneurship and management research has identified innovation networks as the answer to complexity and real-time competition in the 21st century (cf. Weick & Sutcliffe, 2007; Prahalad & Krishnan, 2008; Baldwin & von Hippel, 2011; Maurer & Valkenburg, 2014). Research is increasingly devoted to the study of innovation clusters and networks (cf. Porter, 2000; Gloor, 2005; Hamdouch, 2010; Partanen & Möller, 2012). This happens to be the case in (a) organisational management (cf. Powell, Koput, & Smith-Doerr, 1996; Powell et al., 2005), (b) innovation management (cf. Ozgen & Baron, 2007), and (c) disaster management research (cf. Meesters & Van de Walle, 2014; Ai et al., 2015; Kapucu, 2015).

The main areas of potential discussed relate to the clustering of technology sectors. ICT, biotechnology, nanotechnology and the defence industries in particular have already attracted the interest of governments and private actors (cf. Romanelli & Khessina, 2005; Robinson, Rip, & Mangematin, 2007). Among scholars, there is increasing evidence that competitiveness in a global economy ironically relies on the “local things” (cf. Porter, 2000). While considerable investigation has been devoted to understanding this ‘localisation’ and materialisation of global innovation processes (see, e.g., Orlikowski, 2005; Orlikowski, 2009), less attention has so far been paid to temporal dimensions of collaboration, the dynamics of non-linear innovation processes.

To speak of emergent practices is clearly not new. The ‘strategy-as-practice’ movement (cf. Jarzabkowski, 2004; Johnson, Scholes, & Whittington, 2008) draws more largely on the ‘practice turn’ (Schatzki, Knorr-Cetina, & Von Savigny, 2001) for at least two decades. But only little attention has been paid by mainstream perspectives of strategic management to these theoretical concepts, while innovation research has become a standard field of recent economic theory.

Recently, public and private actors aim to support innovation networks. However, that support often did not lead to success (cf. Backhaus & Büschken, 1997). Looking at the results of Figure 2-2, we know better why: there are opposing items in traditional strategic planning and ad hoc innovation collaboration. Three important differences are: (1) innovation networks are not deliberatedly ‘created’ by any side, (2) they are not the result of initial planning by central actors (cf. Jones & Lichtenstein, 2008), and (3) they are not controllable and ‘manageable’ in ‘goal targeting’ ways (see, e.g., Weber et al., 2014).

To learn more about successful dynamic management and governance structures, it is necessary to investigate cases where they have worked in a highly dynamic field. Below, the study therefore introduces the case of DINs in global disaster management (2.4.1). Observation of this high-velocity environment ultimately opens up the prospect of a turnaround from traditional strategic management (2.4.2) to a new foresight (2.5).

2.4.1 *The case of DINs in disaster management*

A response to global disasters and thereafter the long-term rehabilitation of the environment is a dynamic process with potential for a great deal of innovation. What we are used to seeing is rather ineffective management by which this potential is often lost. Many textbooks on crisis management offer examples of both unsuccessful (see, e.g., Weick, 1996) and of successful management. The latter are based on ad hoc collaboration in fast changing environments (see, e.g., Jenkins, Gremillion, & Nowell, 2010; McGilvray & Gamburd, 2010; Sheperd & Williams, 2014; Sword-Daniels, Twigg, & Loughlin, 2015).

This thesis argues that global disaster management mirrors the identified problems of traditional management in real-time collaboration. In the post-disaster period, opportunities emerge for innovation from the destruction of the former dominant structures (cf. Schumpeter, 1934). Seen as an ad hoc and real-time process, crisis management is described as *"the art of making decisions to head off or mitigate the effects of crisis often while the event itself is unfolding"* (Mossalanead, 2008, p.82). Considering the managerial antipodes depicted in Figure 2-2, it is now possible to state that we understood the conceptual misfit in a practical field.

In the above described strategic management traditions, crisis management is seen as a process of different stages (see, e.g., Pearson & Clair, 1998; Green, 2000; James, 2011). Although, there exist a different number of stages and technical terms in the literature and practice (cf. Dorasamy et al., 2013) there is consensus on three basic managerial stages: response, recovery, and preparedness (see, e.g., Quarantelli, 1988; Fazarmand, 2007; Lalonde, 2011). Those three stages involve different actors, different steps of intervention, and different technical expertise.

In spite of highly organised professional transnational aid structures, increasing technical standards (Acar & Muraki, 2011; Wukich & Steinberg, 2013) and rising public participation via social media and mobiles (Perng et al., 2012), we observe that humanitarian missions often fail to achieve local sustainable ends. Moreover, after the emergencies, there are enduring crisis periods that have to be lived through (cf. Pearson & Clair, 1998; Twigg & Steiner, 2001; Majchrzak, Jarvenpaa, & Hollingshead, 2007; James, 2011; Sheperd & Williams, 2014).

In the crisis management literature, the problem of cooperation and collaboration is an 'all-time high' topic. Although various network studies and foresight studies describe efficient collaboration in emergencies (cf. Drabek & McEntire, 2003; Turoff et al., 2013) and networks (cf. Comfort et al., 2013; Kapucu, 2015), long-term relief and successful innovation collaboration rarely receive research interest (cf. Twigg, 2006; Olshansky, Hopkins, & Johnson, 2012). This fact is all the more surprising since the bulk of public and private investment falls into this relief stage. First in research, then in practice, global relief management is fragmented into (a) goals which are often context free, and (b) short-term goals (see, e.g., Buchanan-Smith & Maxwell, 1994; Sperling, Remington, Haugen, & Nagoda, 2004; Jenkins et al., 2010).

However, in crisis management research, SNA studies have the upper hand. They draw from the traditional strategic management concepts: in most network studies, homogeneous actors (and nodes, and ties) are compared (cf. Balcik, Beamon, Krejci, Miramatsu, & Ramirez, 2010). Central SNA studies on crisis management (cf. Comfort et al., 2004; James, 2011) focus on such inter-organisational cooperation: cooperation is examined as a problem of individual actors based on simulation of demand and supply in linear curves that disband when a disaster is over. Cooperation only occurs in the intersection of the linear curves: that is later, namely, once demand and supply take on equal values once again. The individual choice model (see Figure 2-1) behind the traditional strategic management concepts was presented earlier. Suffice it to say here that conceptual traditions actually influence management analyses and collaboration practice but do not address the described managerial gap.

In contrast to SNA studies, real-time relief processes do not just depend on organisational actors of humanitarian aid. They mainly depend on multiple heterogeneous actors, such as public and private donors, local communities, infrastructures, media coverage, and many other heterogeneous actors during their long-term local rehabilitation.

Worthy of particular note are studies on Hurricane Katrina in 2005 which demonstrate how much routine ex-ante planning hinders local flexibility, sense making and real-time improvisation (see, e.g., Wachtendorf, 2004; Weick & Sutcliffe, 2007). Cascading real-time problems, such as sanitation needs arising from a lack of usable water – are invisible at the beginning. They cannot be planned for, but need a real-time response. Under the pressure of time, when collaboration is most important, horizontal management perspectives and long-term orientation are repeatedly lost (cf. McGilvray & Gamburd, 2010) in favour of new management routines, either traditional or ad hoc.

In conclusion, new models and methods are required to better understand and conceptualise dynamic long-term processes of successful collaboration. With regards to the previously mentioned methodological misfit, this study claims that traditional management repeatedly led to ambivalent results as a consequence of effective short-term operations; moreover, it led to the misfiring of comprehensive and local sustainable rehabilitation in the longer term (cf. Sellnow, Seeger, & Ulmer, 2002; Boin, 2009; Schulz, 2009).

In global disasters in this millennium (Tsunami 2004, Katrina 2005, Haiti 2010, Hayan 2013, Nepal 2014, Ebola crisis 2014/15), the transnational global aid structure has evolved considerably (Donini, 2012). Global players of transnational aid and non-government organisations (TNGO) meet and support smaller local NGOs (LNGO) in disaster prone regions on affected sites. There is detailed and hierarchic top-down management of most processes in traditions of command and control. This approach is challenged by the new IT driven public participation of local communities and virtual observers. In the technological challenge, some actors see an enormous potential to change the traditional management styles: the inclusion of social media capacities could enhance collaboration and co-creation – towards sustainable ends, and in ad hoc relief.

2.4.2 *The turnaround from strategic management*

Traditional management contains elements that counteract successful ad hoc collaboration. In answer to RQ 1 this study has identified five conceptual barriers that hinder dynamic collaboration processes and ad hoc network emergence. It here proposes a managerial turnaround regarding the identified five opposite items (see Figure 2-2) in order to prepare the world of disaster management for collaborative innovation processes. Management has to abandon (1) central actor perspectives, (2) initial goal setting and initial resource allocation, and (3) the implicitness of full information, and has to embrace (4) a lateral instead of hierarchic managerial role and (5) the switch from planned cooperation to real-time collaboration.

In practice, this means the following. Ad hoc collaboration can mean mass-collaboration and co-creation with many and varied actors in a location. This will “signal” (Giones & Miralles, 2015) the interests of each actor to the others so that the right ones, those which are highly critical, may be matched. According to collective action (cf. Ostrom, 2010), finding and mobilising engaged co-operators in co-creation is nothing more than identifying the ‘norm-using players’, rather than staying with ‘rational egoists’ in real-time collaboration.

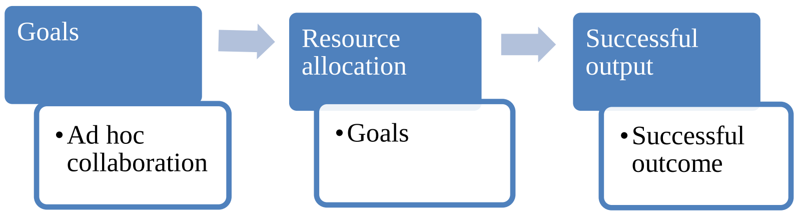

Figure 2-3: Opposed processes of strategic management and ad hoc collaboration

In unexpected challenges, dynamic processes and ad hoc collaboration all show themselves in different vistas. Instead of targeting identified goals over a set period of time, management has to *start* collaboration from an unexpected point in time, without clear goals, and even without familiar infrastructures and controllable partnerships. The collaboration with multiple heterogeneous and new actors stems not from choice but from the local and global reality of the status quo.

The conceptual (about) and practical (when) management situations are depicted in three offset process steps in Figure 2-3.

An important difference is that the dynamic process starts from collaboration, not from planning. Immediately after the start, parallel real-time activities begin to achieve an outcome. The ‘trigger point’ for the start might be a disaster that has occurred, or a market disruption that requires immediate response. From this moment, all interactions begin.

The process unfolds and is not controllable from a central point over time. Still, real-time collaboration intends to achieve successful ends. In contrast to a process towards a predictable end or goal, we see that in innovation processes, the successful end is not exactly clear at the beginning or throughout the dynamic collaboration process, but particular goals will be defined, reached and reset depending on the emerging collaboration.

Two different management modes are legitimated. They are guided by opposite contextual requirements, challenges and managerial motivations. The first mode is ingrained in our managerial routines (from experience). Then, on the spot, leadership has to be learned and developed. Using that capacity, it is possible to switch to the second mode.

The described dynamic course of action under conditions of uncertainty is characteristic of innovation processes (see, e.g., Sarasvathy, 2001; Sarasvathy & Venkataraman, 2011). To begin to provide an unexpected support to a terrible disaster is to start without an already existing concrete goal and predictable tasks. The intriguing questions are: how to start ad hoc collaboration, but with long-term perspectives into an unpredictable future; and how to manage the dynamic collaboration process successfully.

2.5 In search of a new foresight

Foresight concepts have a specific potential to direct short-time perspectives into long-term orientation (see 2.1.2). From its beginnings, *"...foresight is a process by which one comes to a fuller understanding of the forces shaping the long-term future which should be taken into account in policy formulation, planning and decision making"* (Coates, 1985, p.343). However, from the above sections, we also know that traditional TF has no grip on real-time collaboration (cf. Cunha et al., 2012).

For non-hierarchic collaboration, we see that in recent studies, scholars integrate network perspectives (cf. Nugroho & Saritas, 2009; van Mierlo et al., 2010; Heger & Boman, 2014; van der Duin, Kleinsmann, & Valkenburg, 2014) into foresight processes to stimulate more lateral planning modes. However, for our purpose of improving management of ad hoc collaboration, this is not sufficient. Planning as an initial 'upstream' period is no longer practicable when situations require immediate interaction (see Figure 2-2). A real-time foresight mode therefore would mean a switch from planning to readiness. Awareness of the working rules and requirements of ad hoc collaboration will be the mark of a new foresight mode, one which is designed to employ dynamic innovation processes from the very beginning.

The "working rules" (see Ostrom et al., 2010) of collective action (see 2.2.1) already partly exist in social norms and partly in dynamic collaboration patterns (cf. Park, 2015). Order in dynamic processes manifests itself in patterns of interaction which emerge in irregular, but repetitive and similar forms (cf. Burnes, 2004) in processes of self-organisation (cf. Maurer & Valkenburg, 2014). Dynamic processes are governed by the ordering of the generating operations (cf. Ostrom, Walker, & Gardner, 1992; Branzei, Dimitrov, Pickl, & Tijs, 2004; Sydow et al., 2009).

To identify temporal patterns (network dynamics) that enhance successful and innovative collaboration, we need to explore: (1) DINs (cf. Hakansson & Snehota, 2006; Chen & Vang, 2008), (2) their emergence, and (3) their evolution as best practice cases of successful collaborative management (see Def 1-4). Only empirical investigation of successful collaboration processes allows us to identify governance patterns. The comparison of network patterns in several cases leads to the confirmation of generic facilitators of DINs. Then, in a later step, the patterns lead to their potential formulation as management principles, and can be used for crafting new tools and foresight methods that may support actors in successful lateral governance processes (see more detail in Chapters 3 and 4).

DINs are observable in many different settings of social complexity, uncertainty and multi-stakeholder dynamics (cf. Parmar et al., 2010; Hörisch, Freeman, & Schaltegger, 2014), but this thesis (see Chapter 6) focuses on two different societal settings: (a) the context of global disaster management and (b) the context of start-ups, business incubation and co-creation. The challenge of ad hoc collaboration by heterogeneous actors is a potential starting point for DIN emergence.

To consolidate the results of this chapter and to pave the way forward in the managerial field, Figure 2-4 shows the research rationale for the study, namely that three mismatches in the managerial field hinder successful ad hoc collaboration. Based upon the research rationale, the study adopts three goals, as set out below, and uses them to develop a collaborative real-time foresight.

1. The end of the mismatch caused by management and foresight traditions

The study aims to end the mismatches that occur particularly in temporal dimensions of management between time pressure and planning routines and result in conflicts between ad hoc action and *sustainable and innovative* outcomes; there is a rationale to insert long-term orientation into ad hoc collaboration.

2. The end of the governance mismatch

The study aims to end the governance mismatch between hierarchic management traditions and new networked, non-hierarchical collaboration settings by proposing a rationale for a polycentric process management of heterogeneous interests and actors.

3. The end of the mismatch between data collection, analysis and reality

The study aims to end the mismatch between static measures and nonlinear processes by proposing a rationale for big data and long-term studies to obtain empiric evidence on successful innovation processes and patterns.

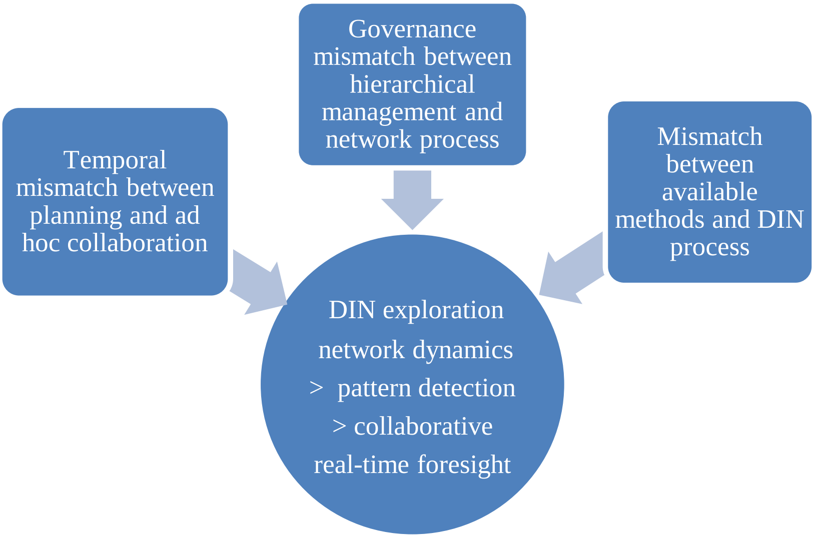

Figure 2-4: Research rationale for a new real-time foresight

3 Exploring the dynamic innovation process

Chapter 3 addresses RQ 2: how is it possible to adequately explore successful ad hoc collaboration in dynamic innovation networks (DINs)? In particular, it searches for collaborative *patterns* in successful innovation processes and employs successful global-local relief processes as an exemplary setting of investigation. It aims to answer RQ 2 in the form of a research design. We compose the design which is derived from a comparison of three successful DINs in unstable environments (see Table 3-1).

After a global disaster, the response of the transnational and local aid actors usually emerges in a chaotic manner. Soon after the initiation of rehabilitation schemes, and over time, initial project plans, goals and actors change, and programmes are disrupted and revised as critical incidents (CIs) occur. Ultimately, the response can lead to sustainable outcomes or to a marked dissatisfaction (cf. Telford & Cosgrave, 2006; Concord, 2010). Indeed, the sustainability of the outcomes of the collaborative processes can only be assessed years after the disaster. The dynamism of the global relief process explains the management challenge of ad hoc collaboration when the aim is to achieve long-term innovative and sustainable ends. The disaster showcased in this thesis is the Tsunami 2004 and its impact upon Tamil Nadu, Indias' most affected coastal state. The gigantic flood gained real-time media coverage as the first global disaster of the new millennium. In that time, the three DINs of our sample emerged around their focal actors (LNGOs) in global-local ad hoc collaboration around the Indian coastal villages of Ayam, Keniparam, and Kanni. The size of the DINs ranged from 13 to 15 actors and they were active between 2004 and 2010.

Table 3-1: Sample of three DINs with their focal actors

DIN	Enroled LNGO	LNGO experience	DIN size
DIN 1 Ayam	Dantishan established 1996	1-5 employees; rural development NGO involved with the women's micro saving culture; community based	15
DIN 2 Kenip aram	SRDS established 1990	1-5 employees; Christian NGO involved with community development, backward casts; community and diocese based	14
DIN 3 Kanni	Trustpeace established 1984	15-20 employees; sector NGO involved with children's rights, environment advocacy and labour associations; sector based	13

In the first column, the three DINs are listed with their locality names. The second column gives the names of the focal actors, the enrolled LNGOs and their experience (viz. 8, 14 and 20 years, respectively). The third column provides information on the achievements of the enroled LNGOs. The fourth column gives the staff size of the DINs.

In these three emerging DINs, relief collaboration as a dynamic management process is retraced from the parallel perspectives of their heterogeneous actors. A cross-case comparison of the DINs makes it possible to identify shared dynamic patterns (the aim of this research) of successful real-time collaboration. The description which follows provides background information on the investigated disaster.

On 26th December 2004, an earthquake under the Indian Ocean with a magnitude of 9.15 on the Richter scale hit littoral countries from Indonesia to East Africa in unprecedented ways. It was the heaviest recorded seismic shaking for over 40 years, and it caused unprecedented devastation; livelihoods in cities and on beaches were washed away, as were those of complete villages. The disaster affected thirteen countries, killed 226,000 people (published data varies), injured 500,000 and affected 5 million (see, e.g., Werly, 2005). 1.5 million of the affected persons were children. The estimated total damage was nearly US$ 7.5 billion.

In real-time, on 27th December 2004, the UN announced the loss of 150,000 lives, and billions of dollars' worth of damage. It invoked the largest humanitarian operation in its 60 year existence. On 1st of January 2005, donations had already reached US$ 2 billion, and a few days later, private and public donations were in excess of US$ 11 billion. By April 2005, polemics on aid and humanitarian support had reached a critical point, as many organisations still tried to raise funds. One of the first NGOs involved, Médecins sans Frontières (MSF), appealed for a stop to 'tsunami relief' and launched an appeal for a funding for the parallel hunger crisis in Niger. On 15th November 2005, close to the first anniversary of the disaster, the official humanitarian balance was at least 285,000 human losses with 165,708 victims in Indonesia, 16,389 in India and 8,240 in Thailand (Werly, 2005). In India, the following five districts of the Tamil Nadu state were most affected: Chennai, Kancheepuram, Cuddalore, Kanjakumari and Nagapattinam (cf. Karan & Subbiah, 2011; Kumaran & Torris, 2011). The study sample for this reason looks at DINs from these districts.

The course of this chapter is as follows. In section 3.1 criteria for qualitative research methods are specified. In section 3.2, the process analysis features (see Van de Ven et al., 1999) are elaborated upon. Section 3.3 presents a process analysis framework that combines critical incident technique (CIT) and actor-network theory (ANT) in a coding scheme for *pattern detection*. In section 3.4, the *composition and realisation* of the study design are described, and sampling and field access are also discussed. Section 3.5 completes the chapter with a table that provides a check on the methodological rigour of the employed research design.

3.1 Criteria in qualitative research

By their nature, constructivist social scientists contest the meaning of objectivity in social research (see, e.g., Stallings, 2003; Latour, 2012). Thus, the nature of qualitative research is first to aim at ‘understanding’ social phenomena. Today, qualitative and quantitative research paradigms are recognised as complementary rather than as exclusive (cf. Onwuegbuzie & Leech, 2005). This can be seen in the increasing academic ground that mixed methods and the application of different epistemological methodologies have achieved (cf. Creswell, 2013). Qualitative research is nowadays an accredited base of theory building, and of contextualisation in management research (cf. Miles & Huberman, 2002; Eisenhardt & Graebner, 2007; Zahra, 2007). However, the three standard criteria established for quantitative research – objectivity, reliability, and validity – do not apply to epistemological backgrounds of constructivist studies (cf. Crabtree & Miller, 1999).

In their place, there are different criteria for assessing the quality of qualitative studies (see, e.g., Seale, 1999; Gibbert, Ruigrok, & Wicki, 2008; Blatter & Haverland, 2012). There is ample literature about how to establish quality in qualitative research. Instead of ensuring objectivity, a methodological framework has to be established that contains (1) *reflexivity* and *credibility*. Instead of assuring reliability, qualitative studies have to be built on (2) *intersubjective confirmability* (see, e.g., Altheide & Johnson, 1994; Berg & Lune, 2004; Creswell, 2013). And instead of validity, (3) *relevance* and *appropriateness* must be assured for all three research parts: (a) the research question, (b) the research setting, and (c) the data (cf. Edmondson & McManus, 2007).

In management and organisation theory, the original field of planning and foresight (cf. Linstone, 2011), qualitative studies have a long history (cf. Mintzberg, 1973; Weick, 1993; Watson, 1994; Weick, 1996; Mir & Watson, 2000; Scandura & Williams, 2000; Prasad & Prasad, 2002) but still need to make their stand in journal publications (cf. Cassell, Symon, Buehring, & Johnson, 2006). Therefore, committed qualitative research has to be explicit about the standards to which it adheres (cf. Cassell & Symon, 2004).

To fulfill this requirement, special attention is paid to these criteria by a methodological rigour check at the end of the chapter. The thesis uses six parameters based on Altheide, Yin and Gibbert (Altheide & Johnson, 1994; Yin, 2003; Gibbert et al., 2008), since the author agrees that "without rigor, relevance in management research cannot be claimed" (Scandura & Williams, 2000, p.1263). The six parameters are derived from the methodological framework (see above). The verification of reflexivity and credibility is performed by (1) construct validity, (2) internal validity, and (3) external validity checks. The other three parameters are (4) intersubjective confirmability, (5) relevance, and (6) appropriateness.

3.2 Research approach

Through the presentation of the chosen methodological framework this thesis is able to explain how dynamic innovation processes in non-linear network collaboration can be explored. The research adopted a process study approach (cf. Van de Ven, 2007) on a sample of informative cases (cf. Eisenhardt, 1989; Yin, 2009), enabling it to investigate a number of initially unpredictable, but ultimately successful real-time collaborations. The three DINs (see Table 3-1) selected as “comparable cases” (Blatter & Haverland, 2012, p.42) emerged from an urgent initial situation in a turbulent global post-disaster context (see, e.g., Wachtendorf, 2004; Mendonça, Jefferson, & Harrald, 2007) and ended in local sustainable relief.

Process studies (Van de Ven, 2007, p.195) are conducted to find out either (1) about things or variables that change over time (variance approach), or (2) how change unfolds over time (process approach). This study seeks to gain empirical evidence on the *how* question. The network approach chosen (see Chapter 2) is the dynamic ANT lens (cf. Callon, 1986; Latour, 2005). ANT operations offer the analytical frame that is needed to explore network evolution as a socio-technical innovation process (see Subsection 2.2.4) including not only human actors but also artefacts and practices (cf. Orlikowski, 2005). The study also used an event-based interview technique to retrace dynamic changes (Sword-Daniels et al., 2015). This technique is the critical incident technique (CIT). It is in line with RQ 2 that asks us to explore adequately how time, space and technology shape a DIN's evolution and how we can achieve first a successful ad hoc collaboration and then a long-term innovation process.

This section presents the comprehensive research design employed to adequately explore successful ad hoc collaboration (3.2.1). In more detail, it then focuses on the methodological implications of actor-network process analysis (3.2.2), critical incident technique (3.2.3) and the coding process (3.2.4) for pattern detection. The section ends with a presentation of the elaborated coding scheme (3.2.5) to explore ad hoc collaboration to sustainable and innovative ends in global relief and recovery.

3.2.1 *A successful ad-hoc collaboration*

The text below briefly describes the research design. Three methodological steps (Steps 1 to 3) and two operational steps (Steps 4 and 5) are the basis of the research approach (see Table 3-1). Successful ad-hoc collaboration is taken as the point of departure.

Table 3-2: Stepwise research approach to successful ad hoc collaboration

Step	**Methodology and operation**
1	'Theoretic sampling' of successful DINs and data collection
2	Coding for actor-network process analysis
3	CI mapping and pattern identification within cases and cross-case
4	Investigation of innovation strategies of DINs in global relief
5	Identification of five dynamic network principles for a new real-time foresight (RTF) and development of real-time evaluation tools (RTETs)

Step 1: The ‘theoretic sampling’ procedures were investigated. The procedure dealt with the collection of data on successful global-local DINs. Product or process innovations due to collaboration managent included, for example, rebuilt, more resilient houses; new night schools; health distribution cards; female start-ups; new means of income generation in fisher communities; and savings groups for men. All of these were visible references to sustainable relief outcomes in 2010.

Step 2: After the collection of primary (interviews) and secondary data (see Appendix B) the text interpretation software package (ATLAS.ti 7.0) was used to code and to process the voluminous empirical material. The elaborated codebook (see Appendix D) contains descriptive and theoretical codes for actors (ACT), critical incidents (CI), network dynamics (NETDYN) and innovative activities (INNOACT), among others. Actor-networks were retraced and their changing shapes compared.

Step 3: CIs are mapped. This happens within-case as well as cross-case, for pattern detection in a non-linear long-term collaboration. Evidence on dynamic pattern structures was first obtained for *one* successful DIN and then compared and confirmed as a generic success pattern with both of the other cases of successful ad-hoc collaboration.

Step 4: The resulting dynamic network patterns are further examined (see Chapter 5) to explore collaborative innovation strategies of DINs in relief. Innovation strategies are examined as emerging network structures by cross-tabulations and robust frequency counts of the coded data. Two of the most important dimensions of collaborative success in DINs in global relief are identified.

Step 5: A collaborative real-time foresight as preparedness for DIN emergence is developed as a public and corporate foresight method (see

Chapter 6). The pattern findings of successful real-time collaboration are used (a) to derive five principles for a managerial agenda, (b) to outline a real-time feedback mechanism, and (c) to develop an evaluation tool for the emergence of DINs in the fields of both disaster management and flexible business incubation and co-creation.

As primary and secondary data were collected and used, the thesis provides two definitions that classify the different sources (see Definition 3-1 and 3-2).

Definition 3-1: Primary data

Primary data are original data collected for a specific research goal (Hox & Boeije, 2005).

Definition 3-2: Secondary data

Secondary data are data originally collected or produced for a different purpose and reused for the research question (Hox & Boeije, 2005).

Step 1 to 3 will now be explained in more detail with regard to the methodological basis for pattern exploration. Step 4 of the research design addresses RQ 4 (see Chapter 5) and step 5 addresses RQ 5 (see Chapter 6). The application of the pattern findings will be dealt with in chapters 4 and 5.

3.2.2 *An actor-network process analysis*

In studies on innovation processes, Van de Ven et al. (1999) found that models had a stage-wise progress from idea to innovation. However, the models did not help to explain the dynamic process: not just one invention was transported but multiple re-inventions and re-implementations. Their conclusion was that an empirical process analysis would offer better real-world insights.

Process analysts in general (see, e.g., Pettigrew, 1997; Pittaway et al., 2004; Van de Ven, 2007) require four key issues to be specified (cf. Van de Ven, 2007, chapter 7).

(1) meaning of the process,
(2) frame of reference,
(3) chosen observational method, and
(4) ‘theoretic sampling’ in (a) diversity and (b) size.

In Table 3-3, the four key issues (column 1) are listed, together with the decisions taken for this study (column 2), and the rationale to do so (column 3).

Table 3-3: Key issues of process analysis (framework adopted from Van de Ven, 2007)

Key Issue	Decision	Rationale
Meaning of process	Process as developmental progress	1. Dynamic, non-linear process 2. How question (not a factor rating) 3. Real-time collaboration (multi-sided collaboration not a central actor process)
Frame of reference	Actor perspectives in emerging DINs in global disaster management	This study aims to explore successful patterns of real-time collaboration in DINs; LNGOs are focal actors in sustainable relief DINs.
Observation methods	Cross-case actor-network analysis using CIT	Pattern detection of network dynamics around CI in successful ad hoc collaboration and long-term relief.
Theoretic sampling	Success cases of ad hoc collaboration in a real-world setting Constant context	Disaster management in three successful DINs of global-local collaboration; comparative cases for an exploration of dynamic network patterns. Most affected districts in India after the 2004 Tsunami.
Diversity	Data triangulation	1. Primary data: (a) CIT interviews (LNGOs, TNGOs, INGOs, donors, governmental actors), and (b) participant observation 2. Secondary data: (a) official documents, e.g., monthly, annual, and end reports, (b) emails, (c) evaluation reports, (d) project contracts, (e) control data: Fukushima 2011 and Hayan 2014 3. Comprehensive additional data, Tsunami 2004: (a) newspaper clippings (THE HINDU 05- 06), (b) Disaster Act 2005, (c) Global risk reports.
Size	Small N-study (Ostrom et al., 2010; Blatter & Haverland, 2012)	Cases: N = 3 DINs of successful ad hoc collaboration Size of cases: N= 13-15 heterogeneous network-actors/DIN

The four key issues are briefly discussed below.

(1) In this case, process is synonymous with network emergence. The process follows the sequences of dynamic real-time collaboration (rationale 1). It is asked *how it unfolds* (rationale 2) and how it *is managed* over time (rationale 3). We are neither investigating a causal relationship nor a pure evolution, but hold a *developmental process perspective* (cf. Van de Ven, 2007). For disaster management, research has established at least three stages: first response, rehabilitation, and preparedness (Phillips, 2014, p.7). In contrast to this limited number of stages, this study investigates complete non-linear relief processes of real-time collaboration. This approach includes heterogeneous actors' perspectives on the innovative collaboration (which is seen as one process).

(2) The frame of reference of the research design is set from three different actor perspectives. For good reasons, the study deliberately explores the perspectives that three different focal actors take: (2a) LNGO, (2b) TNGO, and (2c) the affected community. They should not be harmonised rapidly. What is needed to retrace is the *network* level, and this has to be approached from heterogeneous network perspectives.

(3) The observation method entails data collection over time. Two observation methods (3a and 3b) were possible (cf. Van de Ven, 2007, p.208): (3a) a 'strict' longitudinal approach making repeated observations on entities in a setting over time, and (3b) a retrospective account looking *back* at events or activities that happened. Here, we remember that the ANT and CIT approach are both retrospective. The collection of interviews and secondary data has been a continuous task (see Figure 3-2 in 3.3) in three waves. This study confirms that *"retrospective studies which use tools that facilitate reliable recall have the potential to significantly*

enhance empirical knowledge of post-disaster change and recovery processes" (Sword-Daniels et al., 2015, p.126). Mixed methodologies and creative approaches are required to facilitate the collection of reliable retrospective data.

(4) Sampling of cases involves issues of diversity and size. For long-term process analysis of a new phenomenon, small N case studies are recommended (cf. Poole et al., 2000). A limitation is necessary to avoid the risk of producing overwhelming amounts of data in a field where studies are still scarce (see, e.g., Bourgeois III & Eisenhardt, 1988; Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Ostrom et al., 2010). Regarding diversity in 'theoretic sampling', Pettigrew established four principles for case selection (cf. Pettigrew, 1997; Blatter & Haverland, 2012):

(a) choosing extreme situations,
(b) selection of polar types of cases for display of divergent characteristics,
(c) choice of cases with a long track record in the investigated new phenomenon, and
(d) sampling for cases where interest in the topic is taken and cooperation commitment exists.

This study adopted the principles (a), (b) and (d). The illustrative process of disaster management is an extreme setting of (4a) innovative ad hoc collaboration and rich manifestation of management of dynamic activities. For the DIN selection, we searched for (4b) successful sustainable global-local collaboration in various shapes. From a data pool (conference list), different LNGOs were selected to obtain manifold innovative relief strategies. Pettigrew's fourth principle (4d) is considerably relevant for use of CIT methods, as they require trust and openness of an informant's side. The credibility of the obtained data decides on the quality of the results. However, global relief is a donor driven field and NGO activities depend on donations (see, e.g., Harmer, 2005; Lambell, Ramia, Nyland, & Michelotti, 2008).

All LNGOs in the sample collaborated for the very first time in relief. To investigate ad hoc collaboration and dynamic innovation processes, former experience is of little importance; so Pettigrew's third sampling principle (4c) can be ignored.

Sample size is a key issue of process study design and depends, for a longitudinal process study, on number of (a) events mapped, (b) actors included, and (c) duration of the observed process (Van de Ven, 2007, p.212). The sample size must balance the demand for rich data for theory generation with the risk of getting lost in the data (and data collection). In general, interpretative methods dictate the use of a small N sample (cf. George & Bennett, 2005; Hall, 2006; Blatter & Haverland, 2012).

3.2.3 *Critical Incident Technique*

To identify network dynamics instead of only the network actors that facilitate collaborative innovation processes, we need to assess the changes in network evolution and in management during DIN evolution. Critical incident technique (CIT, see, e.g., Flanagan, 1954; Butterfield, Borgen, Amundson, & Maglio, 2005), is a timeline method for gathering in-depth information on sequential changes. It enables the detection of 'tipping points' in a process. Mapping concrete CIs complements the abstract network operations of ANT with (1) time stamps and (2) details on issues and problem solving. This makes visible a sequential, but non-linear collaboration process.

In retrospect, CIT's advantage in assessing management of ad hoc collaboration is that it focuses on behaviour and action (Flanagan, 1954, p.13) instead of mapping perceptions: *"The critical incident technique, rather than collecting opinions, hunches, and estimates, obtains a record of specific behaviors from those in the best position to make the necessary observations and evaluations. The collection and tabulation of these observations make it possible to formulate the critical requirements of an activity*" (Flanagan, 1954, p.30). Note that, in comparison with the disruptive management processes of different actors, CIT methodology allows for pattern reconstruction. Thus, CIs can be compared within one DIN and also cross-case.

The CIT approach requires primary data collection from participants of the process. Still, the collection of secondary data is also indispensable (1) for better understanding and (2) for verification of the recalled CIs. To avoid a retrospective bias (cf. Middleton, Middleton, & Modafferi, 2014; Sword-Daniels et al., 2015), narrative statements have to be confirmed. The more a process dates back in time (Flanagan, 1954, p.4) the more important a check becomes.

Data analysis and mapping of CIs allow the construction of CI-charts (Miles & Huberman, 2002). A CI-chart displays actors, years and CIs for comparison and visualisation of real-time management. Three elaborated CI-charts of non-linear ad hoc collaborations in disaster relief can be found in chapter 4 (see Table 4-9, DIN 1), and in Appendices C2 and C3

(DIN 2-3). An example of CI coding (see Table 3-3) will be given in the next section. A description of how the CI-chart for pattern reconstruction was used in this study is presented in section 3.3.

3.2.4 *The coding process*

The systematic coding of text is one of the key elements in grounded theory methods (GTM) (cf. Strauss & Corbin, 1998). The coding process starts from a descriptive level and rises to abstract levels. In order to generate new knowledge and to find new categories and keywords to conceptualise dynamic innovation processes and to detect patterns of real-time collaboration, a mix of bottom-up (descriptive) and top down (theoretical) coding was undertaken. Codes, which are defined as follows, are the basic instruments in this study's analytical operations.

Definition 3-3: Code

A code is a keyword assigned to quotations. Quotations are marked data segments that have a defined start and end point (Friese, 2014).

The elaborated codebook, created to investigate innovative collaboration in long-term relief, comprises 123 codes in its final version. The codebook can be found in Appendix D.

To assure intercoder reliability of central codes in the codebook (cf. Campbell, Quincy, Ossermann, & Pedersen, 2013), parts of the data were double coded. In general, multiple coding establishes reliability and validity of coded data through intercoder tests or agreement measures (cf. Carey, Morgan, & Oxtoby, 1996). Coding procedures in the study are used to explore patterns of successful real-time collaboration processes (cf. Peters, 2014), and also of successful management, problem solving, and network dynamics around CIs. In assigning quotations to keywords, and subcodes to codes, the study relied on the "NCT model" (cf. Friese, 2014) that recognises coding as a systematic and iterative procedure of "noticing, collecting and thinking" about phenomena and incidents (cf. Saldaña, 2015). Table 3-4 is an example of CI coding.

Table 3-4: Coding example of the CI boat repair

Code	**Definition**	**Primary data (PD) quotation**
CI boat repair	Key event that influenced or changed an organisation's ongoing plans and operations	"*NGOs will make a comparison like which is cheaper and all and finally, they may not go for the quality part. So we could find many boats end 2005 which were not quality things. We had to react. At that time there was a lot of waste of money*." (PD 6:193)

The CI "boat repair" (see occurrences marked green in Tables 4-11 to 4-14, the CI-chart for DIN 1) in Ayam first occurred as a key event in 2006. As the Tsunami had destroyed the livelihoods of fishermen, boats were replaced by multiple donors. In large numbers, old timber-made catamarans were substituted by new ones, made of fibreglass. As an unintended consequence, new boat production sites cropped up along the coast. The sites were in the hands of non-experienced craftsmen who were attracted by the chance to make a living from the income. In the ad hoc collaboration in DIN 1, the CI "boat repair" first concerned local people (2006), then the LNGOs, and rapidly, it spilled over from fishermen to INGOs (2007) and TNGOs, from there to the media and from the media to global donors (2008). The LNGOs' first reaction had been not to react, but later, this CI changed and influenced the activities of even more network-actors.

Computer assisted text analysis can result in a codebook (while it is also possible for a codebook to be used to start the process). As a matter of principle, a codebook volume of a new research project contains "between 180 - 200 codes as a rule of thumb" (Friese, 2014). This volume allows for (1) hypothesis building, (2) pattern detection (see Chapter 4) and (3) construction of typologies from analysed data (see Chapter 5).

A codebook structure (see Appendix D) has two basic components: *codes* and *definitions*, the latter being the instruction for when to use the code (in multi coder research projects). The codebook can also include examples of quotations. Though the structure is simple, the process of building the codebook is complex and progressive (cf. MacQueen, McLellan, Kay, & Milstein, 1998). Iterative loops of coding lead to increasingly saturated versions of a codebook, the categories of which have to be re-grouped, reviewed and classified according to new data input.

The software package ATLAS.ti 7.0 allows codes to be systematically assigned to text. Voice, videos and pictures can also be collected in its 'hermeneutic units' (HU) of primary documents (PD) that were used in this study to store textual data (Muhr, 1991). The software also offered analytical operations after coding. To answer RQs 3 and 4 (see Chapters 4 and 5) the following analytical ATLAS.ti operations were used: 'frequency count', 'code cross tabulation', 'code family function', 'Boolsche operators', the 'query-tool', and the 'network view'. For the coding process of this study, descriptive and analytical coding and simple frequency counts were sufficient.

3.2.5 *The coding scheme for pattern detection in ad hoc collaboration*

Codes are the building blocks of theory and model building, the quotations are the foundation on which the analyst's arguments rest. Stated more explicitly, codes embody the assumptions and interpretations - the findings of the analysis. A structured codebook provides a stable frame for further analysis of more textual data.

The central coding scheme illustrates the analytical frame of a qualitative research project.[4] Figure 3-1 depicts the coding scheme for this study of dynamic innovation networks in the empirical field of disaster management. Three colours are used to distinguish between three code groups from more descriptive (blue code group) to more analytical levels (green and pink code groups).

The green boxes in the middle of Figure 3-1 comprise the central assumption of the study. It reads as follows from left to right: real-time collaboration is a challenge (COLLAB-CHALLENGE)[5] that is part of the dynamic process of disaster management (DIMA) that often contradicts and counteracts sustainable outcomes (SUSTAINABILITY). Our research aims at exploration of successful ad hoc collaboration by which this challenge is mastered. It is depicted in the pink code boxes and reads

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[4] In ATLAS.ti, the command network view provides the functionality to display multiple codes in flexible relations and graphical illustration for this purpose.

[5] For each code, the full definition is given in Figure 3-1 and in the codebook in Appendix D.

as: critical incidents (CI) are part of this real-time challenge, and heterogeneous actors (ACT) have to master them. We assume that sustainable outcomes (SUSTAINABILITY) of this process are associated with emerging global-local network dynamics (NETDYN) that are related to innovative activities (INNOACT).

The chosen empirical context of successful ad hoc management in DINs is no less than ‘recovery from a disaster’. To embed the observations in the empirical context, we also need descriptive codes. In blue code boxes, the relief context is explored in disaster effects (DIS-EFFECTS) and again related to disaster management (DIMA-INTEREST).

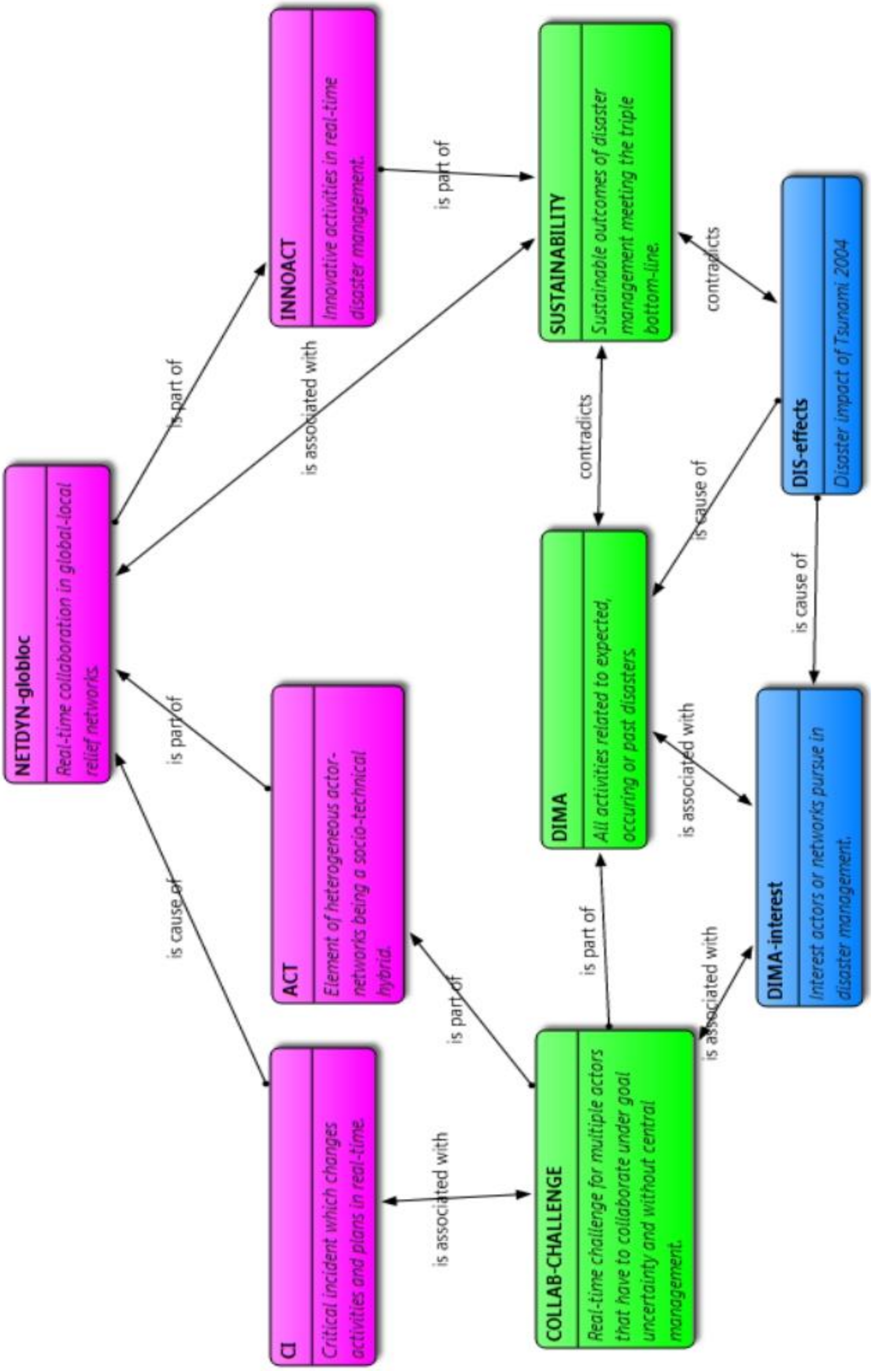

Figure 3-1: Coding framework for successful ad hoc collaboration in relief

Figure 3-1 shows that in order to explore dynamic network patterns, the elaborated coding scheme allows us to analyse DIN processes using analytic and descriptive codes. The analytic codes ‘CI’ and ‘ACT’ are “free codes” (Friese, 2014): they are first defined without quotation to explore the shape and change in the DINs. The actor-network term and process lens (see Table 2-2) enables us to explore and compare DINs as network dynamics and innovation activities. The ‘ACT’ code was used in ANT intentions to first explore *which* heterogeneous actors belong to an innovation network. The code ‘CI’ allows us to find and focus on CIs in order to understand changes in successful management in turbulent innovation processes.

This coding scheme facilitates pattern detection from either of two directions: (1) the CIs which are mapped in three CI-charts and (2) important network dynamics which are coded and composed from primary and secondary data. The three CI-charts allow for management *comparison* actorwise, within case, and also cross-case. The pattern detection happens in a distinctive interpretative way.

3.3 Empirical embedding of the research design

This section briefly discusses the operational implications of the empirical embedding of the research design. It describes (in 3.3.1) the chosen ad hoc collaboration setting and (in 3.3.2) the data collection process.

3.3.1 *The ad hoc collaboration setting – Response to the 2004 Tsunami*

The chosen setting for exploring successful management of real-time collaboration and DIN emergence is disaster management. The 2004 Tsunami is taken as a textbook example of a global disaster. The official meaning of the term disaster, as a social phenomenon, is provided in definition 3-4.

Definition 3-4: Disaster

A disaster is "a serious disruption of the functioning of a community or a society involving widespread human, material, economic and ecologic losses and impacts which exceed the ability of the affected community to cope using its own resources" (UNISDR 2009).

In this definition, the need for collaboration, and in particular ad hoc collaboration, is clear. Accordingly, the management of activities related to the response to such a disruptive incident is recognised as in definition 3-5.

Definition 3-5: Disaster management

Disaster management refers to „all relevant activities of different actors related to expected, occurring or past disasters" (Quarantelli 1988).

Disaster management is therefore a case of innovative global-local ad hoc collaboration suitable for DIN sampling. Disaster management is recognised as a highly dynamic long-term process. In the case of Tsunami

2004 (see beginning of the Chapter) there is: (1) a rich account of global-local collaboration by different actors; (2) clear evidence on innovative and sustainable outcomes, since it took place some time ago and its outcomes are debatable, in particular because; (3) a multitude of secondary data exists to embed the findings of the explorative empirical study.

3.3.2 *The data collection process*

The collection of various forms of data (see Definitions 3-1 and 3-2) concerning real-time collaboration in the year-long relief period was a process which varied in intensity. It started in 2004 and continued in three waves. Figure 3-2 depicts these waves. The visible overlap of data collection and data analysis follows GTM principles (see, e.g., Strauss & Corbin, 1998; Peters, 2014) in the sense that both research steps have to go hand in hand to inform and advance one aother.

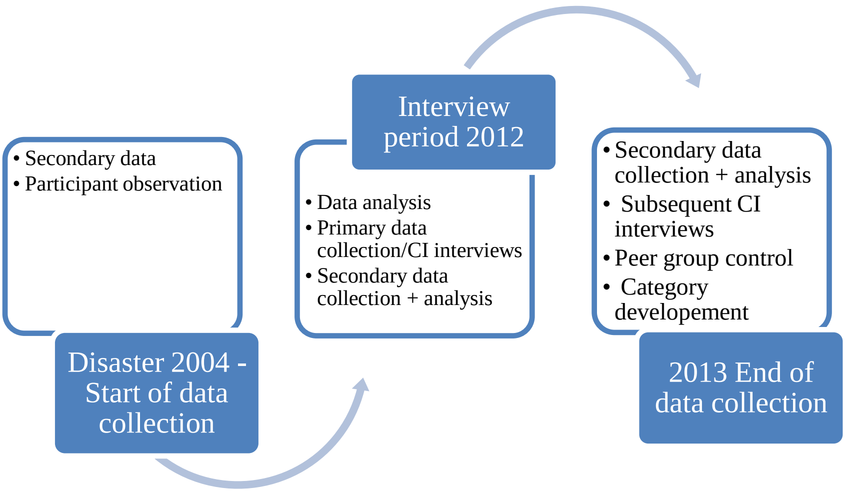

Figure 3-2: Three waves of data collection in accordance with GTM

Importance was also attached to the triangulation of data (cf. Junk, 2011). Triangulation data (see Appendix B) collected for this study included (1) narrative data, (2) secondary data in the form of official reports and grey literature, and (3) as newspaper clippings. In qualitative research processes, the diversification of data sources helps to build stronger interpretations (see, e.g., Yin, 2003).

The first wave of data collection started from the disaster. Basically, it concerned secondary data, but also an initial participant observation (that is, primary data). Memos and field notes date back to the time when the researcher was an active part of disaster management processes. The role of the later researcher in that time was useful in more than one way. Newspaper clippings (see above) on the local tsunami relief and global aid collaboration, for example, could be collected due to initial contacts in 2005 and 2006, from the Indian daily newspaper THE HINDU.

The second wave of data collection took place in January and February 2012. It gathered the primary data and placed emphasis on narrative CIT interviews (see above). During field work in India, 12 semi-structured interviews of 90 minutes each were realised. The interviewees were directors and managers of local, intermediary and transnational NGOs. The in-depth interviews were supplemented by further voice accounts of district collectors, donors and affected people. The main interviews were conducted in standardised CIT formats (see Appendix A1 and A2) and transcribed to become the basis of the coding procedure.

The second data collection period was followed by a third wave of continued collection of secondary data (see above) and context observation in 2012 and 2013. An overview of the whole of primary and secondary data investigated is given in Appendix B.

3.3.3 *The pattern reconstruction using CIT*

Social interaction follows well-defined and well-understood patterns. The study aims to achieve a reconstruction (in ANT terminology) of dynamic network patterns (that have occurred in real-time), using a systematic empirical approach. Based on multiple primary and secondary data, it elaborates upon the three case studies and then uses CIT to obtain CI-charts (see, i.e., Tables 4-11 to 4-14). These matrices systematically display points and periods of change in a real-world collaborative management guiding the non-linear process.

Traditionally, ANT studies are based on ethnographic research, on rich textual data and on its presentation. In the chosen new combination with CIT for systematic comparison of processes and patterns, the traditional basis can no longer be used. The coding procedure in ATLAS.ti, as well as the extended period of data collection however delivered much more explicit and rich narrative data than could be shown in the frame of this study. The unexpected richness in fact is a disadvantage compared to typical in-depth ANT studies (cf. Bijker, 1997) that has been accepted in order to achieve something new: instead of exploring the historical emergence of actor-networks, ANT analysis here leads to exploring CIs in innovation processes in a systematic way, to gain managerial insights.

To detect patterns between and around these incidents that changed the planned course of action, it is necessary to analyse in parallel rich secondary data that was collected in a longitudinal study. Annual reports, project documents, and newspaper clippings build the background for the empirical research leading to the identification of repeating network patterns around reoccurring CIs.

3.4 Methodological rigour check

This chapter has addressed RQ 2: how is it possible to adequately explore successful ad hoc collaboration in dynamic innovation networks? This was achieved by (a) using a research design that recommends the identification of successful DINs in a carefully explored empirical context, and by (b) conducting a process analysis using ANT and CIT concepts for a cross-case comparison and pattern detection. A range of measures has been developed to assess quality in qualitative social research (see, e.g., Eisenhardt, 1991; Strauss & Corbin, 1998; Bryant & Charmaz, 2007; Gibbert et al., 2008). This study adapts the quality criteria developed by Yin (2003, p.33) and Gibbert et al. (2008) and the chapter concludes with an assessment of the proposed research design (see Section 3.1) and implementation in terms of six of these criteria.

The criteria are (1) relevance and (2) appropriateness; then, instead of objectivity, it assesses credibility and reflexivity in Gibbert's terms of (3) internal validity, (4) construct validity, (5) external validity. Finally, (6) intersubjective confirmability is checked. Below are the author's initial short responses to the criteria.

1 - The study is relevant with regard to a need for new management concepts for ad hoc collaboration in contrast to traditional strategic management and foresight.

2 - The research methodology is appropriate as it addresses the PS and RQs 1 to 5 adequately.

3 – The internal validity of the findings was confirmed by provision of an explicit research framework, code cross-checking, pattern congruence checks, and theory triangulation.

4 - Construct validity was confirmed by data triangulation, reviewing processes of parts and sections, research presentations at conferences for different expert communities, clear indications from data collection, the circumstances of data collection, and the explanation of the data analysis.

5 - External validity was checked by cross-case analysis, and by formulating an explicit rationale for the case study selection and for other details.

6 - Intersubjective confirmability of the research findings was checked and ensured through different procedures of data base and protocol archival.

The table 3-5 summarise the fulfilment of the procedures adopted in the realisation of this qualitative research study.

Table 3-5: Methodological rigour check of research design and realisation

Criteria	Procedure	Treatment within study	Fulfilment
Relevance	Identification of the real-world challenge and the research gap	TF and SM are helpless in networked ad hoc settings; examples of challenges of ad hoc collaboration in disaster management (see Chapter 2)	completed
Appropriateness	Fit between PS and RQs and research methodology	Explicit presentation of GTM and CIT in a network process study using LNGO data (rarely available) on collaboration in long-term relief (see Chapter 3)	Completed
Internal validity	Explicit research framework	Transparent research framework of a process study investigating a foresight method for real-time collaboration; using DINs to explore successful ad hoc collaboration (see Chapter 4)	Completed
	Code cross-checking	Iterations from descriptive to conceptual codes; partly double coding for intercoder reliability; external validation by experts; studying DIN and crisis literature	Completed
	Pattern matching	Observed patterns are in line with (1) assumptions within the research framework and (2) with previous findings of innovation management and disaster management	Completed
	Theory triangulation	Foresight, dynamic network theory (ANT) and innovation management are three overlapping collaborative management approaches	Completed
Construct validity	Data triangulation	(1) Secondary data: newspaper clippings, (2) Primary data: expert interviews, (3) Secondary data: reports, evaluations, governmental acts and conference presentations	Completed

Table 3-5 (continued 1): Methodological rigour check of research design and realisation

Criteria	**Procedure**	**Treatment within study**	**Fulfilment**
	Review of transcript parts by academic peers	Review of concepts in papers by academic peers in EU programmes (NITIM), conferences (ISCRAM, ISPIM, IFA) and journals (TFS)	Completed
	Review of transcript by informants	Key informants reviewed and commented on transcripts; external NGO experts acted as commenting control group (humedica e.V.)	Completed
	A clear chain of evidence	Validity of interview protocols and assumptive patterns of DIN actor concepts tested, i.e., at the Humanitarian Conference, Berlin 2011	Completed
	Indication of data collection	Indication of sequential data access in detail in Figure 3-3	Completed
	Check for circumstances of data collection vs. actual procedure	Interviews of 90 minutes; semi-structured interview outline given in Appendices; special focus on experts of the local Indian relief site for rich LNGO accounts	Completed
	Explanation of data analysis	Details of the data analysis procedure are provided to guide the reader and to offer credible and confirmable evidence	Completed
External validity	Cross case analysis	Cross case study on three DIN collaborations in global relief	Completed
	Rationale for case study selection	The explorative study is in GTM traditions (i.e., it has a theory building nature); it uses disaster management as a case for dynamic innovation processes without central actor	Completed
	Details on case study context	Details on Tsunami 2004, LNGO and DINs are provided	Completed

Table 3-5 (continued 2): Methodological rigour check of research design and realisation

Criteria	Procedure	Treatment within study	Fulfilment
Intersubjective confirmability	Case study protocol	Interviews were recorded and transcribed; description of how a cross-case study has been performed is provided (Chapters 3 and 4)	Completed
	Case study database	Research memos (Friese, 2014) on cases are not transcribed but collected in files of the database	Completed
	Storing all actual names given of the organisations involved	Names of all NGOs involved are kept in the database; for privacy reasons names and places are anonymised in the thesis manuscript and in most publications	completed; stored for use at Leiden University

4 The patterns that facilitate real-time innovation processes

Chapter 4 deals with RQ 3 that reads: which network patterns facilitate real-time innovation processes? Here the thesis presents a process analysis of three successful long-term disaster management networks in order to examine the RQ and to detect patterns in the process data. By the end of the analysis, it will be possible to describe five dynamic network patterns that facilitate (1) the emergence and (2) the successful management of DINs.

Mass-collaboration in disaster management is a real-time, dynamic and long-term experience. So far, strategic management by public and corporate actors has repeatedly failed, in particular in the long-term, because of the mismatch between single interests in a complex process. As one Indian NGO director described the post-disaster collaboration experience: *"Everybody wants to do something according to their own way. But that will not be fitting to the people, you see? So, billions of rupees wasted*" (PD 1:91).[6] The dissipation of donations and the mismatch of implemented rehabilitation schemes with local needs are typical relief threats. However, the divergence of interests is not the only issue. Unfamiliarity of central government and foreign aid with the local culture is a second iterative issue in global crisis (cf. Rangan et al., 2006; Tomasini & Van Wassenhove, 2009). Collaboration challenges increase with the influx of transnational NGOs (TNGOs) to rural communities. In

[6] In the ATLAS.ti nomenclature, quotations are indexed by PD number and text line (PD x:y)

Indian Tsunami 2004 regions, this influx was called ‘the second wave’. Organisational mismanagement, then, seemed to follow its own laws: *“All were dumping in one village, to one particular community with all the latest products of which they (the local affected) are not familiar”* (PD 5:11). Still, in all this post-disaster mass turmoil, certain collaborations achieved sustainable ends. What kind of management made these alliances successful?

This chapter describes a five step cross-case process analysis which was performed in search of network patterns that facilitate real-time innovation processes. A network pattern is defined as follows.

Definition 4-1: Network pattern

> In sum, a network pattern is a repeatedly performed interaction of multiple actors in a collaborative context (cf. Johanson & Mattsson, 2015).

The first step (Section 4.1) presents three exemplary cases of successful and innovative real-time collaboration. In the second step (Section 4.2), the emergence of dynamic innovation networks (DINs) is explored. Subsequently, main actors of successful management and plan-changing incidents are reconstructed. Based on the characteristics identified in the three case studies and main coding results, one DIN case is chosen for closer inspection of the unfolding dynamics. In the third step (Section 4.3) this case of successful real-time collaboration in global relief is retraced to identify the most significant network patterns. Five patterns were found for the Ayam case. In the fourth step (Section 4.4) a comparison was made between the five idiosyncratic dynamic patterns and the two other cases to test whether the identified patterns also apply. The comparison was performed accurately. In the fifth step (Section 4.5) the five dynamic network patterns are consolidated, analysed, and re-identified as collaborative innovation management principles which are actually needed to facilitate and govern collaborative innovation processes.

4.1 Three dynamic innovation processes

The three successful innovative relief processes were introduced at the beginning of chapter 3 (see Table 3-1). Below, the study extracts the DIN information on the successful collaborations from the collected primary and secondary data. It does so for both local and global aspects of the networks. To reproduce the DIN processes in a systematic and comparable frame (cf. Norman, Redfern, Tomalin, & Oliver, 1992; Strauss & Corbin, 1998; Austrin & Farnsworth, 2005), the study follows the same narrative scheme for all cases, as shown in Table 4-1 below. Four parameters - called DIN attributes - are used to structure the narrative cases with regard to the research topic. Subsequently, all three examples of a sustainable and innovative collaboration process are described. Subsection 4.1.1 deals with Ayam, subsection 4.1.2 with Keniparam and subsection 4.1.3 with Kanni.

Table 4-1: The four DIN attributes used to compare dynamic innovation processes

	DIN attribute	Display
1	LNGO	Short description of the local non-government organisation (LNGO)
2	Ad hoc collaboration	Disaster management, starting from first response
3	Dynamic innovation process	Co-created process innovations (institutional and organisational innovation) and product innovation in relief
4	Critical incidents	Main CIs in the non-linear relief management process

Empirical evidence concerning these parameters of real-time innovation processes is required to identify shared network patterns. LNGOs are focal actors in global relief networks. Successful ad hoc collaboration is the process we seek to better understand, in particular in the dynamic field of disaster management. Thus, the DINs in the sample were selected because they were innovative and sustainable.

The observed real-time collaboration leads, albeit sometimes in very different compositions, to (1) product innovation and (2) process innovation (see Table 4-1, item 3). With regard to process innovation, the thesis specifies in more detail (2a) institutional innovation and (2b) organisational innovation in a real-time process defining institutional innovation from a collective action perspective (Van de Ven & Hargrave, 2006) as follows.

Definition 4-2: Institutional innovation

Institutional innovation is the introduction of new institutional arrangements. They develop through a process in which actors contribute to a larger solution by combining practices, technologies and institutions to address their unique interests (Van de Ven & Hargrave, 2006, p.2).

In contrast, organisational innovation, relates to a precise and more limited unit of social interaction. The denoted phenomenon is different in scope, but not necessarily in kind. It is defined here as follows.

Definition 4-3: Organisational innovation

Organisational innovation means the implementation of new organisational methods in (1) the business practices of an undertaking, (2) the workplace organisation or (3) the external relations (Laforet, 2011).

This classification is sufficiently sensitive for the study (1) to distinguish between different scopes of innovation and (2) to understand the change imposed upon an actor, a network of actors or a societal sector, and it makes it possible to conduct the previously mentioned comparison and pattern analysis. The text which follows tells the stories of three different successful ad hoc collaboration cases.

4.1.1 *Case 1: Ayam*

This subsection describes Case 1, Ayam, in terms of its four DIN attributes.

LNGO: The LNGO showcased is 'Dantishan' which has supported coastal villages in Kanyakumari since 1982. It focused on woman's micro-saving groups with support from the government and private donors when the 2004 Tsunami hit the coast.

Ad hoc collaboration: The director and staff of Dantishan were alert by villagers using their cell phones and were involved in the response from the very first hours. Injured people were taken to nearby hospitals, debris was removed, water was distributed and later food, clothes and blankets. On the first and second day transnational NGOs (TNGOs) were contacted, again by cell phone. Around the village of Ayam, the emerging alliance provided fishing equipment for 250 fisher families and organised medical and psychological care. The emerging alliance established counselling, skills training and night schools for children. 'Dantishan' first helped, but then competed with TNGOs that, when they arrived, were unfamiliar with Ayam. In parallel, on the other side of the globe, the TNGO network partners enroled new actors for advocacy and funds within the DIN. The contract to start this rehabilitation programme was signed very early, in January 2005. It aligned all interests in the idea of entrepreneurial local relief within a four year period.

Dynamic innovation process: From the beginning, innovative outcomes were realised in this collaborative process. The outcome was (A) *manifest* in (1) process innovation and (2) product innovation and (B) *progressive* in (1) income generation, (2) medical care and (3) gender support. Here the thesis presents two manifest examples.

(1) Process innovation: The entrepreneurial local ideas changed the local traditions in the following three ways, amongst others: (a) Advanced global aid standards were initiated in creating micro saving groups for men. (b) Engine repair training groups and technical startup empowerment for women were introduced. The initial resistance to this from the donors was soon overcome and the DIN ventured into a business. The development of the business received a boost when established company Yamaha collaborated with these, the first woman to lead an engine repair workshop anywhere along the coast. As a follow-up innovation, (c) the concept of a newly introduced ‘night school’ for school dropouts was adopted by the government when the foreign support ended in 2008.

(2) Product innovation: In the first year, self-made ‘distribution cards’ were invented. For medical care, ‘primary health care tents’ were erected to help out overcrowded hospitals. Later, it became apparent that there was an enduring local need for trauma counselling, and medical trauma training was set up with teams consisting of local affected people, priests and barefoot activists.

The DIN avoided media contact in real-time relief both during the early years and later on, the LNGO preferring experimental activities (with risk of failure) in this way attempted to protect the village community - as well as the innovative relief outcomes. The DIN also enforced local contributions for livelihood rehabilitation schemes, and as this did not happen in ongoing relief projects, this entrepreneurial approach repeatedly caused conflicts between the LNGO and the local community. Conflicts also arose as a result of the donor and private company’s differing opinions about visibility.

Critical incidents: The seven main CIs in this emerging network were:

(1) competition and negative experiences with a high influx of TNGOs,
(2) lack of coordination and directedness (for example, around the boat repair issue),
(3) conflicts with beneficiaries about the required local contribution,
(4) money overload in nearby villages,
(5) conflicts between donors and for-profit companies,
(6) alcoholism,
(7) reporting and accounting problems in efforts to meet global accounting standards (of interlacing contracts).

4.1.2 *Case 2: Keniparam*

This subsection describes Case 2, Keniparam, in terms of its four DIN attributes.

LNGO: The LNGO showcased is Sangram Rural Development Society ('SRDS'). This is a small voluntary unit of a religious institution. It empowered the backward population in the fisher villages when the 2004 Tsunami hit the Tamil Nadu coast.

Ad hoc collaboration: The director and staff of SRDS began to help the affected people near Chennai within two days after the Tsunami. The director had been asked to do so by its Indian superior. During the first weeks, the LNGO 'slipped' into emergency assistance, but then was asked to oversee an extended housing scheme. The media, many TNGOs and tourists crowded the area close to the tourist venue of Mumbai airport and housing reconstruction, commodities and real estate became the most relevant issues. In parallel, the needs for income generation, children's and livelihood support (catamarans) were recognised by the DIN. In the conflict between a variety of local parties and multiple TNGOs, the small, unprepared LNGO was almost obliterated by so many heterogeneous interests. Three issues were at stake: (1) the local Panchayat raised opposition to the DIN idea of cohabitation for different religious groups, (2) the donors' expectations extended in different directions and (3) the cancellation of the promised construction of 100 houses (due to the rocket market price of cement) needed to be managed. The DIN struggled to survive, from year to year. Many more contracts, after the initial one, had to be handled over the years.

Dynamic innovation process: During the DIN emergence and evolution of this DIN, process innovations such as (1) institutional innovation and (2) organisational innovation were of most interest.

Concerning (1) institutional innovation: The multi-lateral collaboration between several TNGOs replaced the command and control chain between global and local organisations. To avoid a collapse of the network, due to the cancellation of 100 promised houses, the LNGO (being in trouble) merged multiple TNGOs to provide relief assistance. It did so for one local village, through the establishment of one LNGO. This constituted an exception to all rehabilitation projects in the near environment: it was a new and 'unusual' structure of vertical TNGO collaboration. Since the village was not reconstructed in the disparate and 'streetwise' manner typical of various TNGOs working separately, the action led to less spatial fragmentation than is frequently seen in disaster management. Thanks to the mutually enforced centrality of the small LNGO in this

DIN, an inclusive housing and reconstruction process was achieved. It can be seen as a process of institutional innovation.

Concerning (2) organisational innovation: As a consequence of the action, the struggling LNGO was often out of reach and also out of sight for its many global partners. In brief, it faced so many local real-time issues that its communication capacities towards international partners in disaster management repeatedly failed. Facing the need for critical rehabilitation processes with disrupted communications, the small 'SRDS' almost collapsed in the early years, but after a while it began to grow and to transform and to produce socially innovative rural living structures. Subsequently, it scaled up to meet global standards for resilient housing (thanks to a global architecture team sent by one of the TNGOs). The director who wanted to wind down at the end of the first year, had initiated unusual but successful new management styles. In the end, the LNGO had changed completely and so the dynamic innovation process here has initiated a real-time organisational change.

Critical incidents: Main CIs in this emerging network were:

(1) contact overloads, punctual distance and lack of LNGO management capacity,

(2) disaccord amongst local people on resilient and socially inclusive reconstruction,

(3) distribution and duplication problems in substitution of new catamarans,

(4) competition for visibility between donors,

(5) governmental agencies' reluctance to assume responsibility for the sanitation of houses,

(6) rise of market prices in cement and cancellation by a TNGO of 100 promised houses, and

(7) the solution of parallel, horizontal TNGO collaboration in one project.

4.1.3 *Case 3: Kanni*

This subsection describes Case 3, Kanni, in terms of its four DIN attributes.

LNGO: The LNGO ‘Trustpeace’ has been active since 1984; it promotes and advocates children’s rights and environmental and fishery causes. It is based in central Tamil Nadu and is connected to central government and Indian universities. In response to the 2004 Tsunami, its staff began a year-long commute to the remote coastal area.

Ad hoc collaboration: The LNGO members on their sofas at home during the Christmas holidays, were alarmed by the TV pictures. They immediately started out for the places where the highest death toll was to be expected. These included, as they had anticipated, Kanni as famous destination by the sea for Christian pilgrims. Contact with local and global partners was initiated in real-time by mail, mobile, pictures, video and radio. The shattering death toll pushed actors to intervene as fierce as the disaster hit. Soon, the ambitious claim ‘safe future for 100 children, for 10 years” was circulated. An old green bus was organised for the ad hoc transportation of five teachers - later used by the children as a school bus - from village to village.

To avoid child trafficking, a search for orphans and affected children was immediatedly begun. The green bus rapidly became a local institution and a symbol of hope, long before the first stones of the envisaged building could be laid. On the other side of the globe, the green bus also mobilised network actors: private and public donors could be attracted by visual material concerning its real-time activities focused on displaced children. Long-term support was facilitated only by rapid enrolment of its most important partners and private resources. The initial vision of this DIN was fixed in a contract, three months after the disaster. New actors were included, others left the DIN. The centre was inaugurated only in 2007.

Dynamic innovation process: Slowly, but steadily, the innovation process accelerated from year to year. Single goals of the DIN emerged from its ‘numeric’, digit-based (100/10) shared vision. The strongest DIN impact was realised in (1) institutional innovation as a children’s centre of lighthouse character was created. Semi-orphans stayed in contact with their families and became change agents for education in rural regions. However, in particular (2) product innovations and (3) process innovations are clear marks of the DIN.

(1) Institutional innovation: the distinction between ‘full borders’ and ‘semi-borders’ from temporary shelters nearby was an innovative and not very simple approach, as was the mobile teaching system based on the green bus immediatedly after the disaster. Bargaining for real estate and the construction process, turned out to be challenging and time-consuming, and took the inexperienced DIN longer than expected. Fierce NGO competition, heavy rain falls, rising market prices and changing legal regulations hampered the centre’s construction. However, its foresight and

flexible claim to become an ‘orphanage of the future (100/10)’ constituted something completely new and different from other child programmes.

(2) Product innovation: Fundraising became an expanding DIN activity in the early days. It led to new partner inclusion on global and on local levels. An example of product innovation is the artistic photo book on Tsunami children which was produced for this purpose (Sutera, 2007).

(3) Process innovation: The centre became a hot spot for local relief coordination due to the LNGO’s advocacy and technical skills. The technical skills (IT and community trainings) led to process innovations in children’s relief such as real-time reporting by children via community radio, and transformation of victims into agents of preparedness and awareness (namely, a pupils’ theatre group that travelled to other disaster regions with the green bus).

In 2008, the centre was awarded an UN title of ‘Role model in children’s relief’, but skilled labour fluctuation remained a vexing problem, and tension increased between the cosmopolitan education centre and its rural environment. This was most visible in the struggle against child labour. Innovative vocational training in community radio, the Internet, and cell phone repair, as well as public health education, took priority. The centre’s outreach grew as a process innovation, taking forward children as change agents for the temporary shelters of their neighbourhood and families. The DIN finally co-created an open education facility for coastal communities.

Critical incidents: Main CIs in initial and long-term collaboration and DIN emergence were

(1) skilled labour fluctuation which was in strong competition with the TNGO influx on site,

(2) the rise of the market prices in real estate and cement,

(3) opposition to the government's (a) coastal regulation act and to (b) insufficient legal protection of affected children (for example, 'tsunami marriages' and child trafficking),

(4) delay in real estate construction and progress towards enduring living conditions of temporary shelters,

(5) local people who were in discord over the child labour issue, and

(6) local people who were in discord over the local contribution to education.

4.2 Emerging structures of collaborative management

Comparing these dynamic collaboration cases to the existing crisis management literature, three features appear at the head of the list: there is (a) an ample heterogeneity of enroled actors, (b) a high number of critical incidents that hamper planned programmes, and (c) a lack of resources but no lack of cooperation. The three most familiar challenges of post-disaster literature (cf. Comfort et al., 2004; Kapucu, 2005) share their top position with more unfamiliar issues of duplication, money overload and TNGO influx. The discussion below considers the three striking features, (a), (b), and (c).

(a) Other studies have, so far, produced no account of the dynamics between heterogeneous network actors (see, e.g., Varda et al., 2009; Parmigniani & Rivera-Santos, 2011; Schreurs, 2011; Jordan & Javernick-

Will, 2013). Typically, inter-organisational cooperation is focused upon and examined in isolation (cf. Tatham, Kovács, & Larson, 2010; Dorasamy et al., 2013) in crisis management literature. However, the data from this study indicate that successful relief is embedded into much more complex networks of actors and dynamics that can promote and deter ad hoc relief.

(b) In all three successful long-term collaborations, CIs permanently shatter the planned course of action: in Ayam, in Keniparam and in Kanni, the DINs were likewise responding to the following four issues: multiple, parallel, repeating and cascading CIs (cf. Cope & Watts, 2000; Nissen, 2011; Gorelick, 2012).

(c) The absence of collaboration, a "threefold lack of resources, communication and cooperation" (Comfort, 2007, p.296) has been identified by SNA studies as a barrier to successful relief, moreover as a characteristic of the management field, and as 'endemic to disaster management'. However, the cases of Ayam, Keniparam and Kanni show that collaboration and support from the first moments are what actually happens. Yet, in traditional strategic management perspectives, interaction, distribution and collaboration are difficult to observe and to identify in real-time turbulences.

The collaborative management practice observed in the three cases enabled the affected people to cope with critical incidents that happened iteratively in real-time and were turned to opportunities for innovative and sustainable solutions. Ad hoc management led to a range of innovations. The study here mentions two of them: (1) small product innovations, such as the self-made distribution card in Ayam; and (2) process innovations, such as (2a) institutional innovations as branding livelihood items within a community instead of only using TNGO logos on catamarans, and (2b) organisational innovations as in Keniparam with the alteration of the LNGO 'SRDS', and in Kanni, the transformation of the children's relief centre that evolved into a rural education and training centre.

The outcome of collaborative management in these DINs was sustainable: in 2011, engine workshops, skills training, night schools, revolving funds and saving groups, even distribution cards were still in use in Ayam, and the barefoot doctors were also still working. The local actors continued their response in Keniparam and Kanni as well, although the Indian government had officially declared the end of Tsunami rehabilitation by 2010.

In order to explore the underlying network dynamics and patterns of successful real-time collaboration in more detail, the thesis now reconstructs how DINs emerged in ad hoc collaboration (4.2.1), highlights two of the less prominent central actor roles (4.2.2), and examines the magnitude of CI occurrence in real-time and long-term relief (4.2.3). Based on actor and CI analysis, it presents a reconstructed CI-chart of the dynamic innovation process 2004 - 2010 (for Case 1, Ayam) in subsection 4.2.4.

4.2.1 *Emerging collaboration in DINs*

In all three cases Ayam, Keniparam and Kanni, it was observed that real-time collaboration did not result from strategic management of one particular actor but emerged from collective network management as part of a dynamic process under conditions of great uncertainty.

A characteristic difference (see Figure 2-2) between traditional management and ad hoc collaboration is their unequal goal orientation. With regards to goal setting, traditional management initially has a fixed goal (right or wrong, it has a goal). In the ad hoc collaboration in the presented case studies, different interests were handled, a shared vision was found and the derived temporary goals varied; between actors, between networks and over time. Goals disappeared or changed over time, according to new local needs[7] or unexpected incidents.[8] While initial goal setting and control did not happen, there was a rapid emergence of collaboration around a hopeful vision in all innovative relief processes. The vision was simple and it developed through the fast communication of heterogeneous needs and interests between core (or focal) actors – affected persons, responders and donors. The ad hoc use of ICT such as mobiles, TV, and local radio enabled actors to spread information concerning different interests in real-time.

Like-minded actors were found by trial and error, problematisation of issues, and communication of interests and convictions. A ‘cyberspeed communication’ connected the local and global real-world actors, but in all three cases, global and distant network actors also appeared immediately at the affected site. Only then was the formulation of claims and shared visions realised in an OPP. In all three cases, such an early found shared vision initiated the emergence and co-evolution of an actor-network with a very specific and actor-dependent disaster response (see also Chapter 5). To understand the dynamic network formation we briefly refer to the ANT model (see Table 2-1) of network emergence as a translation process of heterogeneous interests. The necessary alignment of heterogeneous interests encompasses four steps (see, e.g., Latour, 1999): (1)

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[7] Code: CI cooperation need assessment.

[8] Code: CI solution; CI new partner; CI duplication.

problematisation, (2) interessement, (3) enrollment, and (4) mobilisation. After disasters and in dynamic collaboration fields, actor-networks emerge as temporary networks. They exist as long as single actors mobilise activities which contribute to the above network operations (cf. Stanforth, 2006). The text below retraces all four steps following the LNGO actors in the study cases.

(1) **Problematisation**: in all 3 DINs, an LNGO collaborated for the first time in global disaster management. The problematisation of different interests can initiate network formation. Here, it happened immediately and encompassed activities of assessment of the local needs[9]. The LNGOs became focal actors in this activity and a reference point for their global partners. 'Trustpeace' immediately started with its own agenda, without any initial assessment in place, problematising the protection of children's rights in a chaotic post-disaster situation. The problem definitions of different local and global affected actors and donors around Ayam, Keniparam and Kanni were aligned in real-time. Frequent use of ICT accelerated the contacts and the fluent exchange.

(2) **Interessement**: in the interessement step for heterogeneous actors, the interests of all LNGOs were focused on the local communities. In Ayam, 'Dantishan' had the closest relationship with the fisher villagers. This was the case, from day one. In Keniparam, 'SRDS' enlarged its former small office near the coast and in Kanni, 'Trustpeace' began to commute from the mainland to the coast. Immediately and in parallel, former global partners and new contacts were addressed. Ad hoc communication worked by cell phone in Ayam, and by permanent action on radio and TV

[9] Code: CI cooperation need assessment.

channels in Kanni, whilst face-to-face communication took place in Keniparam. It enabled the TNGOs to rise funds from interested supporters[10] in real-time. In all three cases, contracts could be signed very early between most heterogeneous actors, constituting rapid OPPs for each of the three rather unusual relief networks. And all DINs started with a precious long-term perspective. The envisioned solutions enhanced the network formation and facilitated a collaborative management by contributing to different successful innovation strategies (see Chapter 5). All DINs decided to request a local contribution. Raising interest was very difficult and caused conflicts (CIs) in all three local communities[11] as most relief approaches in the environment relied on charity and free giving.

(3) **Enrolment**: enroling actors in relief included the finding of unusual new partners such as Yamaha (a for-profit company), or unusual actor constellations, such as multiple TNGOs at one site or multiple local NGOs. Sudden CIs (for example, CI distribution, CI boat repair, CI skilled labour fluctuation and CI duplication) repeatedly disrupted planned activities, but the DINs were flexible and enroled new activities and actors. Their shared vision framed the actors' motivation together with their practices on two levels: local (towards beneficiaries) and global (towards donors). In all three cases (Ayam, Keniparam, and Kanni), the TNGOs realised various opportunities to increase the available funds by enrolling additional public and private donors in the first years of collaborative disaster management.

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[10] Code: CI new partner.

[11] Code: CI local people disaccord.

(4) **Mobilisation**: to mobilise the DINs, real-time communication together with punctual and permanent activities were performed by network-actors. Special artefacts were used to mobilise and re-mobilise the attention and commitment of the network-actors. Three examples are: (a) the engine repair workshop in Ayam, (b) the various new contracts in Keniparam, and (c) the green bus in Kanni. Over time, and slowly, the main activities and main actor roles became local. In Ayam, the state government took over DIN activities as foreign partners left. In Keniparam and particularly in Kanni, local neighbours obtained a larger say in reconstruction from year to year. Thus, the transformation and education activities of real-time collaboration became sustainable in the later stages of disaster management.

The spider web diagrams under heading A below illustrate the study findings concerning network dynamics, and DIN emergence and evolution in real-time. Under heading B, the observed network dynamics are supported by exemplary quotations from participating actors.

A: Three spider web diagrams of real-time network evolution

The changing role of actors in successful DINs is demonstrated by the spider web diagrams depicted in Figures 4-1 to 4-3. Each spider web illustrates degrees of actor mobilisation at a point in time (year) for a respective DIN at two different moments (beginning and end) of the innovation process.

The mobilisation of each actor was assessed by analysis of secondary data (see data overview in Appendix B and the CI-charts in Appendices C2 and C3) and ranked activity levels from (0) zero to (1) low, (2) medium, (3) stable, (4) strong, and (5) exceptional activity. The blue webs represent the initial shape of real-time collaboration (year 2005) in contrast to the red webs that show the shift to the local actors (year 2010) in later times. The different states of mobilisation of heterogeneous network-actors over time reveal a first dynamic network pattern. It shows how sustainability of an innovation process is established. Here we see that the sustainable ends achieved in the collaborative relief cases relate to a procedural shift from global to local activities.

Table 4-2: Actors' mobilisation in Ayam

DIN	**Actors**	**2005**	**2010**
Ayam	LNGO	4	3
	INGO	3	1
	TNGO	3	1
	global media	3	1
	global donor TNGO	4	1
	global public donor	5	1
	local community	5	5
	local government	2	3
	local media	1	1
	local private actor	1	4
	local cell phone	5	5
	local catamaran	5	5
	contract	5	1

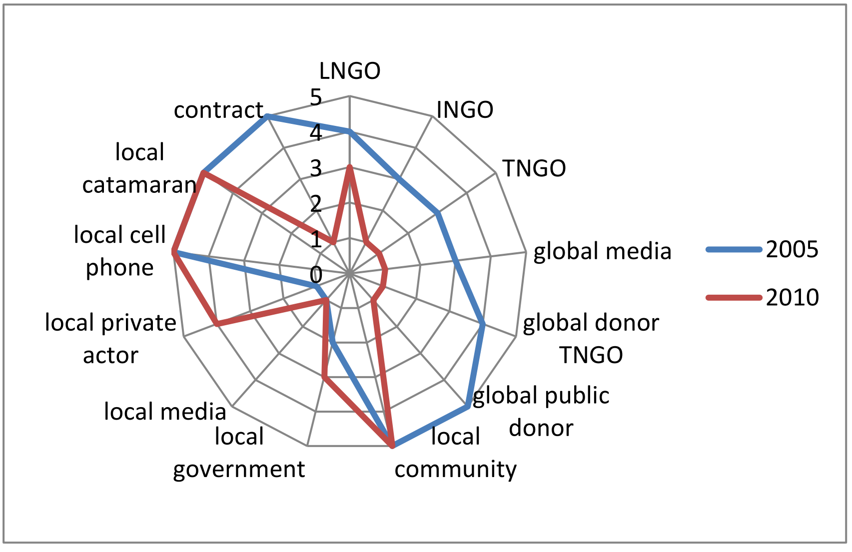

Figure 4-1: Real-time network activity in Ayam

Table 4-3: Actors' mobilisation in Keniparam

DIN	Actors	2005	2010
Keniparam	LNGO	3	3
	TNGO 1	5	1
	INGO	2	0
	TNGO 2	5	0
	TNGO 3	5	0
	global media	4	1
	local community	1	5
	local government	2	4
	local media	2	4
	local houses	4	4
	contract	5	1
	mail	5	2

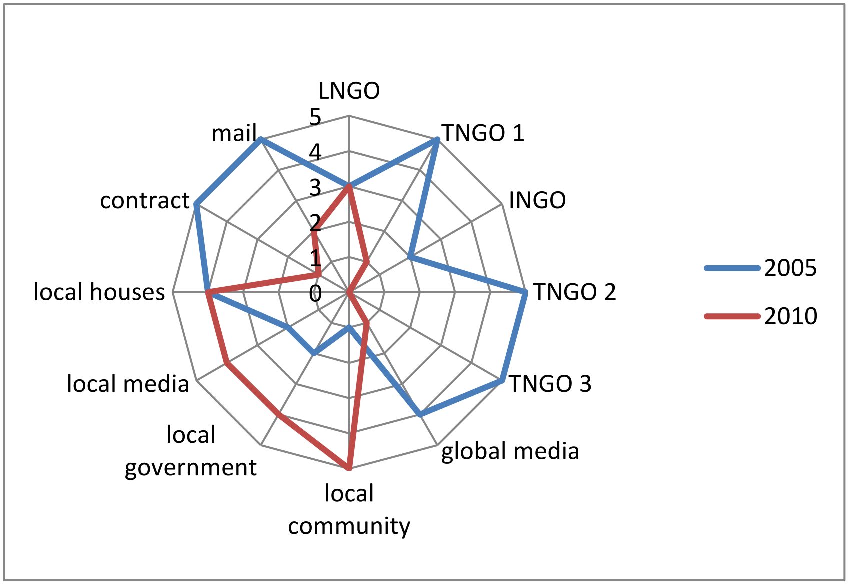

Figure 4-2: Real-time network activity in Keniparam

Table 4-4: Actors' mobilisation in Kanni

DIN	Actors	2005	2010
Kanni	INGO	3	0
	TNGO	3	2
	global media	4	1
	global private donor 1	3	0
	global private donor 2	4	0
	local community	2	4
	local government	1	2
	local media	2	4
	LNGO	1	4
	contract	5	0
	green bus	5	0

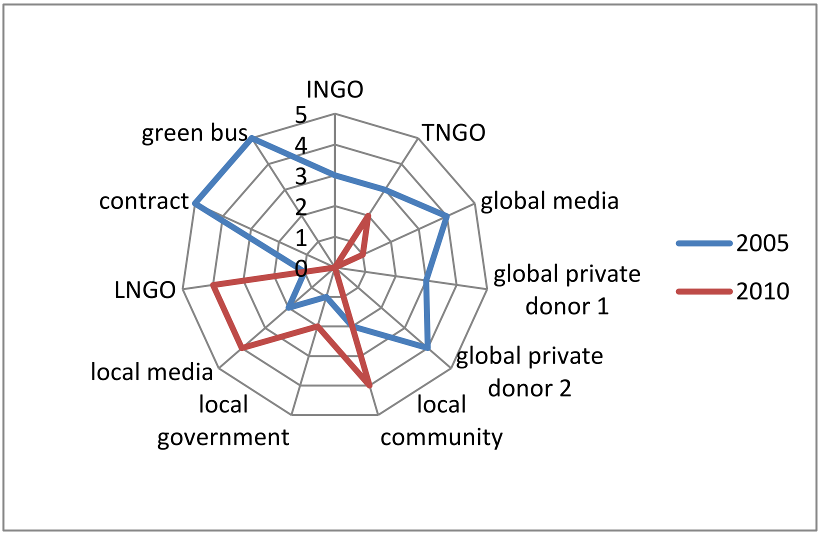

Figure 4-3: Real-time network activity in Kanni

Comparing the blue spider web and the red spider webs from Figure 4-1 to 4-3, a shrinkage and clear-cut shift in the collaborative main activities to local actors is visible. It can be observed that the network formation steps of problematisation and interessement take place in the initial years. Moreover, we observe a similar impetus from global and local network sides (allocation of edges on outer spiderwebrings). Thereafter, we observe that the enrolment and mobilisation activities in later stages are continuously and more strongly driven by the local actors. The realisation of successful local outcomes to innovation processes, directed to a clients' context, is related to these dynamics. Finally, the result is a successful collaborative management structure.

B: The actor-network formation as a collaborative management structure

The DIN emergence in global-local relief happens as a co-evolution of network formation and relief activities (see O'Brien, 2010). Between the initial shape and the final shape of the DINs in disaster relief a network evolution unfolds that needs to be investigated in further detail. Table 4-5 illuminates the dynamic network process by summarising network translation operations and real-time relief activities. They are illustrated by quotations gathered during the field work.

Table 4-5: Actor-network formation in global-local relief

Translation	**Real-time network activity**	**Narrative example**
Problematisation	(1) To identify relevant socio-technical actors by identification of central problems	*"And we were locally. We knew the people by face you see. So, it was our response to shift them to hospitals in the beginning. These other NGO said they will help us but they couldn't know, they didn't know where to go, which hospital, whom to contact. Nothing was there in this NGO, it was useless."* LNGO (PD 1:150)
Interessement	(1) To align interests of heterogeneous actors early (2) To channel them through an OPP with a focal actor	*"Do you remember in which month the approval or the contract signing took place? This, really all, happened in January!"* Global Donor NGO (PD 9:15)
Enrolment	(1) To engage in activities (2) To attract new and unusual partners (3) To change goals and plans (CI) (4) To assess old and new interests	*"Sometimes to ask donors. They just said it's an experimental thing, finally, good thing. When I explained them that it is going to be a sort of business, we will make profit, only one-time support we need for the infrastructure; and first you support us for buying the tools and equipment. After that we don't need any support. So they agreed."* LNGO (PD 1:361)
Mobilisation	(1) To relate to other actors (2) To create or find boundary objects (3) To mindfully use boundary objects (4) To inscribe practices in infrastructure (techn. routines)	*"Telephone is there. And communication is very easy now. What I feel is that, you know, when you are going to help the people their participation is a must. You should consult them and listen to them. According to their need only we should plan things."* LNGO (PD 1: 570)

The contents of Table 4-5 provide a basic understanding of the dynamic process of network emergence. They show how a network changes over time, and make it possible to identify the network activities that facilitate network evolution through the four basic translation steps. The quotations (narrative examples) evidence the importance of the network operations in all four steps of DIN emergence. To analyse further the network dynamics of successful ad hoc collaboration, the study now intensifies its focus on actors in the DINs and applies a network lens to CI occurrence.

4.2.2 *Heterogeneous actors as collaborative management structure*

In all three DINs, heterogeneous socio-technical actors collaborate in real-time. A collaborative management structure unfolds as dynamics between heterogeneous network-actors. But who are the relevant network-actors? In ANT's constructivist approach (cf. Pollack et al., 2013) the actor definition (see Definition 1-8) blurs the distinction between subject and object.

More prosaically, not only do organisational actors and their capability with regard to strategic management contribute to successful network governance but technical artefacts and symbols have management capabilities too. Artefacts can become active influencers of other actors rather than being passive bystanders. In DIN collaboration, they perform practices and become actors.

From the above three DIN case studies, we see, for example, that (1) local and global media inform others; (2a) catamarans contribute to income generation or (2b) endanger fishermen on sea; a contract (3a) constrains activities due to its budgeting arrangements, but also (3b) facilitates long-term activities, and (3c) provides resources for year-long and sustainable relief (see, e.g., Latour, 2005; Pollack et al., 2013). To analyse real-time collaboration as a translation process therefore means to find out which actors made themselves indispensable in the course of action.

In contrast to other approaches in disaster management studies, for the Ayam, Keniparam, and Kanni studies, the thesis first explores the heterogeneity of actors in successful ad hoc collaboration. For this purpose, the study groups them into two code families: (1) organisational actors (ACT org) (which are the most investigated agents of networked relief management) and (2) non-organisational actors (ACT non-org) (which are the more surprising elements of DINs in the sample of successful real-time innovation processes).

An overview of the heterogeneous actors in disaster relief, but split into these two groups, is given in Table 4-6.

Table 4-6: Heterogeneous actors enroled in DINs

1 Organisational actors	2 Technical actors or artefacts
• Small LNGO • Local government (district collector) • TNGO • Additional TNGO & donor • Global corporation, unusual actor • <u>INGO, unusual actor (A)</u>	• Local community • Global media • Local media • <u>Cell phone (B)</u> • Global public donor • Catamarans • Contract • Green bus

Table 4-6 informs us of a large variety of technical actors (right-hand column) that were often hidden but play an actor-role in successful relief and dynamic innovation processes. They even outnumber of organisational actors (left-hand column) that are expected as typical agents of strategic management in global relief.

To understand the potential of the heterogeneity of actors in a dynamic innovation network, the study selects two rather unusual representatives (cf. Rangan et al., 2006) of high importance in the investigated cases, then reconstructs their actor roles in more detail.

Moving from organisational relief actors to non-organisational actors, it first discusses the role of (A) intermediary actors and second that of (B) the technical actors. It does so in two examples that show how these actors matter for the emergent structure of successful collaborative management.

A: Intermediary actors

In the study sample of ad hoc collaboration cases, an organisational actor (INGO) helped to conciliate interests between global and local levels. Hence, it became an important intermediary actor. The INGO was an Indian organisation with global outreach and experiences developed from the beginning in all three actor-networks. Three important experiences were: to match the right partners, to explain the different expectations, and to interfere on its own initiative and also at the request of any other actor.

The background of the INGO helped to clarify divergent expectations, cultural differences and deviant technological standards. Whenever actors were lost in contact overloads[12] the INGO softened direct confrontations and focused attention on real-time available information[13]. Repeatedly, the process of ‘reporting while acting’ was impossible during real-time challenges, for example, for LNGO staff in local conflicts, or for TNGOs working towards public control and private donor meeting deadlines. The INGO then served as a translator, an all-time assistant and as an information broker. A need for intermediaries, be it an organisational or a technical actor, arises in management of ad hoc collaboration more

[12] Code: CI contact overload.

[13] Code: CI solution.

often than in management routines with familiar partners (remember Figure 2-2 in Chapter 2). Obviously, in ad hoc collaboration without a central actor and full information, intermediaries can bridge communication gaps and foster lateral management between multiple actors. Intermediaries also facilitate pragmatic solutions. The need for intermediaries in the observed DINs varied depending on media alertness, the degree of asymmetry of a partnership, and size and actor fluctuation (for more detail see the answer to RQ 4 in Chapter 5).

B: Technical actors

In Ayam, an important technical network-actor role was attributed to cell phones. In 2005, many Internet platforms as we know them today (think, for example, of the facebook security check), designed for crisis management did not exist. At that time, however, the spread of mobiles through all groups of Indian society had already outstripped their use in daily life in Europe (cf. Shet et al., 2010). The level of mobile use in real-time was at a maximum in Ayam. The LNGO 'Dantishan' based most of its activities on this technical device and avoided the substitution of mail, chat, landline or other IT infrastructures. The frequent voice and open ear communication enroled DIN actors and induced central CIs[14] for collaborative dynamics which included:

(1) an early call from the beach to reach global partners,

(2) an ad hoc call one year later to the Yamaha Company on the east coast,

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[14] Code: CI new partner; CI solution.

(3) daily communication with the local community, NGO staff, and the district collector.

'Dantishan's' director explained the role of the mobile within the DIN with the following words: *"So, always communication is there (...) now communication is not the big thing. Everywhere, everyone has cellphone and telephones. So, every now and then, each week, each day, we get news from the villagers. Even at night, they call me if they need something like that. And open-minded, and that openness is there always."(PD 1:574)*[15]

The example shows that the inclusive use of a technology in a DIN makes a real difference. The cell phone mobilised and enroled other actors, and this conferred upon the mobile the status of an actor. Catamarans (Keniparam, Ayam), contracts (Keniparam) and the green bus (Kanni) were three other technical actors (or artefacts) that made themselves indispensable in a dynamic innovation process. It must be remembered that many decisions were influenced by these artefacts.

The open actor perspective clarifies how important the technical infrastructure is to collaborative management. The inclusion of ICT and other infrastructures into practices has a notable effect upon successful collaborative management with an innovative impact. By the time of the 2004 Tsunami, mobiles were ubiquitous in Southern-India, but still, not many relief networks had really tapped the full potential of this actors'

[15] Code: NETDYN-coordination; ACT telephone; REAL-TIME – plan; CI - lack of information.

qualities to make a difference. In many disaster management cases, its true potential was not seen.

We assume that ad hoc collaboration becomes effective where technical network-actors are identified and their strengths are used with foresight (see Turner, 1976; Cook et al., 2014). In other words, an awareness of inclusive socio-technical practices is an indication of their effectiveness (cf. Turoff et al., 2013).

4.2.3 *CIT to identify collaborative management challenges*

The study here leaves the actor level for the interaction level. To identify obstacles and trigger events in collaborative management in a non-linear relief process, we now examine the CIs that occurred. Multiple and iterative events shattered the planned course of disaster management in all three cases (see Subsections 4.1.1 – 4.1.3). In this section, the thesis elaborates upon the results from the application of CIT to identify the main challenges in networked global relief.

The CI code analysis of the study sample was completed as follows. A number of N = 39 CI codes had been properly assigned to the transcribed narrative and to the textual data. By grouping the variety of codes into “code families” (see, e.g., Friese, 2014), all occurring CIs were clustered into categories of similar content and meaning. The following six code families were derived from the primary and secondary data:

(1) conflict related (CI conflict)

(2) network related (CI net-dyn)

(3) psycho-social (CI psysoc)

(4) resource related (CI resources)

(5) success related (CI success), and

(6) time related (CI temp).

A frequency count of the sample' data, based on interviews with LNGO directors resulted in the distribution shown in the middle column in Table 4-7.

Table 4-7: CI distribution among CI code families

CI code family	CI hits in primary data	Number of subcodes
CI-conflict	7	5
CI-net-dyn	73	14
CI-psysoc	13	4
CI-resources	41	6
CI-success	10	3
CI-temp	25	7

Owing to the small N in the case study design, it was not possible to draw any conclusion from the CI frequencies in the data. Therefore, the investigations were considered as explorative research, with the aim of obtaining ideas on and insights into the varieties of categories for further research. To broaden the explorative research, empirical evidence on the conceptual *range* and on the richness of coded *variance* of the computer-assisted text analysis was added. Starting from N = 39 bottom-up coded CI categories (see Appendix C1), it was found that the variance of CI categories (that is, six code families) underpins a dominant role of network dynamics in successful real-time collaboration (see right-hand column of Table 4-7). Fore instance, fourteen subcodes belong to the code family networked CI (CI net-dyn), showing twice as much variance as the next most highly ranked CI code family category (CI-temp).

From the results, it was observed that the code family with the highest range of subcodes (N=14) was network related (CI-net-dyn). The following code families, with significant smaller numbers, were: time related CIs (CI-temp), N=7, which included start, end, and delay of certain activities; resource related CIs (CI-resources), N=6; CIs mapped in relation to conflictive situations (CI-conflict), N=5, and even fewer, psycho-social incidents, N=4. The smallest code family, with N=3, contains CIs related to successful incidents. Please remember that this list gives first ideas on frequencies and connectedness of codes.

Figure 4-4 illustrates the list distribution of CI hits in primary data (see Table 4-7, middle column) in a pie chart. It shows the big share (red pie) network related incidents behold among overall changes in collaborative management in our sample.

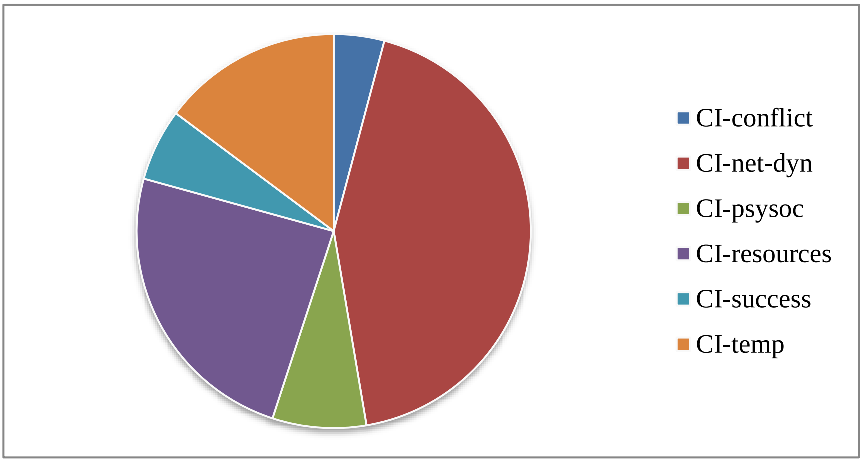

Figure 4-4: Main challenges for collaborative management in global relief

Looking at the three bigger chunks (73, 41, 25) of the pie (CI-net-dyn; CI-resources; CI-temp) and the three smaller slices (13, 10, 7) of the overall CI codes (CI-conflict; CI-success; CI-psysoc) we see which main issues interrupted the managerial processes.

The question arises: did all three DINs experience a similar CI occurrence in the non-linear process? - Probably not. As this question is relevant to understand the network mobilisation around CIs, the distribution of managerial challenges in the process has to be compared. A cross-tabulation in ATLAS.ti was carried out: we designed a code-PD-matrix on LNGO PDs and CI code families. Figure 4-5 LNGO shows the results in a pyramid chart.

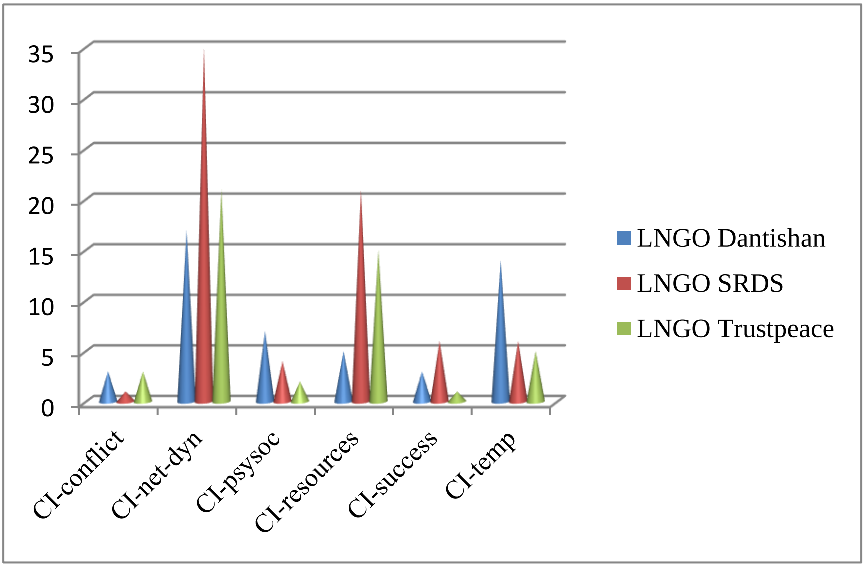

Figure 4-5: Cross tabulation of CIs by LNGOs and CI code families

It reads as follows.

- In Ayam, case 1, with its LNGO Dantishan (blue pyramids), beneath network related CIs, we see less a lack of resources (see introduction in Section 4.2 on crisis management studies), but time pressure (CI-temp) and fear (CI-psysoc) mostly hampered real-time collaboration.

- In Keniparam, case 2, with the small LNGO SRDS as focal actor (red pyramids), most CIs were counted. In complex and difficult *integrative* village reconstruction, after the first network management challenges (CI-net-dyn), then, resource related CIs (CI-resources) prevailed as the second most often occurring incidents.

- In Kanni, case 3, the LNGO Trustpeace (green pyramids) was also most hampered by network related CIs (CI-net-dyn) and next, again, by CIs related to the lack of resources (CI-resources). However, its CI peak is considerably smaller than the red peak of SRDS in the Keniparam relief collaboration. In this case, managerial changes basically are related to later stages of transformation of the Tsunami center into a rural education place.

We can state that in all networks, successful management meant to adapt to changes induced by many CIs that happened over the complete period of long term rehabilitation. Real-time innovation meant in one case (Keniparam) that the focal actor itself (LNGO) had to undergo a transformation (organisational innovation) to master the challenging process. Such a transformation however also suggests that there is a limit to the number of CIs to which a DIN can adapt without change - or loss - of main actors.

The complete codebook list is found in the Appendix D. An outcome is that the obtained CI categories already contest findings of traditional crisis management studies in the following sense. As mentioned above, SNA studies (1) are based on strategic management assumptions and (2) simulate interorganisational cooperation over time. The literature on network cooperation has identified a threefold “lack of resources, cooperation and information” (Comfort et al., 2004; Kapucu, 2005) as main barrier to more successful relief outcomes. The insights of the explorative CIT design into the examination of successful long-term relief (see above) show a complementary picture: the main challenges of collaborative management include, but are not at all limited to the mentioned triple.

Successful ad hoc collaboration processes in DINs reveal (a) additional and (b) *adverse* crisis management issues.

(a) Six additional real-time collaboration issues are: (1) duplication[16] and (2) distribution[17] issues, (3) competition[18] and (4) skilled labour fluctuation[19] on global, local and global-local NGO levels, (5) lack of management capacity[20] of small organisations, and (6) rise of local market prices[21].

(b) Four issues that are adverse to research traditions of crisis management are: (1) frequent contact overloads[22]; (2) disruption of

[16] Code: CI duplication.

[17] Code: CI distribution.

[18] Code: CI competition.

[19] Code: CI skilled labor fluctuation.

[20] Code: CI management capacity.

[21] Code: CI rising market prices; CI skilled labor fluctuation.

[22] Code: CI contact overload.

communication processes[23]; (3) global-local misunderstandings[24], and (4) money overloads[25] in all stages of disaster management processes.

The mapping and analysis of the CIs that changed the planned course of action in the process of global disaster management reveal real-world turning points for leadership at which incidents led from planned management into dynamic ad hoc collaboration. The CI analysis therefore encourages crisis management research by providing evidence on (1) management obstacles and (2) sensitive points in non-linear relief. More precisely, the CI analysis provides valuable information for a *better* planning. Still, more important for our research interest is that our study contests the power of traditional strategic management approaches in ad hoc collaboration settings by revealing four issues (see, e.g., b, 1-4) that cannot be planned for or managed by one actor but need a networked real-time response.

[23] Code: CI punct dirdis.

[24] Code: CI local people disacord; CI lack of coordination; CI different goals in reconstruction.

[25] Code: CI money overload.

4.2.4 *Using CIs to identify successful network dynamics*

In this section, the CI analysis is advanced to identify the *network dynamics* between actors in successful DINs. Therefore, the actors and incidents coded in primary data were again checked with multiple secondary data (see data overview in Appendix B). For each real-time collaboration case in Ayam, Keniparam and Kanni, a descriptive time-ordered display (CI-chart) was created (cf. Miles & Huberman, 2002). Each matrix links CIs and heterogeneous actors along the seven collaboration years (2004 – 2010) of the observed DIN process. Lines of sequential and parallel incidents then indicate the DIN activities in collaborative disruptions and changes. The dynamic process becomes visible and comparable in a multi-actor flow that is sometimes iterative and sometimes parallel (see, e.g., Ahola, Kujala, Laaksonen, & Aaltonen, 2013) over time.

CI-charts thus provide an adequate look at what happens in complex ad hoc collaboration processes where the flow of events is not one-dimensional. A process, after all, is essentially a string of related events, but the notion transports a linear concept. Therefore, event listing in a matrix has advantages above other presentations of a dynamic real-time process. Four important issues that help to gain insights into the intricacies of collaboration dynamics are: a reduced size of data, the established time-line, a multidimensionality, and (even more) visibility of inter-event influences (cf. Miles & Huberman, 2002). Still, textual data (as in earlier presented case studies), remain indispensable for grounding the range of different CIs in the context of a specific management field.

To identify the dynamics of innovative non-linear relief processes and their successful network patterns, we choose a specific research approach by employing a congruence analysis (cf. Blatter & Haverland, 2012, p.144) to detect network patterns. As described earlier, we started our study with the traditional three cases (Ayam, Keniparam, and Kanni). Now, after one DIN process has been showcased in detail, we look for congruence in the two other cases. The unit of analysis is the network. So, we concentrate our attention on the three similar DINs with regards to the requirements of exploring our RQ 3: which network patterns facilitate real-time innovation processes? (see also Table 4-1). However, the three DINs vary with regards to their enroled actors, their collaborative practices, their CI occurrence and their innovative outcomes (see, e.g., Blatter & Haverland, 2012, p.42).

In Table 4-8, we provide an overview of the emerging properties of our three investigated DINs. The management processes vary in duration, in enrollment of heterogeneous organisational, technical and non-organisational actors, network size, and CI occurrence. All three dynamic innovation processes unfold in volatile dynamics between global and local levels.

Table 4-8: Sample of DINs: actors, network size, and CI occurrence (Ayam)

	DiMa	Enroled Actors	Size	CI
Ayam	2004 - 2011	**NGOs**: transnational, local, inter-mediary, donor **artefacts**: cell phone, catamarans, contract **others**: local community, local media, global media, local private actor, local government, global public donor	13	194

Table 4-9: Sample of DINs: actors, network size, and CI occurrence (Keniparam)

	DiMa	Enroled Actors	Size	CI
Keniparam	2004 – 2010	**NGOs**: multiple global, local, inter-mediary and many donor NGO **artefacts**: contract, local houses, mail **others**: local panchayat, local government, global media, local media, local community	12	166

Table 4-10: Sample of DINs: actors, network size, and CI occurrence (Kanni)

	DiMa	Enroled Actors	Size	CI
Kanni	2004 – 2015	**NGOs**: transnational, several local and intermediary NGO **artefacts**: green bus, contract **others**: local community, global private company, local government, global media, local media	11	133

Based upon the sample descriptions, Ayam was chosen as the ‘crucial case’ (starting point) for the congruence analysis (see Blatter & Haverland, 2012, p.176) because it had the most of relevant elements (in terms of CIs (194), and size (13 actors) according to Table 4-8), and a strong account of collaborative dynamics enables the best and most straightforward pattern detection.

In global-local real-time collaboration around Ayam N=194 CIs were mapped that changed ongoing or planned activities during a seven-year collaborative management period with 13 actors. Given that frequency, it can be stated that CIs are interveners *and* catalysts of innovation processes. Each CI indeed blocks a planned action, but it also pushes network mobilisation and new approaches to ad hoc collaboration (see, e.g., Francisco, 2010;18; Bakker & Veldhuis, 2013). Moreover, CIs initiate adaptive activities towards a surrounding environment.

Obviously, dynamic collaboration is a sequential flow of events over time, but successful collaborative management involves mastering a non-linear process (see, e.g., Figure 4-6). The managerial ambivalence becomes evident when comparing Figure 4-6 to Figure 4-7. The first graph (Figure 4-6) shows the overall CI distribution of the dynamic innovation process in Ayam: there is a peak in the initial stages (see year 2005: 45 CIs) and a sustained CI cutback later. The collaborative process of the DIN approaches, but never reaches, zero CIs (even in 2010 when there were fewer than ten CIs).

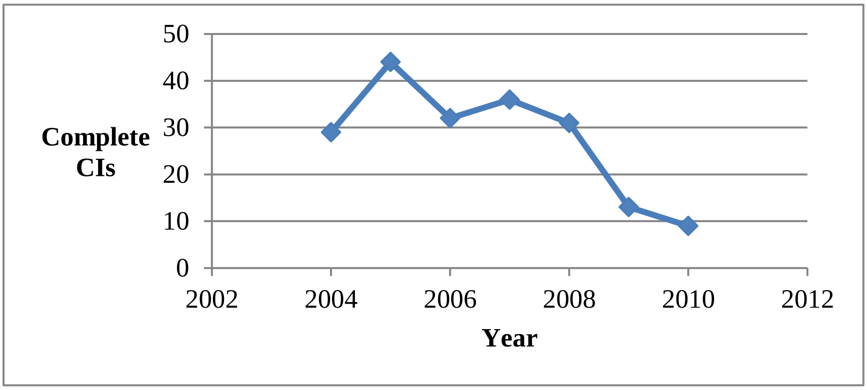

Figure 4-6: Timeline of CI occurrence over 7 years (Ayam)

When looking at the turbulent disaster management process from a strategic management and central actor perspective, the process appears to be linear and controllable. To change the simplified perception, we only have to abandon the one-dimensional perspective for a dynamic network view. The dancing curves of Figure 4-7 are a far better illustration of the real-time management challenge for actors in complex disaster relief collaboration over time.

From the illustrations it can be concluded that at any given point in time within the same DIN, actors experience quite different numbers of CIs. Here, it is deduced that, for successful management, deviation from planned programmes has to be performed independently and has to be learned.

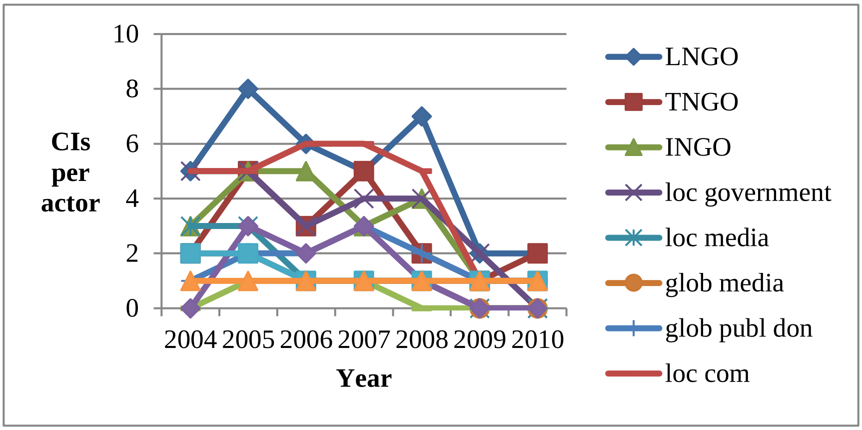

Figure 4-7: Timelines of CI occurrence by actors over 7 years (Ayam)

Figure 4-7 shows the real-time and highly dynamic structure of successful collaboration in long term innovation processes. There is a continuous and parallel change of activities and ongoing adaptation to new goals. The reduction of complex collaboration to a linear management curve (see Figure 4-6) is the standard solution in strategic management, for individual actors as well as for organisations. However, it is misleading for successful collaborative innovation processes because the reality of parallel and cascading (or chaotic) real-time activities is lost.

Yet, the shift to parallel real-time activities is important. The patterns of unfolding network emergence are to be found here. There were 13 relevant actors in the emerging collaboration in the Ayam case. To investigate in detail the parallel real-time activities of these 13 different network-actors (in order to find dynamic patterns between them), the study now deploys a matrix of the dynamic innovation process (see CI-chart in the Tables 4-11 to 4-14).

In this CI-chart, the heterogeneous network-actors of the Ayam case are not grouped according to global and local networks (as was the case in the spider web diagrams, see Figures 4-1 to 4-3). We now seek to identify spill-overs of CIs and cascading incidents, therefore, organisational and non-organisational actors are grouped to follow one another (see Table 4-11, left column).

The chart indicates which actors were enroled and which collaborations were completed in a particular year. For instance, it is evident that (1) all focal actors appeared in 2004 and (2) media actors left long before the end of the relief. Moreover, it is striking that (3) no DIN actor in this network managed ad hoc or in long-term collaboration without unexpected changes (CIs).

To retrace dynamic network patterns, specific CIs in the CI-chart (see Tables 4-11 to 4-14) were coloured. In particular, the serial CIs are coloured to make it easier to notice the relationship between them. From the matrix, it can thus be read when, where, and which CIs occurred. Moreover, from the coloured CIs, it can be seen which real-time dynamics unfolded from or around some incidents and how they related to other CIs and to particular actors. Three different temporal and one causal relationship are observed between the CIs. All four are mentioned below.

(1) cascading CIs, such as “boat repair” (green)

(2) parallel CIs, such as “starting workshop” (cyan)

(3) loosely coupled CIs, such as “contact overload” and “punctual directedness and distance” (red)

(4) behind plan and budget allocation dropping CIs, such as “medicare” (yellow)

The fourth group (yellow) highlights the case of CIs that occurred due to mismatch between strategic management and planning artefacts (budgeted costplan) and the reality of the disaster management process on the ground and in real-time. Caused by the budget management style applied, the study identifies the CI medicare as a critical incident only because of its occurring later than expected and therefore behind the planned timeframe to allocate money for its appropriate handling.

Reading the CI-chart on the next pages, changes and disruptions in the overall successful dynamic innovation process become more evident and the complex real-time process is filled with concrete issues. These iterate, accelerate and block the planned action. In each year, this happened repeatedly and with different issues to the single actors activities. So first of all, there is strong evidence for an iteration of several CIs (for example, CI skilled labour fluctuation, CI contact overload, CI cooperation need assessment, CI donor travel).

There are also CIs that happened to one actor only, and just once. This is the case, for example, for the 2005 released Disaster Management Act by the Indian government (see Table 4-11, row 5, column 3, CI contract). It is noted that the zero effect it had on the multiple other network-actors is rather an exception, and might come as a surprise to political scientists.

Then, there were parallel CIs that concerned more than one network-actor in real-time: examples are the "Lessons Learned Workshop", an International Disaster Management Conference in Coimbatore in 2005 (see Table 4-11, row 4+7, column 3, CI LFT workshop) and the inauguration of the female engine repair workshop in 2007 (see Table 4-12, rows 2+3+4, column 1, CI starting workshop and Table 4-14, rows 4+5, column 1, CI starting workshop).

Many other CIs did mobilise the outer network: the CI boat repair became a cascading issue that occupied eight actors over months and years. This CI had major implications, but admittedly the budget plan did also not account for cascading or iterating issues.

Especially when medical problems (CI medicare) caused a need to respond to symptoms of trauma and physical problems related to the catastrophee but outbreaking in later years, this demand and challenge to cover physical needs posed rather severe management problems. Because, the medical need was fixed to emergency stages and in general, any medical treatment was by plan allocated to initial emergency relief stages.

The distribution of the CIs and the relationship between some of them also indicate the existence of coupled CIs. Whenever the CI 'contact overload' happened and blocked one of the relief actors, it was followed by some specific other CIs, namely CI punctdirdis, CI solution, CI new partner, or even other CIs that emphasised building a network pattern of success.

In all the above observations, the CI-Chart now allows us to "add flesh to the bones" of the introduced abstract ANT operations (see Chapter 2) by providing evidence on governance of a non-linear innovation process, in long-term disaster management from multiple actors' perspectives in real time. The ensuing pattern analysis is therefore based on the elaboration of this analysis.

Table 4-11: CI-chart DIN 1, Ayam, top of list: 2004-2006

Year / Actor	2004	2005	2006
1 Local NGO	CI lack of resources CI cooperation need assessment CI lack of information CI innovative action CI distribution	CI NGO Influx CI competition CI doubling self-help groups CI cooperation CI innovative action CI fear of sea CI money overload CI contact overload p.	CI new partner CI money spoiling self reliance CI NGO Influx CI skilled labor fluctuation CI local people discord CI contact overload p.
2 Transnational NGO	CI new partner CI cooperation need assessment	CI competition CI NGO Influx CI opposition to government CI new partner CI punctdirdis	CI lack of information CI competition CI cooperation need assessment
3 Intermediary NGO	CI new partner CI decision making CI cooperation need assessment	CI distribution CI lack of coordination CI opposition to government CI contact overload p. CI LFT Workshop	CI punctdirdis CI donor travel CI cooperation need assessment CI boat repair CI NGO Influx
4 Local Government	CI different goals in reconstruction CI cooperation need assessment CI lack of coordination CI NGO-Influx CI contact overload p.	CI contract (DiMa Act; Coastal Regul Act) CI NGO Influx CI punctdiridis CI fear of sea CI opposition to government	CI cooperation need assessment CI money overload CI time pressure housing delay
5 Local Media	CI starting relief action CI lack of information CI visibility	CI local people discord CI skilled labor fluctuation CI contact overload p.	CI ending relief action
6 Global Media	CI starting relief action CI lack of information	CI NGO influx CI LFT Workshop	CI ending relief action

Table 4-12: CI-chart DIN 1, Ayam, top of list: 2007-2010

2007	2008	2009	2010
CI starting workshop CI boat repair CI contact overload CI-money spoiling self reliance CI duplication CI medicare CI punctdirdis	CI lack of resources CI lack of information CI boat repair CI new partner CI distribution CI innovative action CI medicare	CI distribution CI skilled labor fluctuation CI punctdirdis	CI cooperation need assessment CI opposition to government
CI starting workshop CI boat repair CI money overload CI skilled labor fluctuation CI medicare	CI lack of information CI punctdirdis CI duplication	CI money overload	CI lack of information CI decision making
CI starting workshop CI donor travel CI punctdirdis	CI donor travel CI boat repair CI punctdirdis CI doubling self help groups	CI report	CI report
CI time pressure housing delay CI money overload CI local people discord CI distribution	CI time pressure housing delay CI local people discord CI gender CI rising market prices	CI rising market prices CI NGO influx	
CI boat repair	CI duplication		
CI boat repair	CI duplication		

Table 4-13: CI-chart DIN 1, Ayam, bottom of list: 2004-2006

Year / Actor	2004	2005	2006
7 Gl. Public Donor		CI contract	
8 Gl. Donor NGO	CI starting relief action	CI LessLearn Workshop CI lack of resources	CI lack of resources CI innovative action
9 Local Community	CI lack of resources CI lack of information CI lack of management capacity CI fear of sea CI distribution	CI fear of sea CI NGO Influx CI skilled labor fluctuation CI contact overload p. CI cooperation need assessment	CI distribution CI rising market prices CI urgent CI skilled labor fluctuation CI boat repair CI lack of management capacity
10 Local Private Actor		CI decision making	CI new partner
11 Contract		CI starting relief action CI starting relief action CI visibility	CI starting relief action CI ending relief action
12 Local Cell phone	CI solution CI new partner	CI new partner CI innovative action	CI innovative action
13 Local Catamaran	CI lack of resources	CI distribution	CI boat repair

Table 4-14: CI-chart DIN 1, Ayam, bottom of list: 2007-2010

2007	2008	2009	2010
CI ending relief action	CI accounting	CI report	
CI lack of resources CI boat repair CI new actor	CI innovative action CI end of relief action	CI donor travel	CI report
CI Starting workshop CI distribution CI competition CI fear of sea CI rising market pric-es CI medicare	CI rising market pric-es CI Skilled labor fluc-tuation CI solution CI boat repair CI local people disac-cord	CI donor travel CI medicare	CI medicare
CI starting workshop			
CI time pressure housing delay CI medicare	CI solution		
CI innovative action	CI new partner	CI local people disac-cord	CI lack of resources
CI distribution	CI boat repair	CI duplication	CI duplication

As a first result (the final result will be given in Section 4.5) of the condensed information, regarding the collaborative innovation process between heterogeneous socio-technical actors by CI occurrence, a presumption of traditional crisis management is seriously put into question. Many SNA studies presume that cooperation between single agents only becomes probable in later stages of relief (see Chapter 2.2).

But what is the precise assumption? First, let us take for granted that demand and supply of resources will structure the organisational cooperation. Moreover, let us assume that they both show a linear curve under the condition of scarcity. Then, we conjecture that these curves diverge post crisis, and that they only cross again at the end of the relief. In micro behaviourist approaches, this can be summarised as follows: *each actor maximises the own interests*.

The CI distribution in real-time collaboration above (the Ayam relief case, Table 4-11 to 4-14) *contradicts* this latter statement. From the data and mapped incidents, there is evidence that dynamic networks between heterogeneous actors emerge ad hoc. It can be seen that in real-time interaction DIN actors align interests (Table 4-11, rows 2+3+4+5, columns 2+3, CI cooperation need assessment) and translate all others into new directions rather than following their own preset ones. An ability to align heterogeneous interests and to master initial disturbances collaboratively is the main issue. This will lead to network emergence and a shared visionary management.

4.3 Identifying the significant network dynamics

Here the thesis begins to retrace the prevailing meaningful network dynamics of case 1: Ayam. The aim is to obtain some fruitful ideas concerning the interaction patterns that facilitated the observed innovative and sustainable relief. The other two cases, Keniparam and Kanni, are for the moment set to one side but will be examined in the next step which looks for coherent practices and patterns. The CI-charts for Keniparam and Kanni can be found in Appendices C2 and C3.

This section searches for network dynamics around and between the CIs in the CI-chart (see Table 4-11 to Table 4-14), in the case studies (see Subsections 4.1.1 to 4.1.3) and in the narrative data. Five different types of collaborative pattern are identified in the successful collaboration. Below these are described, one after another, as (a) initial time pressure and DIN emergence (in 4.3.1), (b) punctual and continous dynamics (in 4.3.2), (c) continuous interaction patterns (in 4.3.3), (d) time dependent actor roles as adaptive dynamics (in 4.3.4) of coupled CIs, and (e) coherent patterns (in 4.3.5).

4.3.1 *Initial time pressure and DIN emergence*

The CI peak in the initial stages is illustrated in Figure 4-6. It is repeated by the CI-chart that displays the highest CI density in the year 2005 (see Table 4-11, second column). The initial stage of the ad hoc collaboration process is the most dynamic period. The study therefore investigates this initial period in more detail. It uses interview data and secondary data in addition to the CI-chart to retrace the unfolding network process. Related and additional codes in this subsection are displayed as footnotes (all codes can be found in the codebook, see Appendix D).

In the aftermath of the global disaster, the time pressure for rescuing people and bringing them into temporary shelters converged with another management challenge, the sudden high influx of TNGOs (see Figure 4-8). In the year 2005, Tamil Nadu state experienced a ‘second wave’ after the flood: more than 500 global and local NGOs were identified as being active within its borders[26], compared to less than 50 NGOs before the 2004 Tsunami. From the figures, it is evident that many NGOs in relief had not been there before, so (1) to find the right partners[27] therefore became a competition[28] and a difficult challenge for them, and (2) their arrival was a second disturbance for the local, economically dispriviledged communities[29].

[26] see www.tntrc.org for the NCRC and TNTRC data bases

[27] Code: NETDYN - glob-loc.

[28] Code: CI competition.

[29] Code: CI NGO influx; CI doubling self-helf groups.

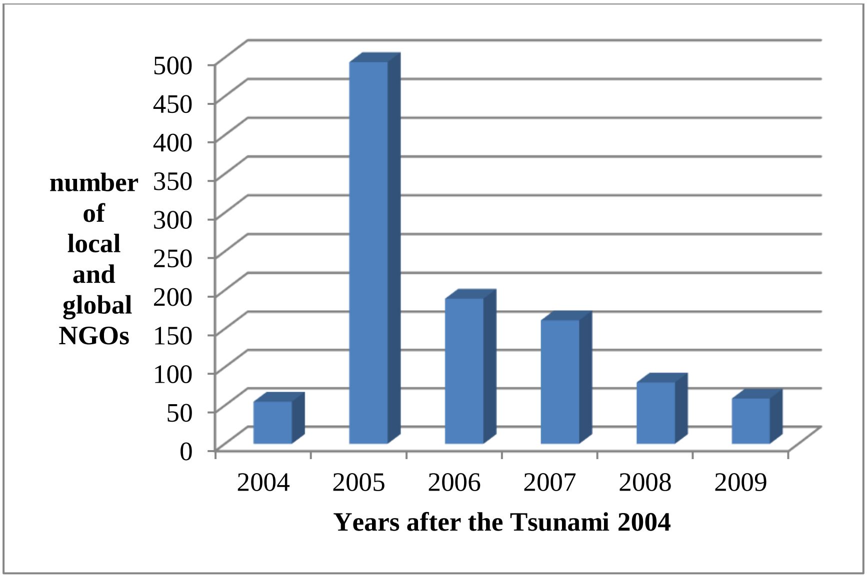

Figure 4-8: Influx of NGOs to Tamil Nadu after 2004 Tsunami (TNTRC report)

For all TNGOs that did not have local partners, it was observed that they were without rapid local orientation[30] and information. For the local NGOs, the LNGOs, the influx of foreign professionals meant the influx of foreign money with all its contradictory consequences such as an increase in resources[31], increased market prices, fluctuations in skilled labour, and strong real-time competition[32].

Whatever the case, we know that in January 2005 around Ayam, heterogeneous actors also began to operate as a network (see Subsection

[30] Code: CI lack of coordination.

[31] Code: CI innovative action; CI cooperation.

[32] Code: CI contact overload pressure; CI doubling self-help groups; CI money overload.

4.1.1). At that time, ad hoc collaboration started from the affected local level[33]. From a few phone calls, a first small global-local alliance emerged. As information could be exchanged in real-time, the addressed global partner rapidly appeared on site[34] (cf. Boin & MacConnell, 2007; Palen & Liu, 2007; Partanen & Möller, 2012; Ai et al., 2015) and, in parallel, activities also began on the other side of the globe. Subsequently, more actors were enrolled in a snow-ball process and from a fruitful mutual exchange of different interests, the interaction grew. Owing to an early contract signing[35], the network process became stabilised as a DIN. It continued by leaps and bounds.

The rapid DIN emergence included expected but also unusual relief actors[36] (cf. Duffield, 1994; Selsky & Parker, 2005; Nadarajah, 2011) on global and local network sides. While in Ayam, a for-profit company was enroled, in Germany, additional public and private donors were mobilised, in contrast to 'typical' aid constellations actors (cf. Bennett et al., 1995; Donini, 2012). The actors' heterogeneity was an emergent and serendipitous quality of the DIN.

A 'chainlike' vertical flow of resources and commands from global donors and NGOs to local beneficiaries is the traditional way of managing humanitarian relief (cf. Donini, 2012). But central command and control

[33] Code: CI innovative action; CI distribution; CI new partner.

[34] Code: CI cooperation need assessment.

[35] Code: CI contract.

[36] Code: CI new partner (usual and unusual ones).

was apparently not the governance structure in the Ayam case[37] where an INGO mediated between all partners from the very beginning (see Table 4-11, row 4), donors travelled to the south, and INGO people to the north (see Table 4-12 and Table 4-14, row 4, column 1). Moreover, there was decision making at a variety of levels. Sometimes, local people disagreed with ideas, and influenced or disrupted activities and changed the course of collaboration. In sum, we see from Table 4-11 to Table 4-14 how the DIN emergenced and that the exchange of information pushed the network forward in many situations. This changed the humanitarian actions by the relief agencies to (a) non chainlike and (b) non centralised collaboration in real-time.

With regards to the emerging global-local network, namely the enrolment of LNGOs and INGOs, an experienced global donor said (Table 4-11 to Table 4-14, row 8): *„No: that's not the usual way of doing it. That is not how it works elsewhere. If you take FAO, as a global player in the humanitarian field, then, they operate by themselves on site: with locals directly. There is nothing in between"*PD (09:054).

The director of the TNGO saw the early commitment as crucial to the successful DIN outcomes, as the basis of what he called a "relaxed planning frame": *"The commitment to this collaboration started very, very early and therefore with a high donor input, directly January 2005. We could start with a relaxed planning frame; adding to this, BMZ funds came on top. But all this happened in real-time and parallel, so that we*

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[37] Code: CI decision making; CI cooperation need assessment; CI lack of information.

relatively early shared a common project idea and agreed on a common support concept" (PD 8:012).

This relaxed planning frame allowed the DIN to cope with more than 190 CIs. A contractual long-term protection allowed for entrepreneurial experiments[38] from the beginning. The strong early commitment was grounded in a shared vision that mobilised permanently the bespoke *commitment.* The shared vision in the Ayam case focused on entrepreneurial mindsets and women's empowerment. In an exemplary LNGO quote the shared vision is given as follows: *"see, when we started in 2005 like this, I thought, when I see girls who are not employed and some of them are affected by the Tsunami parents are gone, we thought of rehabilitation for them. See, you cannot give them money and support like that. We give them some sort of training and employment"* (PD1:343).[39]

The initial shared vision that rapidly crystallised in calls and during visits in the dynamic innovation processes led, in Ayam, to an increase in gender equality and local entrepreneurship. This vision made its way through all status reports: it was a core claim of the DIN that it would respect and foster local entrepreneurial structures, and would particularly protect the pride and self-reliance of fisher folk.

General charitable aid around was experienced as a threat[40]. In this respect, the shared vision became also a dynamic of exclusion[41] of certain

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[38] Code: CI innovative action; CI medicare.

[39] Code: INNOACT-gender.

[40] Code: CI money overload.

[41] Code: NETDYN-NGO-exclusion.

actors and activities. This was expressed as follows: *"so, people are attracted to this, free money. In Dantishan culture we don't give anything free. And also we will never write off the loan what you have taken. If you are very sick or you are not in a position to repay, then a relative who gave a guarantee for this loan has to repay. That is the system we have"* (PD01:407).[42]

To complete the CI-chart analysis, attention is paid to the last three rows of the CI-chart (see Table 4-11-to Table 4-14) indicating the activity of socio-technical actors. The contract, the cell phone, and the catamarans were technical artifacts that were strong initiators of DIN emergence and relief processes. Most CIs occurred with or were achieved by cell phones (see Table 4-11 to Table 4-14, row 12, columns 2-8).

To sum up, the CI-chart analysis based on the interview data and secondary data shows four initial global-local interaction patterns. They are (1) starting from local needs[43] using an LNGO access, (2) enroling intermediaries from the beginning, (3) achieving an early contract signing which embodies a shared vision, (4) including socio-technical actors with foresight in a reciprocal (non-chainlike) communication. From case 1: Ayam, we consider these to be the most significant initial patterns of successful collaboration in a dynamic innovation process.

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[42] Code: NGO-STRAT-gender.

[43] Code: NETDYN-locneeds, CI cooperation need assessment.

4.3.2 *Punctual and continuous dynamics*

Critical incidents produce intended and unintended consequences. From the CI-chart, they can block multiple actors as a cascading CI – for example CI boat repair (see Table 4-11, row 10, 2006 onwards) or be a parallel incident that does not cause consequences. The frequency of CIs in the Ayam case confirms that real-time collaboration processes are controllable only to a certain extent. The old idea that controlling collaborative management is the successful approach to governance therefore has to be replaced by the idea of *facilitating* an often changing, dynamic long-term collaboration. Not just initial interaction, ongoing collaborative management needs to be flexible. In the long run, we may question ourselves: which punctual and continuous network dynamics belong to a successful collaborative management process?

For emergence and evolution of a DIN, three punctual (or strict) dynamics seem significant according to the observed case. The three strict dynamics are: (1) contract signing (OPP) - this is a parallel strict dynamic; (2) using a boundary object (see Section 2.2.4) - this is an iterative, strict dynamic; and (3) innovative action - a strict but sometimes also cascading network dynamic or pattern. These are discussed briefly below.

(1) The first strict dynamic from the CI-chart is contract signing[44]. The investigated DIN passed its OPP (obligatory point of passage) early in this event: all actors would later very well remember this important stage. The significance of a 'uniting' inaugural moment with a main point of interest was described in detail in chapter 2 (see also Table 2-2).

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[44] Code: CI contract.

(2) The second punctual dynamic observed in the successful collaboration was the creation and use of a boundary object. As the engine repair startup was owned by a skilled female workforce the co-ventured workshop in the village became a lighthouse of the DINs' shared vision. Originally, the inauguration[45] (see Tables 4-12+14, year 2007, CI starting workshop) was a platform for heterogeneous global and local actors to meet. As a visible object of the year-long collaboration, it was mentioned in status reports, on donor flyers, and on web pages. The engine repair workshop had courted controversy, but it underpinned (a) the entrepreneurial orientation and (b) the DIN's endeavour with regard to gender. In the end, this workshop also symbolised the DIN's capability to manage internal controversies. So, the reference to this boundary object (see Table 2-1) could become a strict, strategic network mobilisation pattern. Meaning different things to local and global actors, it was a central intermediary artefact for both. We may therefore assume that the creation and the purposeful use of such boundary objects in communication is an important collaborative structure of successfully managed DINs.

(3) The realisation of innovation activities appears as a third strict network dynamic that chaperoned the collaborative relief process[46]. The network-actors repeatedly seized opportunities to solve emerging problems[47]. Examples were: new ideas for medical aid[48], the invention of new

[45] Code: CI starting workshop.

[46] Code: CI innovation action.

[47] Code: CI solution.

[48] Code: CI medicare; INNOACT medicare.

counselling formats, and the hand-made distribution card which was introduced to prevent livelihood duplication[49]. This card was developed in one of the first local meetings: *"They should form a sort of committee and form a sort of system and we made a model (...) I draw it in my paper, a card, and showed them and they said (...) and immediately I get a person printed that and thousands of it printed and distributed[50]. The villagers were saying that whoever comes, you know, write the name of the person and whatever we give should be marked on the card so that, you know, the person cannot come and ask again, you see*?" (PD1:087).

4.3.3 *Continuous interaction patterns*

In addition to noticeable initial and punctual dynamics, specific continuous interaction patterns were observed in this sustainable relief and ad hoc collaboration. Two such dynamic network features are discussed below: (1) communicative reciprocity and (2) network centrality of the focal actor.

(1) There was communicative reciprocity between heterogeneous global and local actors from the very first contacts, as mentioned by all interviewees. The heterogeneous interaction remained a permanent interaction pattern. When network attention was directed to *one* actor, however, contact overloads[51] removed this reciprocal status. It was observed

[49] Code: CI duplication.

[50] Code: INNOACT-distribution.

[51] Code: CI contact overload pressure.

that around CIs and in stressful situations, actors felt focused[52], they experienced contact overloads and they needed some distance (see, e.g., Table 4-9, row 3, year 2005-6). The directedness of contacts increased at moments when respective actors had to deal with local problems. It happened when all capacities were absorbed by ad hoc problem solving; then *distance* from external contacts[53] was needed. Actually, from the contact seeker side, punctual distance was realised, and sometimes, it happened at moments when real-time information was badly needed.

In the Ayam case, on the one hand, the ability to cope with punctual directedness and distance was repeatedly needed (see Subsection 4.3.5). On the other hand, the pattern of *communicative reciprocity* was continuously re-created. This facilitated sustainable and innovative outcome in the end: *"It was difficult in some cases because getting information for the partners, from the European side was maybe very urgent. For example, a (...) donor meeting may be tomorrow. So from (...) global NGO side, it has to be reached today itself. But partners, they may be in the field and they will not be available - because they are telling we have a lot of problems in the field. They were right, but the thing is on the other hand we have to present it, so we struggled, and that was right, too"* (PD 03:296).

Re-establishing reciprocity in communication was often the task of the INGO. However, all DIN actors had to develop routines for punctual non-visibility and dealing with the distance of others. It is assumed that the

[52] Code: CI punctdirdis.

[53] Code: CI punctdirdis.

development of trust, and a tolerance of communication gaps play a major role in successful dynamic innovation processes.

(2) Second, network centrality of the local actor was a continuous interaction pattern in successful long-term relief in Ayam. The LNGO leadership was established at the beginning and it was continually respected by the more powerful organisational network-actors. On the one hand, the DIN could profit in this way from an optimal local integration[54] for sustainable relief and local entrepreneurial experiments. On the other hand, the DIN had to respect the obvious limits of its LNGO. With regards to its low media alertness, Dantishan was never forced into additional reporting or pushed into PR activities from which global partners could have profited. Dantishan was reluctant to change its size or management style with regard to real-time collaboration. This prevented both the scaling up of the good work and the advertisement of success. Still, there was nothing but loyalty from the other actors and the TNGO side: *„I am convinced that the mobile contact, the contacts to private economy from local NGO part contributed enormously, and obviously this was not our success, but this was initiated directly by the local NGO partner*" (PD 8:051)[55].

[54] Code: NETDYN-NGO-loccom.

[55] Code: NETDYN-inklus; ACT-LNGO; ACT-TNGO.

4.3.4 *Time-dependent actor roles as adaptive dynamics*

The CI-chart (see Tables 4-11 to 4-14) shows that in the end successful long-term collaboration requires (1) an ability to revise particular goals, time and again; and (2) flexible actor roles to achieve the goals set. Even a focal actor role can change over time. The heterogeneous actors in this relief network proved a real-time readiness to shift roles and activities over the years. A permanent readjustment of plans, goals, and roles was necessary instead of a linear strategic management.

The network evolution that leads to local sustainable ends has already been described, and the shifting actor roles, in line with the DIN's evolution over time, were depicted in Figure 4-1. They emphasise the web of global-local network-actors that have transmutated into a local shape (2005-2010). Moreover, they do not show a threshold shrink but rather indicate a network *shift*. Consequently, network dynamics have an impact not only on the network level but also on the actor level and on an actor's activities. And that is the level which is of interest here.

During the initial activities, the TNGO initiated a multitude of activities, against the clock, onboth their side of the globe and on the affected side. However, in a dynamic long-term collaboration, its role changed. The DIN could only 'localise' over time because the TNGO well understood that it needed to reduce its engagement (see Table 4-11 to 4-14, row 3): the CI-chart tells us this – note the decreasing CI distribution for the

TNGO over the period 2004 - 2010. It thus indicates that a moderate commitment was delayed until the end of disaster management[56].

4.3.5 *Coherent patterns in the detection of coupled CIs*

This subsection points to a last CI-chart finding for within-case network dynamics, namely, the dynamics of coupled CIs. Next to a time dependency of actor roles in the emerging and unfolding DIN and relief process, there is also a time dependency and coherence of specific CIs.

To visualise the dynamic, the CI contact overload pressure was coloured in red. These CIs are soon followed by the CI punctual directedness and distance. In a similarly dependent and coherent way, the CI cooperation need assessment is followed repeatedly by the CI contract, CI new partner or CI solution in line with the same or a related network-actor. The CIs punctual directedness and distance, again, are often followed the by a CI solution. All these CIs seem 'loosely coupled' in the CI-chart. It is a relationship known from system dynamics models (cf. Forrester, 1992; Gonzalez, Bø, & Johansen, 2013; Jiang, 2016) that demonstrate and simulate the coherence of flexible variables in complex systems.

In sum, the meaningful network dynamics so far retraced provide a fruitful framework for pattern detection with the aim of answering RQ 3: which network patterns facilitate real-time innovation processes? The findings allow for congruence testing against the other cases of successfulglobal-local relief.

[56] Code: CI lack of information.

4.4 Cross-case evidence of network dynamics

The CI analysis emphasises the role of improvisation in successful disaster management (cf. Wachtendorf, 2004; Turoff et al., 2015) as ad hoc collaboration contradicts linear project planning. In improvisation and in entrepreneurial effectuation (see, e.g., Read et al., 2010), the real-time collaboration of heterogeneous actors follows a dynamic structure, patterns of which can now be compared.

With regards to the standards of global relief interaction (cf. Bennett et al., 1995; Abelson, 2003; Karan & Subbiah, 2011) the emergence of DINs seems to imply a different positioning of managerial parameters (see Subsection 4.3.1). Four of them are mentioned here.

(1) LNGO dominance in the process,

(2) heterogeneous socio-technical actors in ad hoc collaboration,

(3) communicative reciprocity and a shared vision for innovation actions, and

(4) collaborative management to cope with sudden and repeating CIs.

At this point in process analysis, it is necessary to gather plausible hunches about the collaboration success of the DIN from the data of case 1: Ayam. All four process parameters displayed in Table 4-1: LNGO, ad hoc collaboration, dynamic innovation process, and CIs, have been discussed in detail in the analysis. In this section, the study aims to test the congruence of patterns so far observed with the other cases. For this purpose, it reuses the five network dynamics for a cross-case comparison.

Table 4-15 thus reuses the within-case findings on network dynamics and looks for congruence of data with cases 2 and 3, Keniparam and Kanni (see Appendices B, C2 and C3).

		Within-case network dynamics	**Cross-case confirmation**
1	Initial time pressure	Early call and contract signing of global and local focal actors, emerging heterogeneous alliance including unusual actors	Early contract signing in all cases; additional contracts made in parallel (Case 2) with heterogeneous actors in unusual lateral ways
2	Punctual and continous dynamics	Early alignment of interests in a shared vision of local entrepreneurship and gender	Rapid development of shared visions by core actors on inclusive reconstruction (Case 2); better future for 100 children over 10 years (Case 3)
3	Continuous interaction patterns	Boundary object as focus of network activities for global and local sides; incorporated the shared vision in an artefact, the women's engine repair workshop	Use of boundary objects intensifies activities from global and local sides; shared vision incorporated in houses logo mix (Case 2) and a green bus and a photo book (Case 3)
4	Time dependent actor roles	Adaptive network dynamics of directedness and distance around CIs allow struggling actors to 'save their face' in critical times	Punctual directedness and distance for local problem solving; INGO as mediator; strongest role in case 1 and case 2, but central actor role in all 3 cases
5	Coherent patterns	Sustainable outcomes due to LNGO integration into daily life of the local community; avoidance of publicity and organisational growth	LNGOs not always from the local region, but with strong local ties; in all cases LNGOs are focal actors and respected in their own profile

Table 4-15: Cross-case evidence on network dynamics

The specified network dynamics (4.3.1 to 4.3.5) are condensed in the third column of within-case observations. As condensed network patterns, they appear in all three DINs of the sample. Thus, the cross-case confirmation of Table 4-15 (fourth column) shows that without central control and initial goal setting, a dynamic network structure emerged and was able to govern the collaborative DIN process in the form of initial, punctual and continuous network dynamics. Thus, the network-actors followed working rules of success. Together with adaptive and coherent collaboration dynamics, specific network patterns of a successful ad hoc collaboration can be seen. They make for a heterogeneous but resilient innovation team, for a sustained process and for sustainable outcomes.

In the following five short paragraphs, the thesis provides the context for the cross-case confirmation of the network patterns from Table 4-15 (as elaborated from CI-charts and data, see Appendices B, C2 and C3).

(1) In all cases, in an active initial period before contractual agreements, **mutual identification of usual and unusual global and local relief actors** occurred in real-time. While a first LNGO reaction often was to turn to former partners, in all cases the emergence of DINs involved additional new network actors. The initiative came from the affected local site with real-time available local technology. In Ayam, the local community contacted the LNGO with mobiles, in Keniparam, an LNGO director was called by his national organisation, and in Kanni, the LNGO got mobilised in real-time by local TV. In all three successful DINs the

initial period of highest time pressure ended early[57] in reciprocal contractual agreements which lasted for several years.

(2) Just as ‘female local entrepreneurship’ rapidly became the shared vision of the Ayam relief network, collaborative need assessment and problematisation rapidly led to a vision of ‘inclusive reconstruction’ in Keniparam. These **shared visions** kept the actors going even as initial plans collapsed when market prices climbed and the local panchayat rose up in opposition. In Kanni, very quickly, a digit-based shared vision circulated between actors that inspired global and local partners: when adoption of children was delayed, or real estate bargains blocked housing construction, then it was the actors’ commitment to their ‘10 years, 100 Children’ vision that sustained the ambitious network and made its innovative childcare a reality.

(3) In Ayam, a **boundary object** for successful network governance was the engine repair workshop owned by a newly skilled female workforce; in Kanni, the green bus became just such a useful symbol. In both artefacts, heterogeneous global and local interests became visible for strict use in network mobilisation. The workshop underpinned entrepreneurial orientation and innovative gender politics, the green bus signalled hope and help for children. Both did so in rural India as well as in brochures and reports in Europe. While the co-production of the boundary object took time and was serendipitous, strict *use* of the boundary object

[57] Code: CI contract; ACT-contract

was then possible sustainably. This makes a boundary object a network management tool for strict use. In Keniparam, deliberate use of boundary objects was less frequent.

(4) The **loose coupling of** CI contact overload pressure and CI punctdirdis was also cross-case confirmed. In Keniparam, three actors took a punctual distance to keep their faces during real-time collaboration: (a) the TNGO that canceled the construction of 100 promised houses (2005); (b) another TNGO acted only money transferring but needed to stay incognito for that; and (c) the LNGO got into serious trouble whilst solving the housing issues locally. But each time, the collaborative process was able to continue. The solutions were reached by (1) adaptation to real-time absence, often bridged by the INGO, and (2) by accepting temporal silence between partners. In Kanni, though, the CI contact overload blocked the LNGO when transforming the orphanage to a rural training institute. The emerging conflicts on paying for the education of pupils and working children became extremely difficult to handle. The advocacy skills of an experienced LNGO were badly needed and fully employed. The LNGO here did not seek for INGO support and problem exchange with partners in this local and cultural challenge. This observation leads directly to the next and last point.

(5) The pattern of **adaptation to the focal actors' profile** is obvious in all three cases. Indeed, the LNGO actor's profile – communication style, resource allocation, team motivation, contact with local people, technological penchants, and reporting standards – was allowed to dominate all three successful real-time processes (Ayam, Keniparam, and

Kanni). The powerful global actors' inclination towards local priorities was consistent. Where a local actor underwent an institutional change over time, its new profile was also accepted and followed: this was the case in DIN 2, Keniparam. Learning, capacity-building, and scaling up of the small LNGO was part of the innovation process. Here, from almost no mail communication at the beginning, a smooth electronic reporting system became the standard for networked DIN communication.

In summary, the five identified successful network dynamics are confirmed by the cross-case findings: the process analysis resulted in five comprehensive **dynamic innovation patterns**. Whilst it should be remembered that the small number of DIN cases investigated does not allow for completeness of patterns, the study claims instead to have identified most general and significant network patterns that facilitate dynamic innovation processes.

Thinking a timeline of ad hoc to long-term collaboration, the identified patterns would appear at different points in time. This allows us to draw a final conclusion consisting of three types of patterns: (A) initial process patterns - DIN patterns 1 and 2 -, (B) continuous process patterns, - all five DIN patterns -, and (C) final stage patterns, - DIN pattern 5. All five DIN patterns (1-5) have continuous impact on a DIN's evolution; and with respect to the outcomes in a final stage, pattern 5 is most relevant to sustainable ends of innovative reconstruction processes.

Figure 4-9 illustrates the managerial timeline.

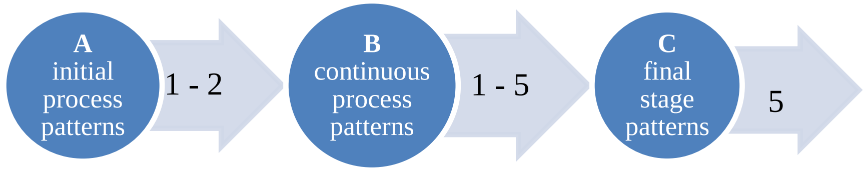

Figure 4-9: The collaborative management process

4.5 The identification of five dynamic network principles

At the end of this chapter, it is possible to answer the RQ 3: which network patterns facilitate real-time innovation processes. The within-case (see Section 4.3) and cross-case (see Section 4.4) analysis showed that successful ad hoc collaboration shares specific and dynamic network patterns. The stepwise identified collaborative dynamics have been condensed to five distinct network patterns, and allow the following answer to be formulated: there are initial, continuous, strict, adaptive, and coherent network patterns that facilitate successful ad hoc collaboration in an uncertain innovation process.

Managers of successful ad hoc collaborations are endowed with five qualities: (1) they are alert from the very beginning of the process, (2) they are tenacious and act continuously, (3) strict, (4) adaptive, and (5) their approach in the dynamic collaboration processes is coherent.

In order to implement and use the five patterns for the governance of successful innovation processes, the study now presents them as five *principles* of collaborative innovation management: in innovation processes, management has to back out of strict control, and it has to facilitate network emergence. To repeat the study findings, DIN emergence and sustainable ends are based on collaborative management which is guided by the following five dynamic network principles.

4.5.1 *Alert: identification of actors and early alignment of interests*

Dynamic innovation networks are heterogeneous and enrol (in real-time) human and non-human elements. Artefacts play actor roles. This requires an initial awareness for their identification, especially in digital interaction where usability and interoperability enable and limit the communication of heterogeneous actors. A networks' ability to include unusual actors enlarges its spectrum of activities in response to a situation. In heterogeneous actor-networks, though, a common worldview is improbable. For the emergence of a dynamic innovation network, in particular, for high levels of performance and for sustainable outcomes, divergent voices *and* the rapid alignment of heterogeneous interests are indispensable. Heterogeneous interests relate to the agreed problematisation and need to be channelled through an obligatory point of passage (OPP). This 'point' may be any event, a meeting, a written document or any act that gains the commitment of all of the different actors.

Heterogeneity is a basic pattern of success, even from the study sample. In all cases, the reoccurring CI new partner, the inclusion of unusual and additional (German donor NGO), or even group-adverse actors (an established for-profit company in a charity field), increased the opportunities for improvisation and entrepreneurial outcomes.

4.5.2 *Continuous: governance by a shared vision*

Goal uncertainty is a major problem for planning and it is often the reason *not* to start ad hoc collaboration. But in processes of change and innovation - as in year-long rehabilitation after large scale disasters or in start-up processes - premature goal definitions may spoil real-time improvisation, and the local actors' development and ownership. What is needed instead, for a DIN emergence, is the development of a shared vision. It encompasses and delimits heterogeneous interests, and it orients all actors' ad hoc practices into the future. It works best as an official or informal claim, clear and short.

A shared vision is not a promise that will come true, even less a goal that has to be reached; rather it is a powerful sketch that brings in sight a possible future. From the cross-case analysis above, the multiple functions make it the key element of sustained network governance: the creation of audience and external visibility; the motivation of actors and long-term commitment; the orientation of short-term goals; the impact evaluation in the end - or in real-time (for more details on measuring DIN performance or emergence, see Chapter 5).

4.5.3 *Strict: mindful use of boundary objects*

The green bus, the starting of the engine repair workshop run by females, the building of the night school, or the inauguration ceremony for completed houses had far reaching impacts on the global as well as the local level of the relief networks. In the above explored network formations, the artefacts or events became "boundary objects" (Briers & Chua, 2001) of the dynamic innovation process. This means, they mediated between heterogeneous actors. Moreover, they linked polar interests strictly back to the shared vision and helped to recall or mobilise the activities of different actors. Artefacts, events, and technical items all three have the potential to become boundary objects in a collaborative process. As such, they obtain symbolic power and will transport or visualise a DIN's shared vision.

The fact that boundary objects transport a meaning *for all* actors does not mean it is the same meaning or denotation for all. The mindful use of boundary objects is a strict governance practice. Actors can try to invent objects that have this managerial function, but they need to be adopted by all network-actors to realise full potential. In the study sample, deliberate creation of boundary objects is a frequent means of achieving a shared vision for collective action.

4.5.4 *Adaptive: directedness and distance amongst implementing actors*

In all three polycentric and dynamic innovation networks, mutual directedness of contacts led to reciprocal communication in real-time for most of the processes. Around critical incidents, however, there is strong evidence from DINs 1 and 3 that mutuality was lost. In that case, an adaptive double reaction and rebalancing took place. The disruption happened, for example, when implementing actors struggling with distinctive management tasks delayed network activities. Communication then stopped and became one-dimensional. Questions returned more frequently and network attention focused on a silent actor. There were time-outs and network distance as periods of accepted non-visibility and this reinstalled mutuality.

The timely acceptance of distance is an adaptive principle of all successful DINs and serves to obtain a sustained reciprocity between actors. Punctual directedness and distance patterns are important resources for local problem-solving in all kinds of conflicts. The principle of directedness and distance seems an integral part of sustainable and innovative long-term collaboration. In the observed processes, it was needed by different actors over time (see CI-charts).

4.5.5 *Coherent: local integration and network centrality of the focal actor*

The fifth dynamic network principle relates to coherence. Here, the thesis identifies a double-sided focal actor function that implies directedness just as the network pattern before. But here, directedness means an orientation and positioning without a temporal adaptive component. In this case, the study found not a sequential dynamic, but a two-sided orientation that promoted coherence of real-time collaboration. One side concerns a DIN's internal orientation - on focal actors. The other side concerns its external integration - via a local and focal actor.

In real-time collaboration, CIs occur as singular, parallel, iterative, or cascading events between local and global actors. From whatever incident (a disaster, a distribution problem, an income generation issue, a growth to market pressure, or a medical problem) a DIN emerges, it should be effective, and it should address a given local ecosystem. In a local village or in a global market, the specific context, the local needs, and the culture are relevant. Local integration of DINs and understanding of cultural ecosystems form criteria for sustainability as well as for customer identification. Attracting clients and realising a shared vision requires local integration.

The following two points were characteristic of the three DINs. First, LNGOs are the point of access to an affected population. Their focal actors define the main channel to a local base, and depend on integration for network interaction which may take different forms. Second, network-actors adjust *their* activities to align with the focal actors' profile. Through this double-sided orientation, coherent collaborative strategies emerge that lead to innovative and sustainable ends.

5 Collaborative innovation strategies in global relief

This chapter takes the findings of chapter 4 one step further to develop collaborative innovation strategies for use in response to disasters. It investigates RQ 4: which innovation strategies are used by DINs in global relief? The answer is derived from an analysis of the recovery processes used by the study sample sites. Three different strategies are identified, as applied in Ayam, Keniparam and Kanni.

The analysis employs (1) the identified dynamic network patterns, (2) the primary data, (3) the secondary data, and (4) the central analytical codes which characterise the emerging network strategies. As a contribution to managerial practice, the investigation (a) results in a typology of different innovation networks in global relief and (b) informs us about potential matching parameters. The insights gained from analysing the networked innovation strategies may facilitate better NGO matching in global relief, and will improve the long-term collaboration of TNGO professionals and their local counterparts towards emerging DINs in global relief situations.

The author suggests that a comprehensive theory of sustainable *recovery* has yet to be formulated (cf. Jordan & Javernick-Will, 2013). Early literature defined recovery as a process of return to normality (cf. Quarantelli, 1982). Nowadays, researchers and practitioners claim that successful recovery has to include the motivation of ‘building back better’ and should increase a community’s resilience to future disasters. Thus, numerous elements of recovery would bear further exploration using a qualitative approach to, for example, infrastructure reconstruction, housing repairs, ‘green’ rebuilding, business recovery, and psychological recovery needs (cf. Phillips, 2014). Yet, understanding how people move through innovative recovery processes and finding patterns that improve collaborative efficacy is of significant value.

To answer RQ 4, the study first investigates the difference between strategic management and collaborative strategies, and then clarifies the process character of collaborative strategies (in Section 5.1). It therefore compares the DINs’ dynamic patterns with strategic management definitions by Mintzberg and Van de Ven (cf. Mintzberg, 1987; Van de Ven & Hargrave, 2006). In section 5.2 it revisits central analytical codes of the study (see codebook in Appendix D) and selects six relevant elements for comparison of the strategies adopted by the three DINs. Section 5.3 classifies three alternative collaboration strategies of innovative global relief: (1) a protective, (2) a capacity building and (3) an advocacy-based network strategy. Here the chapter answers RQ 4.

From the analytical procedure, the study distils two parameters which are of crucial importance in the asymmetric global collaboration. The sample shows how LNGOs as focal actors vary considerably in two dimensions: media alertness and readiness to scale up. Successful network processes are based, to a considerable degree, on network fit in these dimensions (see DIN pattern 5). In section 5.4, the chapter therefore ends with a matrix to align profiles and network strategy in successful global-local relief.

5.1 Strategic management or collaborative DIN strategies

With regards to the cross-case study on successful disaster management in chapter 4, it can be stated that the formation of DINs is the first and most important strategy for achieving both sustainable and innovative relief outcomes. Where crisis management authors hold that “a general lack of cooperation and coordination between humanitarian organisations is among the issues criticised most” (cf. Schulz, 2009) this thesis acknowledges successful ad hoc collaboration as an achievement (cf. O'Brien, 2010; Kumaran & Torris, 2011), and aims to grasp the network strategies of these long-term dynamic innovation processes in more detail.

What is the difference between traditional strategic management and collaborative DIN strategies? To address this difference, the study relies upon the conceptual background of the above elaborated managerial misfit (see Figure 2-1 and Figure 2-2) between traditional strategic management and successful real-time collaboration.

According to traditional strategic management and network theory (cf. Stegbauer, 2010; Partanen & Möller, 2012; Hill et al., 2014), individual actors pursue their own interests in line with hierarchic preferences. As a consequence, strategic networks traditionally are considered to operate according to the following four characteristics.

(1) Networks are seen as rather static structures of actors composed of strong or weak ties.
(2) A network consists of homogeneous actors.

(3) Interaction in strategic networks is fully intended and follows initially defined goals (cf. Partanen & Möller, 2012).

(4) Strategic networks are competitive and have clearly defined limits with regards to (a) actors and (b) time (a static or goal defined perspective).

The differences between the ANT and the characteristics listed above were explained in the thesis before (see Chapter 2) and are expressed here in four statements.

(1) A network is a dynamic process between heterogeneous network-actors.

(2) A focal network-actor is one that initially mastered an alignment of heterogeneous interests.

(3) Focal actors channel divergent interests through an obligatory point of passage (OPP) which marks a moment that unites all different interests (cf. Akrich, Callon, & Latour, 2002).

(4) Aligning interests does not lead to an irreversible actor-network, but still requires steady mobilisation and inscription (cf. Latour, 2005), guided by a shared vision.

In strategic management, decision-making and goal planning are initial acts of individual actors. Admittedly, in both approaches, the actors do follow their own interests. However, the important differences are found in (a) the actor role (see Figure 2-1) and in (b) the (emerging or preset) goals in a collaborative management process (cf. Weber et al., 2014). Collaborative strategies, from the studies' data and in ANT perspectives, are not deliberately designed by a central body or by individual actors' interest alone, they emerge in a network and are translated by an actor-network (cf. Howcroft, Mitev, & Wilson, 2005).

Collaborative strategies follow dynamic structures and remain uncontrollable for the individual actor. To advance our understanding of a *collaborative strategy*, we use a basic definition with many implicit notions of *strategy*. Although it is taken from a classic work by Mintzberg (see, e.g., Mintzberg, 1990; Ansoff, 1991) it still applies to the DINs. The definition of network strategy accordingly contains the relevant five notions.

Definition 5-1: Network strategy

> A network strategy is a combination of five different features: a plan, a ploy, a pattern, a position, and a perspective (adapted from Mintzberg, 1987, p. 12).

Plan and *ploy* are concepts pointing to deliberate action (see Figure 2-1) by central management with periods of strategy-making and planning in advance. In contrast, in the notion of a *pattern* (see Definition 4-1) standard performance, working routines, and real-world processes are addressed.

Through the notion of *position*, the relationship of an actor to his environment of other actors is emphasised, for example, being the first to market, or conversely, *not* being the first. It points to relational and temporal strategy elements.

Finally, by understanding strategy as a *perspective*, internal aspects are addressed: strategy here means to orient an action based on norms, values and visions with a direction or mindset which looks to the future.

Having highlighted these five features in the notion of strategic management, Table 5-1 relates them to the strategic management operations and to the collaborative innovation management principles derived in section 4.5 from network patterns identified from the data.

Thus, for its analysis of collaborative real-time relief, the study falls back on its knowledge of the five collaborative DIN principles (see Chapter 4).

Table 5-1: Strategic management results and collaborative DIN principles

	Feature	Strategic management result	Results of collaborative DIN principles
1	Plan	Consciously intended course of action; decided in advance	Development of a shared vision
2	Ploy	Intended, competitive manoeuvre	Boundary objects
3	Pattern	Stream of actions, whether or not intended	Identified initial and sustained DIN pattern as five collaborative principles
4	Position	Place of an actor in an environment	Double-sided focal actor orientation
5	Perspective	Concept, mental frame, culture	Shared vision

The task now is to explain what the comparison of managerial features in Table 5-1 reveals and which conclusions may be drawn from an analysis of different collaboration approaches. The text which follows discusses a transition from traditional strategic management to collaborative DIN strategies. The discussion is guided by the observable results.

The assignment in Table 5-1 in the second row shows that a shared vision can replace traditional *planning* and initial goal setting in "strategic uncertainty" (cf. Koppenjan & Klijn, 2004:252) to support real-time and collaborative management. In the third row, boundary objects are classified as managerial instruments that allow deliberate, mindful context governance. In dynamic innovation processes, they therefore relate mostly to what a *ploy* is for strategic management. In the fourth row, *patterns* are presented as a strategic means being dynamic governance structures; they are explored by the research design (see Chapter 4). In the cross-case process analysis, five DIN specific dynamic network patterns were found that can be used to facilitate a successful process management. In the fifth row, *position* as Mintzbergs' fourth notion of strategy relates directly to the last of the observed five DIN principles (see 4.5.5). The double-sided focal actor position correlates with what Mintzberg sees as a strategy: the position is both closest to an external local ecosystem ('closeness' in a SNA approach) and of highest centrality ('between-ness') within a heterogeneous network. It marks the LNGO role in the DIN collaboration above. Finally, the notion of *perspective* in the sixth row relates to strategic management for future concepts and can be seen as a DIN pattern (see Table 4-15) of a shared vision and as the central element of collaborative governance and DIN evolution (cf. Deken & Lauche, 2014). From the study sample, it is evident that an early developed shared vision co-determines each network strategy from the beginning.

To sum up, many features of strategic management are also found in underlying collaborative network patterns that facilitate the emergence of DINs. Still, the most frequent and important features of traditional strategic management, planning and ploys, have to be dropped and replaced by complementary concepts for collaboration in dynamic innovation processes. To find out about different innovation strategies in collaborative relief, it is necessary to further investigate the collaborative strategic features of pattern, position, and perspective.

5.2 Investigating collaborative innovation strategies of DINs

The objective of this section is to identify the innovation strategies of DINs in global relief. Table 5-1 provided the analytical elements of the framework needed to explore the emerging innovation strategies realised by the successful DINs of the study sample. Six of the most relevant codes from the developed codebook (see Appendix D) are used to investigate the networked interaction and to identify the innovation strategies.

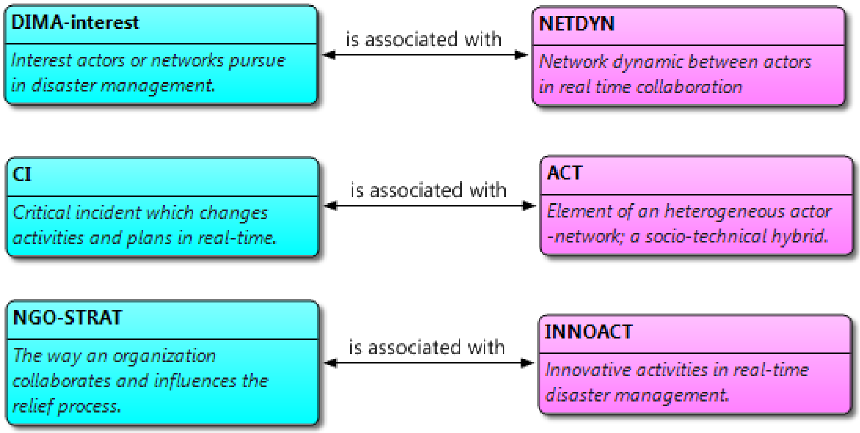

Figure 5-1: Coding categories selected to explore collaborative innovation strategies

Figure 5-1 presents selected codes in blue and pink boxes. Central analytical codes of this qualitative study have already been introduced in a coding scheme in chapter 3 (see Figure 3-1). The narrative case studies of the sample have been presented in chapter 4 as case 1: Ayam, case 2: Keniparam, and case 3: Kanni (see Section 4.1). This section brings together (a) the most frequent CIs, (b) the focal actors' divergent interests, and (c) the most prevalent network dynamics in all cases.

In the blue boxes on the left-hand side, three codes are listed that provide important information on the LNGO: DIMA-interest, CI, and NGO-STRAT. In the pink boxes on the right, three codes provide information on the strategic network level of the three DINs: the codes selected from the constructed codebook (see Appendix D) are NETDYN, INNOACT and ACT. In addition to the six codes, the shared vision of the DINs (see 4.5.2) is also of interest to compare different collaborative strategies in global relief.

The code analysis relies on the interplay of the elements of the focal actor profile with the overall network process dynamics. The interlacement has to be assessed for the reconstruction of the different collaborative innovation strategies of the DINs.

The exploration of the codes and the above specified DIN patterns was executed by analytical operations in ATLAS.ti[58]. The software program was employed to analyse successful real-time collaborations. It is one of several recently available programs for computer-assisted text analysis and was selected for this study for its widespread use and functionality.

The LNGO profile codes were explored as mentioned in Table 5-2.

Table 5-2: Code operations for focal actor profiles

Code	Operation	Source
DIMA-interest	Quote of LNGO director	Narrative data of LNGO PDs
CI	Frequency rank	CI-charts and LNGO PDs
NGO STRAT	Frequency rank	Complete PDs 1-12

The code DIMA-interest is defined as interest actors or networks pursue in disaster management (see codebook in Appendix D). To illustrate

58 ATLAS.ti belongs to the genre of CAQDAS programs. CAQDAS stands for computer-aided qualitative data analysis software by which even large volumes of data can be processed.

the interests, relevant quotations of the LNGO directors of Dantishan, SRDS, and Trustpeace are displayed in Tables 5.4 to 5.6.

To examine the occurrence of the family code “CI” to gain insights into an LNGO profile, PD-code-occurrence matrices were run in ATLAS.ti, to determine which CIs were most frequent during real-time collaboration.

The strategy matrices (see Tables 5.4 to 5.6) display the three highest ranking CIs for each case, in terms of their frequency. For interested readers, the complete CI frequency graphs can be found in Appendices F1, F2 and F3.

The last code that provides information on the focal actor’s profiles is NGO STRAT. It is defined as the way an organisation collaborates and influences the relief process and contains eleven subcodes (see codebook in Appendix D). By applying the same operation as earlier (PD-code-occurrence matrices), the three highest frequency subcodes in the dynamic innovation process were identified.

The collaborative DIN patterns and element codes were explored as shown in Table 5-3.

Table 5-3: Code operations for DIN patterns and elements

Code	Operation	Source
NETDYN	Frequency rank	Complete PDs 1-12
ACT	Frequency rank	Complete PDs 1-12
INNOACT	Frequency rank	Complete PDs 1-12

The code NETDYN is defined as network dynamic in real-time collaboration and contains nineteen subcodes (see Appendix D). The code ACT operationalises the broad actor definition from ANT which was discussed extensively earlier in the thesis (see Chapter 2). The code INNOACT is defined as innovative activities in real-time disaster management and contains eight subcodes.

The respective shared visions (cf. Dant, 2005) were retraced and analysed using the whole of the primary and secondary data for the DINs. They 'shone through' as claims in much of the electronic and paper data, and especially where boundary objects translated a shared vision (see, i.e., the photobook for Case 3: Kanni). Furthermore, the frequency counts were not employed to arrive at precise figures, but were seen as indicators (cf. Friese, 2014). They made it possible to explore specific, emerging, collaborative innovation strategies. The case studies (presented in Subsection 4.1) are a narrative reference to follow the code analysis conducted on the sample.

The following subsections derive three collaborative innovation strategies through a systematic analysis of cases and assigned codes.

5.2.1 *Collaborative innovation strategy in Ayam*

This subsection describes the collaborative innovation strategy in Ayam. It does so by presenting (A) an assessment, and (B) a table which codifies the *protective network* in terms of an innovation strategy (see Table 5-4).

A: Assessment

The assessment begins by looking at the focal actor side, that is, the NGO STRAT core areas. They point to strong coordination capacities, a high entrepreneurial orientation and a distinct media behaviour. To invest in a female local workforce and to attract global companies to rural markets was entrepreneurial and risky, as female technicians were not yet established and so future clients were not guaranteed. This entrepreneurial orientation (cf. Rauch, Wiklund, Lumpkin, & Frese, 2009) portends the specific collaborative innovation strategy of the Ayam DIN.

The dominant CI subcodes were CI foreign NGO influx, CI lack of coordination and CI punctual directedness and distance. At first, TNGOs were welcomed by the Indian NGO, but soon they were seen as harmful. That was consistent with both performing its own relief activities, and the entrepreneurial mindset which the LNGO wanted to foster within the fishing community. So, contacts were very much constrained after a short time. The other two CIs rank so high because the LNGO firstly delayed response to the boat repair issue.

In the actor coding (ACT) in the ad hoc and long-term collaboration of the DIN it was observed how local people, local government and cell phone appear as most important actors in real-time collaboration: this observation marks a high inclusive *and* protective network. Its characteristic operation, ubiquitous use of cell phones, bridged spatial, temporal, and hierarchic ditches. At the same time, this ICT usage pattern blocked indiscrete public involvement. It helped to mobilise old partners rapidly and to enrol new partners. Mobiles took care of privacy issues and speed of communication. Finally, it was noted that TNGO, local government, and other actors adopted the DIN's technical, gender-sensible, and entrepreneurial approach to local needs.

After adding the DIN's main foci with the codes NETDYN and INNOACT, the picture of the double-sided focal actor role became even clearer. The collaborative innovation process was executed in close physical relation and often cohabitation with the affected village people, as all three ranked subcodes of NETDYN expressed. Under INNOACT, coded activities in the creative reconstruction process were manifold. To mention are four of them: (1) medical needs that could not be covered by the costplan (as they happened later than they were allocated by the plan) were addressed by novel barefoot teams, (2) distribution cards were created ad hoc, (3) the engine repair workshop began as a co-venture into local markets, and (4) a savings SHG (Self Help Group) for men was invented and established.

Compared to the other DINs, a highly protective behaviour was adopted in Ayam. In all innovative activities (from night schools to medical relief) sustainability and future responsibility was taken into consideration as for example through regular contacts with the local government. The result was that in only the Ayam case were relief activities taken over by the government when foreign donors left. In innovation networks, such actors with dense contacts and strong ties have a tendency to create shared values, norms, and identities (cf. Katzmair, 2010, p.173). That was observed in the Ayam case, and is described as a dense or closure network (cf. Hemphälä & Magnusson, 2012). The interplay was mainly between the focal actor profile and the overall dynamic innovation. In this way, the emerging collaborative innovation strategy preserved a local culture. This study calls the strategy observed in this innovative global-local collaboration a *protective network*.

B: Table for a Protective Network

Table 5-4 is an illustration of a protective network.

Table 5-4: Protective network as innovation strategy

LNGO profile	**DIN profile**
DIMA INTEREST: *First I was asking for a loan. Then I dropped the idea and thought we mobilize some money locally. And we did that. Dantishan is not looking for more funds to scale up. We don't want to show up in the media either. We wanted to stay with our local people. Many NGO asked me in behalf of the workshop. But we don't want public attention and then fail.* (PD1:380) LNGO director	NETDYN: 1. NETDYN-NGO-local community 2. NETDYN-local need 3. NETDYN-coordination
CI: - CI-NGO influx - CI-lack of coordination - CI-punctdirdis	ACT: 1. ACT-government 2. ACT-cell phone 3. ACT-local people
NGO STRAT: 1. NGO STRAT-coordination 2. NGO STRAT-entrepreneurship 3. NGO STRAT-media behaviour	INNOACT: 1. INNOACT-E'ship orientation 2. INNOACT-medicare 3. INNOACT-distribution

5.2.2 *Collaborative innovation strategy in Keniparam*

This subsection describes the collaborative innovation strategy of Keniparam. It does so by presenting (A) an assessment, and (B) a table in which it codifies the *capacity building network* as innovation strategy (see Table 5-5).

A: Assessment

Again, the second case begins by looking at the focal actor side, and it can be seen that four peaks of NGO STRAT stand out. This LNGO had to master many differences whilst aiming at inclusive village development. This development transformed and scaled up the real-time collaboration process: the inexperienced and small SRDS became an organisation of global standard. Moreover, the organisation had multiple knowhow-exchange donors and was involved with an experienced humanitarian global player in ambitious reconstruction. The Keniparam DIN implemented a technical housing programme, and its LNGO learned to deal with sizeable budgets. Following a period of critical disruptive tension, it fostered innovative lateral relations between multiple TNGOs and donors in real-time. From nearly cancelling the challenging collaboration, the DIN and SRDS excelled in reconstruction of an inclusive, resilient, and multi religious village.

The CI assessment adds to this picture: first, a “lack of resources” and then recurring “contact overloads” hampered the planned course of action. The proximity of the destroyed village to the tourist venue of Chennai was a hardship to nearly all operations. The rocketing market price of cement, high levels of competition, and differences between castes and religions, tourists, and locals made for ongoing CIs. The network dynamics code in Keniparam scored highest among the subcodes NETDYN NGO – NGO and NETDYN-leadership which marks the increase of the power of the LNGO in the real-time process of this asymmetric collaboration. However, the successful end was envisioned in the shared vision, right from the start. By *capacity building* through expert exchange and up-scaling of the local partner capacities, this DIN finally achieved sustainable ends.

The strongest effect of the code INNOACT is therefore on NGO activity and learning. The institutional innovation of a lateral TNGO network and the transformation of the small voluntary association unfolded in massive tensions between local and global interests, as well as high expectations of donors and beneficiaries. Collaboration with multiple global donors was neither planned nor started deliberately. The specific actor configuration coded for this DIN (high score for ACT donors, ACT local people, and ACT houses) reflects the fact that this collaborative strategy emerged from the CI of the cancellation of 100 houses by one TNGO. To avoid the loss of respect of the local panchayat, from that time on, several TNGOs were enroled and connected.

Technical artefacts that won an actor status in this emerging DIN were contracts and houses. Houses required resilient construction plans, more donors, better legal frameworks, and resilience infrastructure experts. Thus they triggered the scaling up of the LNGO. House distribution and beneficiary selection required frequent village meetings, prompted several revisions in budget plans and ultimately called for an inaugural celebration at the end.

The LNGO had very limited previous experience that could be drawn upon. The will to scale up and to learn under conditions of real-time pressure emerged alongside focal actor strategies to escape contact overloads and the risk of complete failure. Collaborative capacity building, technology transfer and resource pooling led to resilient local reconstruction in this DIN.

The institutional innovation process of the LNGO induced ongoing, non-linear, and mutually local and global network learning processes. In the interplay of the focal actor profile and the overall dynamic innovation, the collaborative innovation strategy of ‘network learning under uncertainty’ in this DIN emerged over months and sometimes years. This study calls the strategy observed in this innovative global-local collaboration a *capacity building network*.

B: Table for a Capacity Building Network.

Table 5-5 is an illustration of a capacity building network.

Table 5-5: Capacity building network as an innovation strategy

LNGO profile	**DIN profile**
DIMA – INTEREST: *So we said, come on this is ours and we have the funds for this, construction of the houses. We do this and we will take up so many numbers of houses. Only this much - we can do it.* (PD2:237-238) LNGO director	NETDYN: 1. NETDYN-NGO-NGO 2. NETDYN-coordination 3. NETDYN-leadership
CI: 1. CI-punctdirdis 2. CI-lack of resources 3. CI-contact overload pressure	ACT: 1. ACT-donors 2. ACT-local people 3. ACT-houses
NGO STRAT: 1. NGO STRAT-expert knowhow 2. NGO STRAT-differences 3. NGO STRAT-community developement 4. NGO STRAT-multiple donors	INNOACT: 1. INNOACT-NGO activity 2. INNOACT-learning

5.2.3 *Collaborative innovation strategy in Kanni*

The subsection below describes the collaborative innovation strategy in Kanni. It does so by presenting (A) an assessment and (B) a table in which it codifies the *global advocacy network* as innovation strategy (see Table 5-6).

A: Assessment

The third case, Kanni, started with an outstanding long-term perspective with a focus on children and a powerful digit-based shared vision of a safe future for ‘100 children, for 10 years” (see Table 5-6, top left). The focal actor, LNGO Trustpeace, here was aware of the risks that children in particular face in a post-disaster situation. While the LNGO was the first mover with regard to children’s rights, the concrete numbers of 100 and 10 emerged collectively from heterogeneous interests in response to the high death toll in this place of Christian pilgrimage at Christmas.

Looking at the code rank of NGO STRAT, the subcode media behaviour dominates, similar to the Ayam case, but the activities coded under this category vary considerably. The profile of the focal actor in Kanni consisted of its strength in PR and sophisticated media behaviour, its expert knowhow in education and advocacy, and a high degree of competence in arbitrating political differences.

The most critical period for this LNGO can also be read from its CI rank: namely, its competition for real estate[59] in the early stages. The next CI peaks were rocketing market prices[60] for cement and then permanent skilled labour fluctuation[61]. Partly, this was due to its advocacy function for other NGOs and TNGOs (working for TNTRC, see below) with higher salaries.

[59] Code: CI competition.

[60] Code: CI rise of market prices.

[61] Code: CI skilled labour fluctuation.

Looking at the right-hand side of Table 5-6, at the more collaborative elements of the real-time pattern of this DIN, we observe - similar to DIN 1 that refused publicity - in the Kanni DIN that local government appears as a central actor. In addition, local people and media also score highly.

Most frequent network activities, as coded under NETDYN, happened (1) between global (donors) and at the local level, but also (2) between government and LNGO, and (3) among many different local NGOs (NETDYN NGO-NGO). Thus, Trustpeace became part of the Tamil Nadu Tsunami Rescue & Coordination Center (cf. Raju & Becker, 2013). This district-wide NGO platform collected expertise to spread technical, medical, and organisational best practice in relief, for example, using a wireless network for tsunami rehabilitation, the Internet, and community radio projects.

The DIN's most innovative activities happened in the medical field, in new education formats for children and in the center's outreach and transformation into the temporary shelters of its neighbourhood. Therefore under INNOACT learning took place from other NGOs and local families. In more detail, innovations achieved by this DIN were a new 'semi-border' concept, a systematic involvement of tsunami-families and other adults. Its outreach and preparedness trainings achieved clear results. IT- and skill training were spread into surrounding villages and the centre earned for this success a UN Award "Best Practice in Child Rehabilitation" (2006).

Again, the innovation strategy of this network clearly relied on its LNGO profile. The real-time collaboration profited from high media alertness, from existing contacts with politicians and academics, and from an outspoken DIN culture where conflict and punctual distances between actors were tolerated in order that they should learn from each other in the best ways. This study calls the strategy observed in this innovative global-local collaboration a *global advocacy network*.

B: Table for a Global Advocacy Network

Table 5-6 is an illustration of a global advocacy network.

Table 5-6: Global advocacy network as an innovation strategy

LNGO profile	**DIN profile**
DIMA – INTEREST: *All together expressed the strong wish to support 100 orphelins for a longterm period of 10 years.* Project Fotobook (Appendix B) CI: 1. CI-competition 2. CI-rising market prices 3. CI-skilled labour fluctuation NGO STRAT: 1. NGO STRAT-media behaviour 2. NGO STRAT-expert knowhow 3. NGO STRAT-differences	NETDYN: 1. NETDYN-global-local 2. NETDYN-government-NGO 3. NETDYN-NGO-NGO ACT: 1. ACT-local people 2. ACT-media 3. ACT-government INNOACT: 1. INNOACT-medicare 2. INNOACT-learning 3. INNOACT-NGO-activity

Tables 5-4, 5-5, and 5-6 present findings of the code analysis of the emerging network strategies: as a result, three different collaborative innovation strategies become visible in the cases of Ayam (see Section

5.2.1), Keniparam (5.2.2), and Kanni (5.2.3). The subsection 5.2.4 consolidates the findings in a matrix (see Table 5-7).

5.2.4 *Three collaborative innovation strategies*

At this point, it is possible to answer RQ 5: which innovation strategies are used by DINs in global relief? The emergent innovation strategies in successful real-time collaboration in the DINs of the study sample are summarised in Table 5-7 as three network strategies; they are collaborating (1) in a protective network, (2) in a capacity building network, and (3) in a global advocacy network.

Table 5-7 also summarises the findings that led to the three innovation strategies. In rows 6 and 7, the overview is completed with the addition of two dynamic network patterns (see Chapter 4), formulated as the 'continuous' and the 'strict' managerial collaborative innovation principle: (1) creation of a shared vision (see row 6) and (2) usage of boundary objects (see row 7).

Table 5-7: Overview dynamic network patterns and innovation strategies

	DIN 1 – Ayam	**DIN 2 – Keniparam**	**DIN 3 - Kanni**
Central DIN actors and interests	ACT–government ACT-cell phone ACT-local people	ACT-donors ACT-local people ACT-houses	ACT-local people ACT-media ACT-government
Prevailing CIs in disaster management of LNGO	CI-NGO influx CI-lack of coordination CI-punctdirdis	CI-punctdirdis CI-lack of resources CI-contact overload pressure	CI competition CI rising market prices CI skilled labor fluctuation
Frequent network dynamic of DIN	NETDYN-NGO-local community NETDYN-local need NETDYN-coordination	NETDYN-NGO-NGO NETDYN-coordination NETDYN-leadership	NETDYN-global-local NETDYN–gov-NGO NETDYN-NGO-NGO
Innovative activities in the collaboration process	INNOACT-E'ship orientation INNOACT-Medicare INNOACT-Distribution	INNOACT-NGO-activity INNOACT-Learning	INNOACT-Medicare INNOACT-Learning INNOACT-NGO-activity
Shared vision	*Building back better by local entrepreneurship and enabling gender equality.*	*Inclusive and resilient reconstruction of a multi caste and multi religious coastal village.*	*A lighthouse project for a children's home providing a better future for 100 children over 10 years.*
Boundary objects use	Timely	rarely	continuously high
Innovation strategy	Innovative real-time collaboration in a **protective network**	Innovative real-time collaboration in a **capacity transfer network**	Innovative real-time collaboration in **global advocacy network**

Table 5-7 provides an overview of the central elements of collaborative governance in this analysis. The two additional strategic elements belong to the before identified dynamic network patterns (see chapter 4). Here, the findings contribute to the picture of the different network strategies and reflects the case studies and secondary data analysis (see Appendix B).

The shared visions of the three DINs, shown in cross-comparison in Table 5-7 (see Table 5-7, row 6) reflects the results of the code analysis on central actors and innovative activities within an emerging network: the managerial focus is (a) on female entrepreneurship (Ayam), (b) inclusive reconstruction and resilient housing (Keniparam), and (c) on local people's children and disaster preparedness (Kanni).

The use of boundary objects, in examination of the secondary data for the DINs, was continuously high first and foremost in the global advocacy network, with its cosmopolitan and professional communication standard. The timely usage of boundary objects was lower, and even rarely found in the other two cases.

5.3 Two critical parameters for collaboration in disaster relief

To collaborate successfully in a heterogeneous global-local relief network, two parameters or dimensions of the LNGO profiles and of network collaboration (see Section 5.2) appear to be significant while they vary broadly from one LNGO actor's profile to another in the sample.

These are

1. **Media behaviour (**or **media alertness)**
   (see Table 5-7, row 2), and
2. **Readiness to scale up**
   (see Table 5-7, column 2 versus column 3).

There is a network fit between these two important collaboration dimensions of donor-driven global-local relief (cf. Chang, Wilkinson, Potangaroa, & Seville, 2011). Such a fit would seem to be indispensable (1) when enroling in an innovative network strategy, and (2) in order to realise and profit from the double-sided focal actor role of the LNGO.

The observed LNGOs, in particular, can be polar opposites with regard to dimensions of both (A) media alertness and (B) readiness to scale up. While one LNGO is open to social media use and PR activities online and in all events (the case of Kanni), another LNGO resolutely and successfully refuses publicity (the case of Ayam). And while some LNGOs are eager to scale up in terms of international collaboration (the case of Keniparam), others prioritise their local roots and prefer to maintain indigenous standards (the case of Ayam).

It is the opinion of this study that LNGOs with polar orientations in these crucial collaboration dimensions have the opportunity to contribute to innovative real-time processes and fulfil their double-sided central position in a protective as well as in a capacity building network.

In contrast to industrial corporations, many NGOs and non-profit organisations (NPO) often start without any hierarchical structures. Once they begin to scale up, the situation changes drastically. A higher professionalisation often means division of labour and managerial change (cf.

Cooley & Ron, 2002; Vossen, 2010). While some NGOs prefer to maintain their horizontal organisation and to be managed in agile ways (cf. Lublin, 2011) others grow into hierarchical structures.

Collected data show that (1) LNGOs in asymmetric global-local relief and (2) seed startups in asymmetric collaboration with established companies (cf. Weber et al., 2014) find themselves confronted by a similar dilemma: the choice between scaling up and staying small to preserve their agile structures. This choice has a considerable influence over collaborative innovation strategy - as will be shown in section 5.4.

Nevertheless, it is noticeable that LNGOs with strong entrepreneurial intentions are able to refuse to make institutional changes in size or style. For a successful real-time collaborative strategy, it can be seen from our analysis in section 5.2 that it is highly relevant to know that (1) polar LNGO dispositions exist in both crucial dimensions, and that (2) media alertness and an organisational actors' readiness to scale up are unlikely to change in ad hoc situations.

The dispositions are incorporated in organisational habits and routines (cf. Weick, 1996; Scarry, 2012; Swartz, 2012) and rooted in organisational cultures and norms (cf. Scarry, 1985; Hopf, 2010; Giddens, 2013). They are embodied in the technical infrastructure, in personal preferences, and in a corporation's informal procedures (cf. Giddens, 1984; Latour, 1991; Currion, Silva, & Van de Walle, 2007). In real-time collaboration, such dispositions are reproduced, and do not change immediately.

The finding of the two polar dispositions was checked against peer group data sets and studies of crisis management conducted after the 2004 Tsunami (see, e.g., Werly, 2005; McGilvray & Gamburd, 2010; Karan &

Subbiah, 2011; Kumaran & Torris, 2011) and the search was extended to the recent NGO management literature (see, e.g., Lindenberg & Bryant, 2001; Willetts, 2002; UNISDR, 2006; Vossen, 2010; Schreurs, 2011; Hermann et al., 2012). The existence of the polar disposition was confirmed as both rather unnoticed dimensions have a high coverage in recent publications on crisis management. A second testing of the significance of the two polar collaboration dimensions based on the study sample was accomplished more practically by conducting additional interviews. Again, positive accounts confirmed the significance of the finding for real-time collaboration success in dynamic processes in global relief.

5.4 Matching for collaborative innovation strategies in relief

Putting the study findings in a taxonomic four-field matrix with two polar axes, a robust matching tool for DINs in global-local relief processes is derived. In Figure 5-2, the x-axis marks the polar disposition ‘media alertness’, and the y-axis the disposition between ‘readiness to scale up’ and ‘avoidance to scale up’. Profiling of the LNGOs in this way can (1) speed up the matching of appropriate relief partners and (2) also enable leadership to adjust real-time processes.

Managing dynamic innovation processes and enroling in ad hoc network governance after a CI requires flexibility and adaptability. TNGOs that are aware of their own organisational interest, but also of their own and other actors’ dependend and interconnected position in the field could make much better choices and these more rapidly, on their participation in any real-time collaboration. In the initial turbulence caused by mass-influx of NGOs and the time pressure of relief, regional public online platforms could offer valuable matching pools with such simple instruments (see, e.g., Stephenson Jr., 2005; Goldstein, 2012; Wukich & Steinberg, 2013). TNGOs whose capacities range from adequate to large scale could search for potential local partners in disaster prone areas that are in for the same.

Such support is longed for in the field. As one LNGO director expressed his hope for better ad hoc collaboration in the future: *"Something like that you should have: A kind of a study on the NGOs, more or less who can be doing what, who will be able to do it and their management style and their capacity, infrastructures and their credibility*" (PD 02:396).

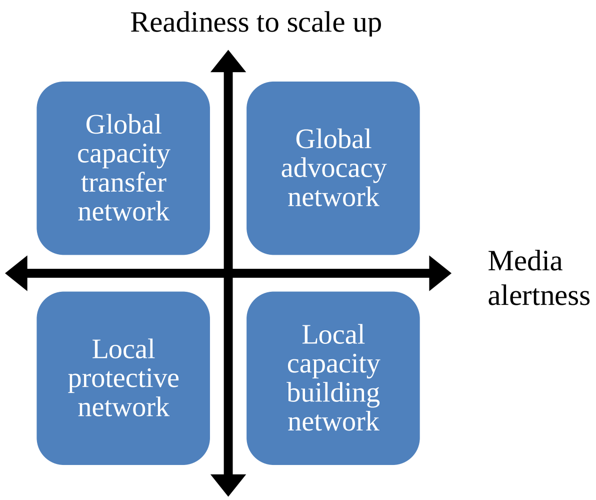

Figure 5-2: Matching matrix for collaborative strategies in global relief

In the first instance, governmental agencies could offer regional matching platforms and national LNGO data bases (see Chapter 6 on public real-time foresight) where a small LNGO could present their collaborative profile, in case of sudden incidents and the need to find global support.

In summary, the study has identified various global relief DIN strategies. By cross-case comparison and analysis of the central codes derived from the data, it was found that innovative and sustainable outcomes are achieved in pursuit of very divergent collaborative innovation strategies. The network strategies observed in asymmetric global and local collaboration in recovery ultimately formed a protective network, a capacity building network, or an advocacy network.

Within one successful DIN, however, a common strategy has to be shared and enacted for continuous collaborative success. The double-sided focal actor role (see pattern 5 in Subsection 4.5.5) is of significant importance for local sustainable outcomes. Following an analysis of strategic elements in the collaboration process of all three cases, two critical parameters were revealed (see Section 5.3). These parameters (media alertness and readiness to scale up) mean that it should be possible to supply a robust matching tool for forecasts of a network fit in real-time collaboration in relief and recovery.

Where small LNGOs could present their collaborative profiles for the case of sudden incidents to find global support, we expect progress from digital infrastructures to accelerate the overall formation of global advocacy networks (see Figure 5-2) *and* local protective networks. It is valuable for the formation of DINs to know the difference between them.

At the very least, in situations where no good matches are anticipated between actors, global actors (TNGOs) should consider opting out of relief missions; or could adjust their network strategy to meet the profile of a local partner, the one which has to implement a programme and reacts in real-time-amongst external and internal network partners.

6 From planning to preparedness

This chapter answers RQ 5: how should a well-qualified management team plan and manage dynamic innovation processes? It does so in two parts. In the first part, the five dynamic network patterns (identified in Chapter 4) serve to outline a collaborative real-time foresight (RTF). This RTF constitutes a managerial solution for the switch from planning to preparedness. The second part proposes two indicator tools for identifying DINs and measuring their performance while they act (RTETs). The indicator instruments are also derived from the pattern findings.

In at least three environments, in real-time operating global markets, flexible business incubation and multi-sector partnerships, leadership can no longer follow the traditional predictable methods of control, guidance, and management (cf. Sydow, 2009; Hamel & Prahalad, 2013). The traditional coordination mechanisms of hierarchy and standardisation have lost their grip. In high velocity environments, it has become important to know how to manage strategic uncertainty (see, e.g., Branzei et al., 2004; Weick & Sutcliffe, 2007; Ries, 2011) and how to initiate unpredictable long-term collaboration (cf. Thomson & Perry, 2006).

That is why a great deal can be learnt from successful disaster management. To qualify management teams for ad hoc collaboration across businesses, public administration, and non-profit organisations, a new preparedness is needed. The challenge of real-time collaboration is an invitation to a dynamic innovation process, but to collaboratively create a DIN, management should be prepared: the network dynamics that underlie successful network governance should be known and expected.

Section 6.1 starts by reviewing and transforming the five identified DIN patterns into RTF terminology. In section 6.2, the new method is set out as a management agenda, proposing RTF as a public and corporate foresight approach. Consequently, it addresses the change question: what could a turnaround from planning to preparedness mean for a new collaboration between public and private actors in (a) innovation regions and (b) for the existing transnational humanitarian structures? (cf. Duffield, 2002; Harmer, 2005; Donini, 2012). In section 6.3, the five network patterns are used with five different intentions: the section outlines their aptitude to measure successful innovation processes as they happen. Manifold actors have an interest in rapid identification of successful innovation teams. The study findings allow us to craft real-time evaluation tools (RTETs) that measure successful collaboration not by an end-of-pipe but by an in-the-pipe approach. Section 6.4 concludes the chapter by answering RQ 5.

Overall, the chapter looks at two different contexts: ad hoc response and management of business innovation processes. The tools it suggests are depicted as indicator catalogues for flexible business incubation (cf. Callegati, Grandi, & Napier, 2005; Jones & Lichtenstein, 2008; Caliendo et al., 2012), and for a sustainable and innovative global disaster management (cf. Tomasini & Van Wassenhove, 2009; Kapucu, 2015).

6.1 Dynamic network patterns for a real-time foresight

In chapter 4, in a cross-case network analysis, the study detected five dynamic elements of collaborative governance. They are the five dynamic network patterns of successful real-time collaboration. Taken from sustainable collaboration in rapidly emerging innovation networks in global-local relief (cf. Rodriguez, Trainor, & Quarantelli, 2006), they offer important insights into all volatile environments for management teams. In a foresight perspective (cf. Cagnin et al., 2013), management has to be prepared for crises (cf. Boin & MacConnell, 2007). This can be arranged by being prepared for dynamic innovation processes, simply by expecting characteristic network dynamics. Technical *and* managerial readiness for ad hoc collaboration can be obtained by adaptation to knowledgeable network patterns.

Managing in the ways of a real-time foresight (RTF) switches organisations from advance planning, initial goal setting, and control (cf. Ordóñez et al., 2009) to awareness of strict and continuous network patterns. For leadership, as shown in Figure 2-2, this means starting collaboration by turning away from planning routines. Two steps have to be performed. First, it is necessary to drop individual management tools and organisational strategies (cf. Weick, 1996) to become aware of one’s own but not independent position, in a plural context of real-time and socio-technical environment (see, e.g., Haddon, Mante-Meijer, & Loos, 2012). Second, and parallel to real-time collaboration, it means striving for interest alignment and process integration (cf. Orlikowski, 2009). In such collaboration with other actors, a DIN can emerge.

The remainder of this section explains again the five DIN patterns (see also Section 4.3) in the form of five principles of collaborative innovation management (see Section 4.5) and formulates appropriate managerial activities with the results of the collaborative DIN principles in mind (see Table 5.1).

(1) Identification of heterogeneous actors and early alignment of interests (initial, alert)

Elaborating and signalling an agenda of own interests; identifying central problems in the surrounding ecosystem; identifying heterogeneous actors' interests; identifying infrastructures and devices related to the agenda.

(2) Development of a shared vision (continuous)

Readiness to explore, find and fix a shared vision, each time with heterogeneous partners; a shared vision for collaborative governance of the complete process that fits one's own interests.

(3) Mindful use of boundary objects (strict)

Awareness of parallel interaction on multiple global, virtual or local levels in complex processes; identification and co-creation of potential boundary objects; strict use of boundary objects to mobilise heterogeneous actors.

(4) Punctual directedness and distance (adaptive)

Awareness of unexpected and iterative CIs in complex collaboration processes; creation of adaptive space for change of actors and one's own actor role in a long-term process; preparedness for disruptive events and awareness of times of punctual distance, silence, or lack of transparency of partners.

(5) Double-sided focal actor orientation (coherent)

Orientation towards focal actors in local implementation of the DIN shared vision; interoperability of technology; identification and support of the focal network actor, its profile, and its resources for a coherent network strategy.

By incorporating these five principles into managerial practice and technical infrastructures, organisations become highly sensitive to both (a) the initial conditions of a dynamic process, and (b) the sustained network mechanisms of governance.

Not all response situations are realisable. In decision-making by well-qualified management teams, there should always be a caveat on collaboration: “Don’t do it unless you have to!” (see Huxham & Vangen, 2005, p.37). This is a statement from the experts by which we abide. Even successful dynamic innovation processes imply a struggle with multiple CIs and the vexing uncertainty of an open end (see Chapter 4). For DINs to emerge, a shared problem has to be recognised as such by heterogeneous actors to which the collaborative challenge has to be worth the investment (see DIN pattern 2 in Subsection 5.5.2). The alignment of multiple heterogeneous interests in an ad hoc situation depends on a shared vision that is not replaceable by forecasting, prediction, and individual goal setting (cf. Blomqvist & Levy, 2006; Fatemi, van Sinderen, Wieringa, & Razo-Zapata, 2012; Weigand et al., 2014).

Still, in complex situations, open collaboration is a better option (cf. Huxham & Vangen, 2005) than business routines. In such situations, adoption of the patterns identified in this thesis could be beneficial to management. They switch the strategic agenda towards ad hoc collaboration, by implementation of five DIN principles.

6.2 The RTF agenda to manage real-time collaboration

In the near future, the rising complexity and novelty of issues (cf. McGuire, 2006) will increase demand for additional resource pooling and sharing of risks (see, e.g., Newbert, 2008; Wukich & Steinberg, 2013); for example, where multi-sector collaborations increase, as required in the case of new technologies that need further exploration and development (cf. Gay & Dousset, 2005; Van den Herik & de Laat, 2016) or in the case of breakthroughs in academic knowledge that will be exploited in a new market. Here there is a need for real-time foresight (RTF). In such situations, an RTF agenda is applicable for collaborative management of innovation processes between heterogeneous actors.

The following three subsections develop an RTF agenda for two different realms. They do this as follows. Subsection 6.2.1 discusses the dynamic innovation network principles of an RTF agenda. Subsection 6.2.2 applies these principles to public and corporate environments as preparedness for dynamic innovation processes. Subsection 6.2.3 applies them in an environment of preparedness for more sustainable collaboration and building back better in global relief.

6.2.1 *The dynamic innovation network principles of an RTF agenda*

The dynamic innovation network principles of an RTF agenda are illustrated in Figure 6-1 as a visual aid to the explanation below.

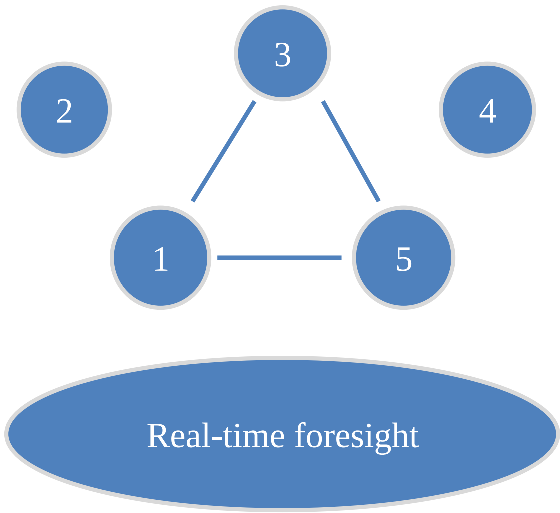

Figure 6-1: Real-time foresight agenda

There are five bullets that can contribute to a real-time foresight. The five bullets represent the five DIN principles of successful innovation collaboration. The explanation is as follows.

(1) The first DIN principle is to become aware of a networked situation, to signal one's own position and to identify other actors that are relevant to a collaboration.

(2) The second DIN principle is to seek the early development of a shared vision. It should align the heterogeneous interests of focal actors which is the most important managerial element. As a continuous governance instrument, it decides long-term success.

(3) The third DIN principle consists of boundary objects. They need to be identified or created for strict use to mobilise commitment,

communication and network mutuality. The more heterogeneous the DINs are, the better the use of boundary objects must be.

(4) The fourth DIN principle is to prepare for time-outs of particular network-actors. In dynamic long-term processes, partial non-visibility and temporal passivity of actors must be tolerable. Intermediary actors can be included to release DINs and to deliver network support.

(5) The fifth DIN principle deals with coherent collaborative leadership. Leadership has to switch from traditional strategic management to a process orientation and adequate *implementation* according to the focal actors' profiles. Thus, in one and the same network, focal actor roles may change over time.

In the Figure 6-1, three of the RTF principles have time bound and adaptive impact (the triangle 1-3-5). The other two (2+4) are of continuous managerial relevance for structuring a successful dynamic innovation process (see also Figure 4-10). From the process study (see Chapter 4) and dynamic network literature (cf. O'Brien, 2010; Ai et al., 2015), the dynamics are best understood as follows.

The alignment of different interests has to happen rapidly for network to emerge in real-time challenges, and this becomes more unlikely with the passage of time. An OPP has to occur early in order to satisfy all, and to avoid the loss of relevant heterogeneous interests. In addition, through an early OPP, the focal actors make themselves indispensable (see, e.g., Akrich et al., 2002) to a DIN. This conveys a degree of irreversibility (cf. Kasimin & Ibrahim, 2010) to the dynamic collaboration process.

The shared vision developed in initial collaboration is of continuous and central importance (2). It has to include the core actors' heterogeneous interests in a future-directed claim that is clear and sufficiently brief to be easy to communicate and use (cf. Alvesson & Spicer, 2010). For flexible global-local and virtual collaboration, it is crucial that heterogeneous socio-technical actors (1) develop a shared understanding of "both a collaborations' overall vision and of what they need to do practically" (see Steen, Buijs, & Williams, 2014).

In the same steady ways and perhaps as the most difficult principle, punctual directedness and distance (4) need to be balanced between multiple actors. This affords enduring and iterative effort and awareness of all network-actors to maintain a reciprocal communication (Caliendo et al., 2012). The use of boundary objects (3) on the one hand, and of the double-sided network roles of focal actors (5) on the other hand are continuous, time adaptive governance elements (see Figure 4-9). Such collaboration facilitates output orientation and mobilises local interaction (see Subsection 4.5.3), for communication between different worlds and cultures. Successful and sustainable innovation collaboration needs the sustained use of intermediaries (cf. Katzy, Turgut, Holzmann, & Sailer, 2013; Sprinkart, Gottwald, & Sailer, 2014).

In summary, the incorporation of RTF in organisational contexts is itself an "emergent strategy" (Mintzberg, 1990) that helps to cope with strategic uncertainty by facilitating a context, time and actor-bound network management of collaboration (cf. Klein & Poulymenakou, 2006; Provan & Kenis, 2008).

The five components of the RTF agenda are interdependent and mutually reinforcing. From a collaborative perspective, the last component implies handling the tensions between competitive corporate or organisational and collaborative interests. The implementation of that principle concerns different actors in different ways: especially public, private, or corporate actors.

6.2.2 *Preparedness for dynamic innovation processes*

This subsection embeds the RTF agenda in the foresight literature context and addresses both public and corporate actors' (see Table 6-1) foresight perspectives. In section 6.2.3, Table 6-2 describes what a turnaround from planning to preparedness means in RTF for global relief and locally sustainable disaster management.

For public administration, real-time collaboration has become a challenging imperative. Accelerated technological change, devolution, scarcity of public resources and rising organisational interdependencies challenge the public agencies (cf. Salge & Vera, 2012). Altough scepticism about networking with private actors prevails in many administrative agencies (cf. Herranz, 2008) it has recently been seen that many pressing problems can only be solved with external partners (see, e.g., Huxham & Vangen, 2005; Sennett, 2012; Bryson, Crosby, & Stone, 2015).

One reason for scepticism over collaboration is the high level of temporal investment for co-working actors (cf. Thomson & Perry, 2006). In particular, doubts may arise when the demands and duration of a collaboration process are not clear from the beginning. However, parts of this process uncertainty can be removed. By adopting RTF, public managers can look inside the former "black box of the collaboration process" (cf. Thomson & Perry, 2006, p.21) and co-create dynamic network processes.

This readiness is catered for by the above five DIN principles transferred into foresight activities (see Table 6-1).

A main difference between corporate and public foresight processes is that the former are performed in pursuit of private interests and rather behind closed doors (see Chapter 2). They serve to achieve competitive advantages in specific markets (cf. Barney, 2001; Wade & Hulland, 2004; Rohrbeck, 2012). In contrast, public foresight processes (1) pursue an (inter) national collective interest and (2) address broader technical and societal topics and market trends.

The proposed real-time foresight (RTF) adds to both of the above stated points with a new network orientation. In this way, it advances the traditional limits of technological foresight (TF) and introduces heterogeneous perspectives of affected and interested socio technical actors in a given ecosystem. Still, there are different directives for public and corporate RTF. Table 6-1 transforms the RTF agenda into a guidebook by which the five managerial DIN principles (see Table 5-1) can be implemented in both sectors.

Table 6-1: Public and corporate activities of collaborative real-time foresight

	Public foresight activities (DIN processes for community and societal development)	**Corporate foresight activities** (DIN processes in co-venturing and co-incubation)
1	Issue identification, communication of identified issues and interessement of heterogeneous actors (on public platforms)	Identification of potential business issues and potential network-actors in a market; visibility strategy to signal own ideas and interests
2	Identification of emerging DINs for public support; sign-posting of national or regional visions; co-creation and development of shared visions	Co-creation of various shared visions with heterogeneous actors; openness for foreign actors' input; readiness to translate unfamiliar ideas
3	Support of intermediaries in DINs and identification of boundary objects; invention of boundary objects that attract citizens and corporate actors to the public sphere	In dynamic innovation processes mindful use of boundary objects to attract, include and mobilize distant (or virtual) actors and potential customers
4	In long-term collaboration, acceptance of non-transparency periods; flexibility in budget and information flows of funded programs where possible	Scouting for potential intermediaries for innovation processes and match making with polar partners; awareness of CI frequency in long-term collaboration
5	Identification of local network partners for foreign organisations interests and influx	In a DIN adaptation to the focal actors profile for success on the market; integration of socio-technical actors

Following the RTF activities row by row Table 6-1 shows how the RTF method depends in many of its principles on visibility and identification of heterogeneous actors and their interests. Visibility and interoperability are significant components of the successful management of ad hoc collaboration. The more DINs rely on public donor or private investor support, the more indispensable media usage, visibility, and collaborative communication become.

To avoid duplication, the relevance of visibility will be discussed in subsection 6.2.3 with regard to the managerial field of global relief.

6.2.3 *Preparedness for sustainable recovery in global relief*

In global relief, visibility has strong effects on emerging global and local network elements. Visibility is a topic of rising interest in disaster management, especially since there are major shifts from public to private funding in the humanitarian fields (see, e.g. Harmer, 2005; Chang et al., 2011; Donini, 2012).

There are many contributions of the new method of RTF to local sustainable recovery and entrepreneurial disaster management. In the cross-case analysis of patterns that facilitate DIN emergence, this study pursued the LNGO perspective on collaborative reconstruction (see Chapters 3 and 4). This perspective is often neglected in the standard crisis management literature (cf. Karan & Subbiah, 2011: 6; Phillips, 2014), mainly due to the difficulty of gaining access to the field and obtaining valid and valuable data.

With long-term data and pattern findings in hand, this study is privileged to use a rare perspective to inform people about the focus of actors that are quite important for sustainable ends in humanitarian relief. RTF is proposed as a method to change the traditional management styles of global humanitarian players since they have been given a market-like structure (cf. Twigg & Steiner, 2001; Duffield, 2002; Twigg & Steiner, 2002) in this often chaotic and sometimes desperate global collaboration field. In response to global disasters, the typical actors meet repeatedly, but still, too often, they are not prepared for successful real-time collaboration. TNGOs, LNGOs, governmental actors, and global donors have built a transnational structure of asymmetric partnerships. Collaborations between partners and beneficiaries, between small local and powerful global actors unfold again and again, but in most cases, this does not lead to sustainable ends.

Planning and budget lines of emergency assistance and rehabilitation of international donors should allow more flexibility for innovative local solutions. In global relief, as in all successful real-time innovation processes, heterogeneous actors should focus more on initial network formation and insist less on *initial goal targeting* and traditional strategic management. In the author's experience, it is difficult to stop planning ahead and setting initial goals as targets (it is so self-evident) in traditional management, but goals set at an early stage do not suspend uncertainty concerning collaboration to build back better. However, goals may mislead actors when they do not stem from real-time enroled actors and affected local stakeholders.

From the perspective of this study, it is recommended that, to achieve innovative and sustainable ends in global relief, governmental and TNGO actors should incorporate RTF to switch into managerial network modes and to facilitate the emergence of DINs.

Put into an RTF agenda, this reads as presented in Table 6-2.

Table 6-2: Real-time foresight in global relief

	Governmental activities of RTF	**TNGO activities of RTF**
1	Virtual platforms to facilitate real-time matches in identified critical collaboration dimensions; as heterogeneity of actors is valuable only sparse restrictions should be imposed on enrolment of actors from third parties	Problem identification, public communication of interests and interessement of heterogeneous actors (partners, virtual platforms)
2	Identification and support of DINs; enhancing the development of shared visions for sustainable reconstruction	Rapid exchange of interests and translation of affected interests and engagement; identification of interoperable infrastructures; development of shared vision
3	Facilitation of technical and legal infrastructure for participation of heterogeneous actors; allocation and support of intermediary actors	Ongoing scouting for boundary objects; identification of heterogeneous actors; mobilisation of intermediaries and mindful use of boundary objects
4	Support of local and global media for information flow; role of media as ‘watchdog’ for actors’ rehabilitation efforts and international visibility; own responsible positioning in DINs	Calculating CIs and justifying periods of non-transparency of LNGOs; flexibility in information flow and budget lines where possible; monitoring of mutuality of contacts
5	Support of small LNGOs and canalization of foreign aid; support of local markets and entrepreneurial solutions; local sustainability as principle of global relief	Respect of LNGO and reaction to local demand as foreign relief partner; decision to *step out* or *step in* to affected regions not to be based on own interests

With rising digitalisation and the predominance of ICT, the visibility of actors can become central to RTF principles. In addition, for NGO actors, start-ups, and SMEs, visibility can be in their own interest (cf. Keck & Sikkink, 2014), but also an onerous requirement of donor-based aid (cf. Hermann et al., 2012) or of markets.

In disaster relief, nowadays, all NGOs brand the livelihood items they provide to the chosen beneficiaries. The practice has become a ubiquitous part of visibility strategies for the consumption of donors and stakeholders. It assures donors of a responsible spending of their money and of specific quality standards realised on a fare-away place (cf. Mitlin, Hickey, & Bebbington, 2007).

However, through an ANT lens, attention has to be paid to the fact that an over-emphasis on single actors will handicap the network-actor process: the forced visibility of *one* network-actor, probably a powerful TNGO, superimposes the impact of boundary objects or even a shared vision. This can counteract sustainable ends by hampering

(a) a network translation process (see Table 2-1) based on the LNGO as focal actor, and

(b) the formation of a necessary local ownership (cf. Jordan & Javernick-Will, 2013) as the network shifts to more local network activity over time (see Section 4.3) could be blocked.

Instead, for a co-evolution of DINs and local sustainable recovery, a mindful use of boundary objects is recommended to support overall network mobilisation (cf. Trompette & Vinck, 2009).

Trust and distrust play crucial roles in the alignment of interests and network evolution (see, e.g., Rousseau, Sitkin, Burt, & Camerer, 1998;

Dyer & Chu, 2003; Patzelt & Shepherd, 2008; Caliendo et al., 2012) in dynamic innovation processes in all societal fields. Owing to the limitations of this thesis the topic is only touched upon, but its importance is clearly seen. Data analysis of CIs in the study sample suggests that visibility practices are added to disturbances and are creating distrust[62]. It is important to further investigate how trust, transparency, punctual directedness, and distance are related in real-time communication and collaboration, and how visibility practices trigger CIs over time. These questions are indicative of a need for further research (see Chapter 7).

6.3 Evaluating dynamic innovation processes

Starting from the need to improve and measure dynamic innovation processes, this section presents a new method of evaluating collaborative innovation processes. It is based on the assumption that successful collaboration follows the underlying dynamic network patterns. For the transformation of the five dynamic innovation network patterns into indicator questions, two real-time evaluation tools (RTETs) are developed. These tools (a) facilitate a real time identification of emerging DINs in entrepreneurial processes, and (b) also allow us to measure and compare the performance of network formation that leads heterogeneous actors in a networked way to innovative ends.

The outlined instruments contrast with existing tools for end-of-the-pipe evaluation. The section contributes in explorative ways, providing

[62] Code: CI competition; CI local people disaccord; CI distrust.

process management oriented and real-time feedback on non-linear innovation processes. A real-time tool can be applied before failures are irreversible. Real-time feedback saves time and money. The most important implication thus is a practical one: the instruments enable leadership to identify, select and support entrepreneurial collaboration while it happens.

Two tools are constructed, based on the following four assumptions.

(a) The dynamic network principles found provide five benchmark dimensions with which to evaluate and measure dynamic innovation networks in different social contexts.

(b) The similarities between collaborative innovation processes in global-local relief and in startup collaboration with established firms have been outlined in the literature (Sheperd & Williams, 2014; Weber et al., 2014) and are grounded in data shown in earlier chapters of this study.

(c) In both fields of asymmetric collaboration, initial goal uncertainty, competition between multiple unfamiliar and heterogeneous actors and real-time pressure - due to time-to-market and time-to-rescue - challenge the actors.

(d) In asymmetric collaborations, heterogeneous actors have divergent objectives and a different level of resource scarcity or abundance, therefore they need different levels of flexibility to be able to collaborate.

The results of this study confirmed that sustainable rehabilitation is deeply entrepreneurial in nature. Sustainable entrepreneurship is inherent in successful reconstruction, and different innovation strategies were observed in different emerging DINs. New ideas, materials and products changed a former dominant and then disrupted socio-technical structure in place, the same is true of innovation as creative destruction on global and local markets (cf. Schumpeter, 1934; Karan & Subbiah, 2011). The evaluation instruments suggested in this section will therefore be specified for both realms of real-time innovation collaboration, co-incubation, and global relief.

The study first proposes an instrument for measuring high performing DINs in co-incubation and start-up processes (6.3.1), then turns the 'pattern skeleton' back to the context of collaboration in global relief (6.3.2) to specify an evaluation tool for innovative recovery in true contexts of building back better.

6.3.1 *An evaluation tool for DINs in co-incubation*

Business incubation and co-creation programmes are designed to accelerate the successful development of entrepreneurial companies through an array of business support resources and services. They are developed or orchestrated by an incubation programme management. A business incubation programme's main goal is to produce successful firms that, when they leave the programme, will be financially viable and freestanding.

Startup processes nowadays are also accompanied by academic and public education institutions. Here, the intention is slightly different in most cases: the aim is to foster an entrepreneurial culture and to enable young people to work in the industry 4.0. Co-incubation involves unique and highly flexible team work. ICT infrastructure and people nurture ideas for new and small businesses and help them to "survive and grow through the difficult and vulnerable early stages of development"[63]. The concept of co-incubation "has been gaining prominence to increase the supply rate of entrepreneurs, create jobs and assist in economic development" (Ramkissoon-Babwah & Mc David, 2014, p.13). Business incubators are viewed as entrepreneurial hubs that can channel DINs and allow them to unleash their shared visions on business enterprises to markets. Nonetheless, there is competition for resources and business incubation placements, and the success of a programme hinges on the performance of the clients. Where innovation teams start in mass collaboration, the identification of high performers is desired.

The evaluation tool provided by the study is an outline as indicator catalogue: the indicator questions are derived from the five dynamic network patterns. Just as above, when transformed for RTF, they need further adaptation to a selected sample and the local context of collaboration. The indicator questions to assess incubation processes in Table 6-3 propose benchmarks for real-time feedback and evaluation. The results can be used by investors, stake-holders and entrepreneurs for decision making in collaborative innovation processes. The tool makes it possible to evaluate ongoing dynamic innovation processes. The precondition is that the collaboration went on for an initial time so that some past activities can already be investigated and observed. They may be documented in various forms. Data generation is a part of business operations and online

[63] *www.diogenes-incubator.com/incubation/business-incubation-definition*

communication is indispensable for most start-ups. The data analysis depends on the concrete operationalisation of the indicator questions to evaluate a chosen specific sample.

The methods used to conduct a real-time evaluation are staff surveys with open questions or multiple choice formats. The advantages of a rapid computability of answers have to be balanced against the level of interest in the generation of new insights (versus preselected constructs to tick and cross). Hard copy or online survey, paper based or online analysis are choices that need to be made before introducing the measurement tools to the DIN actors. This flexibility in the use of the instrument means that evaluations can be conducted in many different situations. The tool can be adapted to virtual and analogue collaboration processes in similar ways.

Table 6-3: Indicator tool for evaluating DINs in co-incubation processes

	DIN pattern	**Indicator catalogue for evaluating co-incubation processes**
1	Early identification of heterogeneous actors, alignment of interests	1 Percentage of the people who eventually lead the startup who have been engaged from the beginning/ before a central investment/ before any significant CI. 2 On which socio-technical infrastructure does production /do services depend?
2	Collaborative governance by an early found shared vision	1 What does the startup stand for? What is the most important thing that this startup is able to deliver? 2 Percentage of identical answers in the startup team. 3 Online or document analysis in search of the shared vision.
3	Mindful use of boundary objects	1 Percentage of people who know the logo/have built a product/ have sold a service of the startup. 2 Percentage of people in a founder team/ supplier group that relate the brand/ a specific wording/ a boundary object to the startup. 3 Which objects represent best the aims/the USP/the goals of the startup? 4 Objects that iterate in administrative data/ PR and marketing documents/ technical infrastructure.
4	Punctual directedness and distance amongst implementing actors	1 Balance to be measured and weighted in contacts between founders and staff, founders and established companies, founders and consumers (calculate the weighted average - on *duration/ content/ kind of contact or communicative frequency* - one direction is +, the other - and a zero sum would be perfect).
5	Local integration of and network orientation on a local actor	1 How many local/foreign founders does the startup have? 2 Percentage of customers that are local. 3 Percentage of investors/resources a startup uses that are local (*Quantitative sum weighted for how far away local ones are*) 4 Agreement and disagreement of partners over bargains, and media visibility, and in meetings.

6.3.2 *An evaluation tool for DINs in global relief*

This subsection takes the real-time evaluation tool for DINs back to the humanitarian field (see Table 6-4).

Table 6-4: Indicator tool for evaluating DINs in sustainable global relief collaboration

	DIN patterns	**Indicator catalogue for evaluation of sustainable relief**
1	Early identification of heterogeneous local and global actors, alignment of interests	1 At peak times of response, how many of the NGOs have been there? 2 Percentage of actors enroled:-at the beginning/ at important parallel CIs, at the passing of important legal acts/ at international meetings. 3 On which technical devices and artefacts does the networked process depend? 4 Which artefacts are obligatory elements in recent standard processes for rehabilitation programmes?
2	Collaborative governanace by a shared vision	1 What is the main goal of the collaboration? 2 Percentage that gives a same answer (*open question/multiple choice).* 3 Online or document analysis in search of the shared vision.
3	Mindful use of boundary objects	1 Percentage of people in a given region/ group who do recognise a specific boundary object. 2 Percentage of people relating the boundary object to the main goal of the collaboration. 3 Data mining: -Frequency of occurrence of a specific artefact in official documents/PR/ corporate identity/media use of DIN actors.
4	Punctual directedness and distance amongst implementing actors	1 Balance of information/contacts between actors.(weighted average - *on duration/ content/ kind of contact or communicative frequency/* one direction is +, the other -, a zero sum would be perfect)
5	Local integration of network orientation on a local actor	1 How many local contributors/ local staff does a DIN/LNGO have (quantitative sum weighted for locals) and from which distances do they come? 2 Quantitative sum or percentage of resources and donors that the NGO uses that are local. 3 Agreements and disagreements of global and local partners in meetings/ media/ collaboration.

On the one hand, the outlined instruments for designing and conducting process evaluations allow an assessment of DINs by external actors. On the other hand, the tool can be used for strategic process management by the enroled actors themselves. Direct field access, open collaboration and availability of primary data from collaborating NGOs are necessary for valuable results and indispensable for an improvement of collaboration in relief projects.

6.4 Conclusion

RQ 5 was: how should a well-qualified management team plan and manage successful dynamic innovation processes. The answer is, through a new network management. Network governance is the answer to RQ 5. This chapter has outlined how to change planning into preparedness and foresight for successful ad hoc collaboration in dynamic innovation processes. It has shown how the application of the real-time foresight method (RTF) involves restructuring organisational routines and infrastructures, and has also shown that a DIN evaluation tool allows for identification of high performing networks in different contexts. The tool derived from pattern findings enables real-time feedback and evaluation of dynamic innovation processes.

While the evaluation tool is designed to evaluate and improve the management of dynamic real-time process, the RTF approach aims at preparedness for the challenging task. In many failed collaborations, and particularly in response to disasters, the lack of awareness, foresight and proactiveness of actors spoils the results.

The three most important RTF insights are consolidated below as recommendations to improve the management of dynamic processes.

(1) Dynamic means early: The study results confirmed the importance of initial process dynamics for sustainable ends, and they confirmed the sometimes neglected and sometimes overestimated role of technical infrastructure in real-time interaction. The early identification of all relevant actors for a problem solution is extremely important, but this identification has to address, confront and align the heterogeneous interests which different actors have.

(2) Collaboration means heterogeneity: Dynamic network emergence does not lead to a common situational awareness. Instead, the early development of a shared vision is a crucial element of network governance. It can easily cross lines of digital business, physical life world, organisational routines and innovation activities. Actors may be experts in a particular field and discipline, but for DIN emergence additional knowledge and expertise are essential.

(3) Visibility should not be confused with trust: A DIN pattern discovered (see Subsection 4.5.4) in relation to temporal disruptions of successful collaboration processes reveals an interesting insight for adherents of perpetual transparency. It is a difficult finding for management and leadership that in dynamic processes time-outs for actors are necessary. The challenged network-actors might need their scarce resources for local problem solving, and if they can employ them fully, without paying attention to the network partners for a while, this can be part of the success.

Following on from the three most important RTF insights, this chapter concludes with a straightforward statement based on the evidence from the study sample: that actor-roles are time dependent in a successful innovative and networked collaboration. For the enroled actors, dynamic processes in a dynamic ecosystem shift from contact overloads to punctual distances over time. Real-time collaboration therefore requires the actor to morph into passive and active network-actor modes (cf. Rief, 2008).

7 Preparedness to collaborate in adhocracies

This chapter provides conclusive answers to the five research questions (RQs) and the problem statement (PS) formulated in chapter 1. First, the answers to the RQs given in chapters 2 to 6 are reviewed (7.1). Next, the problem statement is addressed (7.2) by short appraisals of the pattern findings, of real-time foresight (RTF), and of the real-time evaluation tools described in chapter 6. The conclusions on the theoretical contributions of the study (7.3) for scholars and academics are then formulated, followed by the conclusions on the practical and managerial contributions (7.4). The limitations of the study are acknowledged (7.5), and the thesis closes with recommendations for future research (7.6).

7.1 Successful ad hoc collaboration as network emergence

Real-time collaboration towards the unexpected is a pitfall for public and corporate strategic management (cf. Brown & Eisenhardt, 1997; Stacey, 2007; Weber et al., 2015), at least as long as traditional management, foresight and strategic planning methods are employed (cf. Nelson, 2010). This thesis has explored the challenge of managing ad hoc collaboration in dynamic innovation processes (PS) by answering five research questions (RQs) that orbit the central PS.

In this section, the five RQs are reviewed. Guided by its research objectives, the study first reviewed management literature with the aim of finding out why traditional management hinders ad hoc collaboration (RQ 1); a research design was then outlined, to explore successful innovation processes in emerging DINs (RQ 2); the research rationale was realised and a long-term process study was conducted to detect network governance patterns (RQ 3); next, a deeper code analysis led to the discovery of three different innovation strategies of DINs in global relief (RQ 4). Finally, a new real-time foresight (RTF) was developed from the findings in order to switch traditional management and planning into collaborative real-time modes; from this newly formulated base, the research outlines a real-time evaluation tool for DINs.

The answers given to the five research questions are summarised below (see Subsections 7.1.1 to 7.1.5).

7.1.1 *Reviewing strategic management traditions*

Ad hoc collaboration in response to complex challenges causes enormous problems for leadership - in private companies, non-profits and governmental agencies alike. Even experienced organisational and administrative actors that use technological foresight (TF) fail in ad hoc collaboration when unpredictable and fast changing ecosystems are under inspection. To investigate the conceptual background of this phenomenon, the following initial research question was formulated:

RQ 1: Why do strategic management and foresight fail in ad hoc collaboration?

Behaviourist concepts have established a strong legacy in microeconomics and from here increased central actor perspectives in strategic management: the dominant idea is one of individual and autonomous actors that compete with other actors in resource scarce environments. Clearly, ex-ante planning and initial goal setting - to gain an edge over market competitors - are the established managerial perspective, and when gaining advantages in stable markets, initial information is a strategic demand.

Thus, this study turned to collective action theories to find a more collaborative management approach for more complex environments and ad hoc collaboration. The intention was to find plurality as a better basis for successful management models for “adhocracies” (cf. Dunn, 2012) but instead there were again strong individualistic influences: the first finding came down to concepts of behaviourism and aggregated individual preferences. In a collective action tradition, the idea of homogeneous groups and formal models calculating the action prevails. In such a view, cooperation appears as a threat to individual self-fulfilment and blocks spontaneous collaboration.

Recent opposition to this potent scientific belief also came from an economic discipline: institutional economy (see, e.g., Ostrom, 1990; 2010). Studies investigated collaborative processes in various forms (cf. Kiser & Ostrom, 2000; Janssen et al., 2008) and identified the ‘working rules’ of norms and factors that contribute to collaborative success: dynamic structures were found that emerge from collective action in real-time.

The thesis reviewed the technological foresight (TF) tradition as a managerial future planning method for coping with uncertainty. TF was assessed as a hierarchic procedure for governing actors’ decision making, but one that was still not valuable for management of uncertain futures by dynamic multi-stakeholder processes – at least not in forms established so far.

A traditional relational approach was revisited next, in the form of network theory. Here, dynamic network concepts, evolutionary network structures, and voluntaristic managerial perspectives were presented. It was found that while many studies celebrate innovation networks as managerial answer to complexity, static network approaches still dominate research and dynamic approaches have so far not been connected to strategic management. From the focused literature review we saw that network governance of dynamic innovation processes still remains a black box for managerial practice.

Figure 2-2 therefore reviewed the juxtaposition of five crucial conceptual elements for traditional management and ad hoc collaboration: actor concept, orientation, managerial role, information, and planning. The assumption that successful ad hoc collaboration relates to the emergence of dynamic innovation networks (DINs) in non-linear processes was formulated. This was situated in an illustrative managerial context - global disaster management – as empirical evidence of the need for a turnaround from traditional strategic management to network governance alongside the identified opposing elements.

The study's answer to RQ 1 was that there is a need for an empirically grounded new RTF in the form of preparedness for ad hoc collaboration. The reasons were: (a) mismatch of time pressure and recent planning routines, (b) mismatch of the traditional central actor perspective and a polycentric process view, and (c) mismatch of available data and investigation frameworks for an examination of dynamic innovation processes.

7.1.2 *Outlining a research design for dynamic innovation networks*

To explore successful management of ad hoc collaboration and DIN emergence, global relief was chosen as the empirical context of managerial practice. In the highly dynamic context of failing or sustainable global-local recovery and successful innovation processes, the second question was asked.

RQ 2: How is it possible to adequately explore successful ad hoc collaboration in DINs?

The chosen design for pattern detection was a constructivist research approach. Using a cross-case process analysis of successful DIN cases, *actor-network* concepts (translation process, see Chapter 2) were combined with a timeline approach, *critical incident* technique (CIT). CI coding and mapping made it possible to put contextual time stamps on the abstract network operations of ANT and so to compare the complex interaction of changing networks over time.

So the four basic operations of network formation - problematisation, interessement, enrolement and mobilisation- were used to build the skeleton of this investigation, but pattern detection was also carried out by exploring the dynamic between concrete CIs. Only the combination of both of the methods allowed the study to identify shared patterns amongst DIN processes.

Chapter 3 described conceptualisation and sampling, data collection, and coding, the complete research design in detail. Primary (interview transcripts) and voluminous secondary data (official and informal documents) were a precondition of implementing the qualitative research design. The data collection for the study covered periods from 2004-2010 (disaster management after the 2004 Tsunami).

7.1.3 *Conducting a cross-case process analysis on DINs*

Based on the new research design described in the chapter 3, dynamic patterns of successful management in ad hoc innovation collaboration were explored. The guiding research question was formulated as follows.

RQ 3: Which network patterns facilitate real-time innovation processes?

Chapter 4 presented three exemplary cases of successful real-time collaboration in global relief after Tsunami 2004 around the villages of Ayam, Keniparam, and Kanni. To explore dynamic network patterns, CIs, heterogeneous actors, and changing network dynamics were retraced in all three collaboration processes from 2004-2010.

Investigating cases, CI-charts, and codes, one case was presented in full detail – that of DIN 1 (Ayam) - from which it was possible to identify significant network dynamics. The study then looked for coherent collaboration patterns in the other two other cases and was able to confirm and consolidate those findings. Five dynamic network patterns were identified that facilitate collaborative innovation processes.

From the findings, a new RTF was developed, and alongside it, two real-time evaluation tools (see Chapter 6). For the sake of completeness, the identified collaborative patterns are repeated below:

1. Early identification and alignment of heterogeneous interests (OPP)
2. Early development of a shared vision
3. Mindful use of boundary objects
4. Punctual directedness and distance amongst implementing actors
5. Double sided network-role of focal actors

7.1.4 *Identifying DIN innovation strategies in global relief*

In all explored cases, innovative activities were part of successful relief. Rather varied focal actor (LNGO) profiles were observed in the network processes, and divergent network strategies were adopted to achieve them. To find out about the different DIN innovation strategies in long-term relief, RQ 4 was formulated.

RQ 4: Which network strategies are used by DINs in global relief?

To answer this question, the study revisited a classic strategic management definition (Mintzberg, 1987) and adapted individual strategies to create collaborative and emergent network strategies.

Based on the double-sided focal actor pattern finding (see Subsection 4.5.5) the coded data was analysed using central codes for focal actor profiles[64] and the collaborative network pattern [65] of each DIN. The subsequent use of ATLAS.ti for computer assisted data analysis revealed three very different innovation strategies:

1. Protective networking (Ayam)
2. Capacity building networking (Keniparam)
3. Global advocacy networking (Kanni)

From networked innovation strategies used in the three case network sample, two polar dimensions of the observed LNGO profiles turned out

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[64] Code: DIMA-interest; CI; NGO-STRAT.

[65] Code: INNOACT; NETDYN; ACT.

to play significant roles in successful real-time collaboration. These portrayed organisational characteristics that do not change in ad hoc situations. The dimensions are:

(a) media usage, and

(b) readiness to scale up.

The partnership between global and local NGO is asymmetric in global relief and potentially successful when it fits in with the respective dimensions. It leads to the development of shared innovation and real-time collaboration strategies. The resulting matching tool presented is not limited to rapid real-time and virtual matching, but also applicable as a taxonomic process management tool for orientation in long-term collaboration processes.

7.1.5 *Developing real-time foresight and outlining real-time evaluation*

Chapter 6 transformed the central finding of the process exploration, using and carrying forward the five dynamic innovation patterns to address the last research question:

RQ 5: How should a well-qualified management team plan and manage dynamic innovation processes?

Here the thesis proposes a novel foresight approach (RTF); a turnaround from traditional planning to preparedness in ad hoc innovation processes. For this, the five dynamic network patterns had to be transformed into organisational process management principles. They are repeated briefly below.

(1) First the *alert* principle: to be aware of the significance of initial periods in a networked situation; to signal one's own position and to identify relevant socio-technical actors for collaboration.

(2) Second the *strict* principle: early development of a shared vision that aligns the heterogeneous interests of all actors. It is a central managerial foresight element, replaces initial goal setting and determines long-term success.

(3) Third the *continuous* principle: boundary objects need to be found or created to mobilise commitment and communication in different aspects of a network. The greater the number of actors in a DIN, the more the use of boundary objects is necessary.

(4) The fourth principle is *adaptive*: leadership has to prepare for time-outs taken by particular network-actors. In dynamic long-term processes, non-visibility and temporal passivity of actors must be tolerable. Intermediary actors (see Chapter 4.) can be included as network support.

(5) The fifth principle requires a *coherent* orientation of activities with the focal actors' profile. In long-term network processes and collaborative innovation, the focal actor role can change over time.

The five principles were first presented as an agenda for contexts of public and for corporate foresight. Then the RTF agenda was put back into the real-time collaboration context of global relief, addressing both governmental and non-governmental actors (TNGOs).

7.2 The turnaround from planning to preparedness

The thesis contributes a new foresight method and instruments to measure dynamic innovation networks (DINs). Real-time foresight offers an alternative to traditional planning: preparedness for an unknown collaboration is a foresight method that reduces uncertainty, but instead of being part of a technical planning process, it confers readiness to act. The method is a substitute for traditional management when it comes to collaborative adhocracies (cf. Mendonça et al., 2007; Dunn, 2012), namely, in complex mass and real-time collaboration, on networked global markets and in innovation processes without initial goals. We asked in the problem statement:

PS: How is it possible to collaborate for successful dynamic innovation processes?

The answer is that we have to prepare for real-time collaboration, not by formulating plans, but by pro-actively adopting a dynamic network collaboration mode in both crisis management and innovation processes.

7.2.1 *Real-time foresight*

Real-time foresight (RTF) for successful ad hoc collaboration is based on the five dynamic network principles listed in the subsection 7.1.5. They compose a strategic agenda.

Implementing this agenda of dynamic innovation processes in an organisational context has impacts for the identified (Chapter 2) crucial managerial elements of (1) actor concept, (2) orientation, (3) managerial role, (4) information, and (5) planning. In a turnaround from traditional strategic management, the identification, protection, and support of emerging DINs will gain priority.

7.2.2 *Real-time evaluation*

The newly formulated base of dynamic network patterns enabled the study to answer the PS with two more tools for improving and assessing dynamic innovation networks: two real-time evaluation tools (RTETs) composed of indicator questions for (1) identifying and (2) assessing DINs.

These evaluation tools are described in the second part of chapter 6. The instruments allow the identification of DINs while entrepreneurial networks emerge. In this, they complement existing evaluation tools for end-of-pipe evaluation in (a) flexible business incubation or nonprofit incubators and (b) global disaster management. Real-time evaluation can be applied before failures are irreversible, and this saves time and provides real-time process feedback. Both instruments enable leadership to identify, select and support sustainable entrepreneurial collaboration while it happens.

7.3 Theoretical contributions

The findings of this thesis contribute to literature of different academic disciplines. They (1) advance concepts of dynamic innovation networks; (2) contribute a new collaborative perspective to strategic management debates; (3) offer a new foresight method (RTF).

(1) The conceptual basis of the study is ANT. The process study confirmed the assumption that there is no magical ad hoc collaboration,

but instead, the emergence of dynamic innovation networks (DINs) from initial contacts and then emerging mutually 'respected' network patterns. Real-time collaboration works where innovation processes develop in co-evolution with network formation: if the underlying dynamic network patterns are respected and not spoilt by hierarchic management of command and control.

As dynamic network approaches, ANT and SNA offer complementary concepts. The findings of this actor-network study invite further empirical research that uses quantitative designs to test the new patterns and categories of real-time collaboration on more voluminous samples (see also Section 7.6).

(2) A collective management investigation finds paradigmatic opposition of two popular collective action approaches. Nobel-laureate Ostrom (Ostrom et al., 1992) brought institutional economics into a position against the seminal "zero contribution thesis" of Hardin and Olson's famous prisoner dilemma (Ostrom, 2000; Ostrom, 2010). Individual choice traditions inherited from behaviourist concepts contradict the collected empirical evidence of worldwide practices of collective action without external coercion. The thesis contributes to empirical research on real-time and real-world processes, but instead of finding out about the evolution of social norms, it aims at finding out about the *dynamics* between heterogeneous network-actors. Contextualisation in time and space thus is a common feature of case study and process research.

(3) The contribution of the study to foresight literature was appreciated from the beginning. Foresight as an expert-based process of 'arranged' audiences is established in many political and corporate

arenas. However, resource intensity and central actor perspective make the method inappropriate for the challenge of ad hoc collaboration. As collaborative real-time foresight (RTF), the method can switch management from planning to preparedness. It is the author's proposition, for complex and unpredictable collaboration situations, to build institutional structures that *are* able to take a network perspective rapidly. Preparedness to start collaborative innovation is the method elaborated here to continue foresight traditions.

7.4 Managerial implications for dynamic innovation processes

The results of this thesis beyond RTF also contribute to practical issues and have implications for the management of ad hoc collaboration in dynamic innovation processes. In the following subsections, two managerial recommendations are provided first for dynamic innovation processes in business incubation (7.4.1) and then for the specific field of sustainable and innovative global relief (7.4.2).

7.4.1 *Business incubation*

The thesis provided new instruments for identifying and evaluating collaborative innovation networks for business incubation and startup support (elaborated as RTET in Chapter 6).

The first recommendation is related to government interventions that aim to foster an innovation culture in national, European, or other regional economic systems. Different policy levels (municipal, regional, European, and global) would profit from real-time evaluation and feedback on DIN emergence. The increasing financial support should reach the most capable networks. This study contributes to real-time collaboration in heterogeneous, virtual and highly flexible startup teams: DINs are powerful alliances for flexible temporal and spatial frames, and more resilient than individual innovators. It is recommended that startup hubs and co-incubation units of both public and private origin use the real-time feedback facilitated by the tool developed in this study to evaluate the emergence of innovation teams. By identification of DIN emergence, further investments could be channeled to the best performing teams. The evaluation of dynamic innovation networks could be undertaken by the different actors involved, or by investors.

The second recommendation relates to corporate management. With regard to co-incubation in businesses, the challenge of innovation team autonomy has recently been highlithed (cf. Gard, 2015; Sailer, Wannags, & Weber, 2016). Corporate management in SMEs is challenged to find the right levels of autonomy for flexible business incubation, always between control and laissez-faire. Here, the dynamic structures of DINs can offer a third governance mode. The evaluation of flexible business incubation teams could be facilitated by the new tool.

7.4.2 *Disaster management*

A process study on innovative and sustainable real-time collaboration in relief certainly has implications for disaster management research and policies. The findings of the study address recent debates on structures and activities[66] of the humanitarian community (see, e.g., Donini, 2012). Some observers criticise the established transnational market-like structure of NGOs, and its failure to impact local societies in vulnerable regions. At the same time, there is a global increase in migration and security issues and humanitarian aid sadly reached record levels in 2016.

The study's first recommendation is that misfits between global players and small local NGOs have been neglected for too long. They need to be tackled in the conceptualisation of responsible rehabilitation instead of continuing a technical aid that remains blind for the differences between the partners. A more rapid and simply better matching of global and local partners for local sustainable outcomes will be essential in future.

The second recommendation is that disaster research has to deliver more managerial guidance. In particular, the identified critical incidents (CIs) invite further research. Testing them in different rehabilitation contexts would confirm the evidence. As they validate crisis management findings (cf. Kapucu, 2005; Comfort, 2007), they (1) enlarge the base of managerial knowledge and (2) provide new data on long-term relief. The concrete CI finding is a new advancement in an increasing stream of emergency literature, and offers valuable categories for an IT enabled and improved disaster management in the field.

The same holds for other codes of the elaborated code book (see Appendix D). The new category system elaborated from the study sample invites further employment. In ATLAS.ti, for example, many more data

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[66] See GHA report 2011 at http://www.un.org/en/ecosoc/julyhls/pdf11/has_gha_report_2011-event_flyer.pdf

operations are feasible but would have exceeded the scope of this study. However, it is time for empirical crisis studies that use existing social media data bases. Blogs, videos, chats and newsticker have the potential to produce ‘big data’in the field. The categories identified for dynamic collaboration and innovation offer a useful first scheme for deeper exploration of innovative and sustainable global relief. In the author’s opinion, this is a research task for the Leiden Centre of Data Science (LCDS) and future experts of international collaboration.

7.5 Limitations

While reasonable precautions were taken to ensure the appropriateness, validity, and conformability of the results of this research, the generalisability of the findings of explorative research is limited mainly due to the following two aspects: limitations of sample and data collection (7.5.1), and of the chosen methodology (7.5.2).

7.5.1 *Sample and data collection*

The limitations of the process analysis are first related to its sample. The study is based on a small sample of N=3 emerging DINs in global relief. These successful DINs were selected for their sustainable relief outcomes eight years after the disaster. However, from literature, expert discussions and close observation of too many failed relief projects, an understanding of failed processes was gained. Within the available limited frame, rich heterogeneity of the sample was sought to ensure methodological rigour. In this, the study does not claim to have shown a totality of DIN facilitating patterns, but does claim to have identified the most important ones. The author advises careful generalisation and invites further testing of the five DIN patterns in many other contexts of real-time collaboration to overcome the sample limitations.

Limitations are also seen in the data collection. Metric data would have allowed for advanced modelling of the five dynamic principles identified. A dynamic systems approach or agent-based simulations could elaborate the more time-sensitive dynamics of the five innovation network principles, namely of the patterns 4 and 5, which deal with coupled and coherent dynamic interaction pattern. Limitations on the level of measurement of data in the sample do not allow for further operationalisation. However, this study profits from exceptional data access, data triangulation and in-depth interviews on long-term relief, which was, until now, a neglected innovation field that is marked by data scarcity.

7.5.2 *Research methodology*

A final short remark concerns the limits of CIT, as an interview methodology. The resulting quota of positive CIs was much smaller than expected (see CI success and compare CI-charts in Appendices C1, C2 and C3). As the term *critical* is meant to equally denote positive *and* negative incidents in theory, this result was a little surprising. In the author's opinion, this can be interpreted in a number of ways: (1) as problematic, indicating interviewer or interviewee effects; (2) as pure information, namely on how the human memory works - negative events are easily recalled, (3) as an instructive part of the findings on disaster management that bears so much more difficulties than actually discussed, or (4) as a weakness of the method, regarding the meaning of a central term in interviewing people. The author interprets the result of predominantly negative CIs as follows: first, they indicate a surprisingly high frequency of change and disruptions to (over-) planned relief collaboration; and second, they tell how global disaster management in the 2004 Tsunami was a traumatic event for leadership of smaller Indian LNGOs, the focused expert group in the sample.

7.6 Future research

The thesis opens up, at least four interesting novel areas for future research: (1) consolidation of the pattern findings; (2) further elaboration and testing of indicators in real-time evaluation of DIN emergence, (3) further investigation of CIs in disaster management, and (4) further discussion of real-time foresight (RTF) as a new collaborative and dynamic management concept that complements traditional management and planning approaches.

(1) First, successful management of DINs might follow more underlying network patterns than have been detected in the study sample. It is suggested that the research design should be applied to a larger real-time collaboration sample to test and enlarge the set of principles. Future studies should ground empirical research in various real-time collaboration fields.

(2) *Second*, the five identified DIN patterns invite further research. Studies could (a) focus on the changing roles of focal network-actors in the course of network evolution (quantitative study); (b) explore the probably difficult creation of shared visions at later moments of the dynamic innovation process (qualitative studies); (c) find out more about the need for punctual directedness and distance in network communication (quantitative and qualitative studies).

(3) *Third*, since 2004, process data on relief has become abundant and gradually more accessible today as we live in a digital society. In most institutions, however, the exponential growth has still to be used for research into process dynamics and CIs. The elaborated CI families are candidates for topics of most relevant management research on social media data and corporate data sources: namely the code families (a) CI net-dyn, (b) CI psysoc, and (c) CI temp (see Appendix E).

(4) *Fourth*, the study looked at RTF as a new dynamic and collaborative management method. The dynamic capabilities approach (cf. Teece et al., 1997; Eisenhardt & Martin, 2000; Barreto, 2010) already addresses flexible capabilities to excel in fast changing environments and markets with unfamiliar problems. Path-dependent dynamic capabilities are recognised in this approach as assets to defeat market competitors in ad hoc processes (Ritala, Heimann, & Hurmelinna-Laukkanen, 2016) but these dynamic capabilities still relate to individual organisational actors. There was a turn to collaborative capabilities (cf. Blomqvist & Levy, 2006), but even here, dynamic capabilities are seen as *one* actor's capabilities to take part in a collaboration. This study's RTF concept, in contrast, contributes a relational perspective and can enhance a research discussion on the approach, as it grounds collaborative capabilities *precisely not* in individual but in plural conditions and in shared practices, the 'working dynamics' of DINs.

The thesis closes our research with a final remark. The research on process dynamics confirms the need for more awareness and greater network dynamics literacy in a digital society. This study invites further research into the digital field of collaborative management and the patterns of innovative adhocracies in a blended virtual real-world, our world.

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Appendices

The list of Appendices consists of six parts, viz. Appendix A to F.

Three Appendices are further subdivided.

Below we list the Appendices together with their subdivision (if applicable).

Appendix A1: CIT questionnaire

Interview outline for narrative interviews

1. Recording permission
2. Remembering Fukushima 2011 – which memories come up related to disaster management in Japan/in Germany/in India
3. Remembering Tsunami 2004 and disaster management of the NGO
4. Reading aloud the introduction
5. Pen and paper offer to scribble and visualize thoughts

Introduction

When disasters hit communities, a large number of people and organisations become active in disaster management. Your organisation became active after Tsunami 2004 hit Tamil Nadu. Activities of response and recovery were a long dynamic process. Most activities related to the Tsunami are finished now, but some might continue, even today.

We are asking you to think back to the disaster and to the ad hoc actions taken in the beginning, then in the following weeks, months, and years. Much new collaboration with old and new partners was started in your organisation.

1. Which most relevant events in real-time disaster management, beginning with the Tsunami itself, do you remember, and

2. Which events changed the plans and ongoing disaster management of your organisation?

Please take your time before you answer. Try to remind slowly the months and years of your collaboration with different partners, and the disruptions by supportive or difficult things. Please use the timeline below to make notes.

Disaster

Dec 2004

Appendix A2: Complementing central questions

Single Incidents

Before - Help me to understand what it was like to do disaster management in this moment? What were the concerns of your organisation at the time?

Do you recall special events preceding the incident?

During - Who reacted to this critical incident?

What did others do? What was important at that time? Why?

How could it be communicated? What questions of your own organisation do you remember, and which ones from partners?

How were you informed? Did most people hear it that way?

Did you feel well informed when the incident happened?

How did your organisation react (alone – with other organisations)?

Who decided?

What kind of resources was needed?

After – what was changed by this incident?

How did the network of your organisation change after this incident?

Did the incident change disaster management inside your network?

Did the incident change disaster management outside your network?

Organisation

When did your organisation start, what were and are its main activity fields?

In how many places did and does your organisation operate?
How are decisions made in your organisation (central, decentral)?
How is information spread usually within your organisation (channels, events, technical tools)?
Why did your organisation engage in disaster management after Tsunami 2004?
What other fields is your organisation working on?
What prepared your organisation for disaster management?
What is important to your organisation?

Partners

Who have been the partners of your organisation in disaster management?
How did you find and relate to them?
Did their number change over time?
Which partners are most important to your organisation?
Is your organisation looking for new partners?
How does your organisation communicate with partners (priorities, channels, events)?
Are there reasons for your organisation to say “No” to a partnership?
What are, in your opinion, differences between local and international partners regarding information/decision making/technical standards/routines/expectations/activities?

Innovation

In disaster management and reconstruction after Tsunami 2004, which things and processes were considered new by your organisation? How were they brought up?

Which things and processes were considered new by your partners?

If you think of innovation, did it come from organisational partners? From own activities? Or, from external actors?

Did you see any health care processes or products for the first time, in disaster management?

Are there, in your opinion, technical innovations related to disaster management after Tsunami 2004?

Are there social innovations related to the disaster and recovery process?

Competition

Within a multitude of actors, at which points will competition grow?

Did your organisation come into competitive situations with other actors?

How were the situations solved?

What is a typical resource, or thing, or place that in response to competition did arise?

Communication and coordination

In which events or at what calendar times did your organisation take part?

What did your organisation do to coordinate activities with partners?

Have there been special meetings for coordination?

Have you been able to decide on your own strategies in recovery?

At which points did your organisation face problems in coordination with other actors?

What was the tool or rule to solve coordination problems?

In the course of disaster response, have new members been included into your network?

Has ICT played a role in response activities after Tsunami 2004? Where was it used?

Did your organisation miss more communication with some partners at some times?

When are expectations communicated between partners - in the very beginning of cooperation or at special events?

Issue rising

How did your organisation raise issues in the project network?

What issues have been raised?

What issues did your partners raise?

What issues have been left behind in disaster management? Why?

Which techniques helped in issue rising?

Which elements from “outside” raised issues for disaster management?

How were interorganisational issues tackled?

Visibility and media

How did your organisation find right partners?

What did your organisation do to be visible?

Who should see your organisations activities?

Who should see your partners' activities?

What kinds of things were used to make organisations visible?

What have been problems in making organisations and activities visible?

What kind of media was involved? At which occasion?

Has media involvement been useful or harmful to your organisation/ your partners

What media channels is your organisation using?

Were these already used before Tsunami response activities?

Appendix B: List of data sources

	DIN 1	DIN 2	DIN 3
Primary Data			
Interview local NGO	X	X	X
Interview transnational NGO	X	X	X
Interview intermediary NGO	X	X	X
Interview donor NGO	X	X	
Interview governmental actor		X	X
Participant observation	X	X	X
Control Case data: Fukushima 2011 – Hayan 2014	X		
Secondary Data			
Annual Reports Local NGO	X	X	X
Governmental Documents	X	X	X
Sectorwise NGO list	X		
Evaluation Report	X	X	X
Project contract	X	X	X
Project fotobook[67]			X
Control case data: Fukushima 2011 – Hayan 2014	X		
Additional data on Tsunami 2004			
Newspaper clippings THE HINDU 2005-2006	X		
Tsunami evaluation reports	X		
Governmental disaster act	X		
Magazine articles on disaster management in global relief 2010-2015	X		
Global risk reports, Hyogo framework of action	X		

[67] Photographies by Sutera, P. 2007. *Die Kinder des Tsunami*. Glashütten: C&P Verlag.

Appendix C1: List of complete CIs in CI code families

Code-Family	N=39	Code
CI conflict	N=5	CI child trafficking CI doubling self-help groups CI legal barriers CI opposition to government CI skilled labor fluctuation
CI netdyn	N=14	CI competition CI contact overload pressure CI contract CI cooperation CI cooperation need assessment CI decision making CI different goals in reconstruction CI distribution CI donor travel CI lack of coordination CI lack of information CI local people disaccord CI new partner CI punctdirdis
CI psysoc	N=4	CI fear of sea CI medicare CI money spoiling self reliance CI visibility
CI resource	N=6	CI duplication CI lack of management capacity CI lack of resources CI money overload CI boat repair CI rising market prizes
CI success	N=3	CI innovative action CI solution CI LFT workshop
CI temp	N=7	CI ending relief action CI NGO Influx CI starting relief action CI starting workshop CI time pressure housing delay CI urgent CI inauguration

Appendix C2: CI-chart Keniparam

12 actors N=166	2004 Disaster	2005	2006
Local NGO	CI competition CI lack of management capacity CI starting relief action CI cooperation CI lack of resources	CI lack of information CI lack of management capacity CI contract CI local people disaccord CI NGO Influx CI competition CI distribution CI solution	CI contract CI contact overload pr. CI local people disaccord CI competition CI money spoiling self reliance CI lack of management capacity CI rising market prices
Transnational NGO 1	CI new partner CI cooperation need assessment CI competition	CI competition CI NGO Influx CI lack of resources CI new partner CI punctdirdis	CI lack of information CI competition CI distribution
Transnational NGO 2	CI cooperation need assessment CI competition	CI new partner CI contract CI cooperation need assessment CI duplication CI different goals in reconstruction	CI skilled labor fluctuation CI opposition to government CI local people disaccord
TNGO 3		CI new partner CI money overload	CI punctdirdis
Intermediary NGO	CI cooperation need assessment	CI new partner CI punctdirdis CI donor travel CI distribution CI lack of information CI fear of sea	CI lack of information CI skilled labor fluctuation CI lack of management capacity

Appendix C2 (continued 1)

2007	2008	2009	2010
CI punctdirdis CI opposition to government CI local people disaccord CI distribution CI money spoiling self reliance CI contact overload pressure	CI houses CI cooperation	CI money overload CI local people disaccord CI opposition to government CI contact overload pressure	CI end of relief
CI lack of management capacity CI skilled labor fluctuation CI punctdirdis	CI houses CI donor travel CI lack of information CI visibility		CI lack of information CI decision making
CI opposition to government CI skilled labor fluctuation CI solution CI distribution	CI houses CI donor travel	CI money overload CI punctdirdis	CI money overload
	CI end of relief		
CI houses CI visibility	CI houses CI donor travel		

Appendix C2 (continued 2)

	2004	2005	2006
Local Government	CI different goals in reconstruction CI cooperation need assessment CI lack of coordination CI NGO-Influx CI contact overload	CI contract (Disaster Act; Coastal Regul Act) CI NGO Influx CI punctualdiridis CI fear of sea CI opposition to government	CI cooperation need assessment CI money overload CI time pressure housing delay
Local Media	CI starting relief action CI lack of information CI visibility	CI local people disaccord CI skilled labor fluctuation CI fear of sea	CI ending relief action
Global Media	CI starting relief action CI lack of information	CI NGO influx CI Lessons Learned Workshop	CI ending relief action
Local Community	CI lack of resources CI lack of information CI distribution CI competition	CI local people disaccord CI donor travel CI fear of sea CI competition CI donor travel	CI donor travel CI local people disaccord CI opposition to government CI duplication
Local Houses		CI starting relief action CI rising market prices	
Contract		CI starting relief action CI new partner CI lack of resources CI rising market prices	CI cooperation
Mail	CI starting relief action		

Appendix C2 (continued 3)

2007	2008	2009	2010
CI time pressure housing delay CI money overload CI local people disaccord CI distribution	CI time pressure housing delay CI local people disaccord CI gender CI rising market prices	CI rising market prices CI NGO influx	CI time pressure housing delay
	CI solution		
	CI solution		
CI donor travel CI medicare CI child trafficking CI cooperation CI legal barriers CI contact overload	CI houses CI competition CI innovative activity	CI distribution CI opposition to govern-ment CI duplication	
CI opposition to govern-ment	CI solution		
CI cooperation	CI ending relief action		
			CI ending relief action

Appendix C3: CI-chart Kanni

11 actors N= 133	2004 Disaster	2005	2006
Local NGO	CI child trafficking CI starting relief action CI opposition to govern-ment CI cooperation need assessment	CI NGO Influx CI contract CI legal barriers CI new partner CI time pressure housing delay CI rising market prices CI cooperation need assessment	CI punctualdirdis CI time pressure housing delay CI solution CI medicare
Transnational NGO	CI cooperation need assessment	CI competition CI NGO Influx CI different goals in reconstruction CI rising market prices CI contract CI new partner	CI lack of information CI competition CI cooperation need assessment CI NGO Influx CI solution
Intermediary NGO	CI decision making CI cooperation need assessment CI competition	CI distribution CI lack of coordination CI contract CI contact overload pres-sure CI LessLearn Workshop	CI punctdirdis CI donor travel CI cooperation need assessment CI NGO Influx CI solution
Local Government	CI different goals in reconstruction CI cooperation need assessment CI lack of coordination CI NGO-Influx CI contact overload	CI contract (Disaster Act; Coastal Regul Act) CI NGO Influx CI punctual diridis CI fear of sea CI opposition to govern-ment	CI cooperation need assessment CI money overload CI time pressure housing delay CI rising market prices

Appendix C3 (continued 1)

2007	2008	2009	2010
CI skilled labor fluctuation CI punctdirdis CI local people disaccord CI different goals in reconstruction	CI skilled labor fluctuation CI donor travel CI local people disaccord CI medicare	CI innovative action CI donor travel CI local people disaccord CI skilled labor fluctuation	CI innovative action CI local people disaccord CI medicare
CI skilled labor fluctuation CI innovative activity	CI different goals in reconstruction		
CI donor travel CI punctdirdis	CI punctdirdis		
CI time pressure housing delay CI money overload CI local people disaccord CI distribution	CI time pressure housing delay CI local people disaccord CI gender CI rising market prices	CI rising market prices CI NGO influx	

Appendix C3 (continued 2)

	2004	2005	2006
Local Media	CI starting relief action CI lack of information CI visibility	CI local people disaccord CI skilled labor fluctuation CI contact overload pressure	CI innovative action CI punctdirdis CI solution
Global Media	CI starting relief action CI lack of information	CI NGO influx CI Lessons Learned Workshop	CI ending relief action
Gl. Donor NGO		CI starting relief action	CI solution CI contact overload
Gl. Private Company		CI starting relief action	
Local Community	CI lack of resources CI lack of information CI lack of management capacity CI contact overload	CI medicare CI time pressure housing delay	CI medicare CI cooperation
Contract		CI starting relief action CI starting relief action CI new partner	CI starting relief action CI ending relief action CI rising market prices
Green Bus	CI starting relief action		

Appendix C3 (continued 3)

2007	2008	2009	2010
CI innovative actionr	CI innovative action	CI innovative action	CI innovative action
		CI innovative action	
CI innovative action CI punctdirdis			
CI ending relief action			
CI medicare	CI medicare CI different goals in re-construction	CI medicare	CI medicare
CI time pressure hous-ing delay	CI different goals in re-construction	CI different goals in re-construction	
CI ending relief action			

Appendix D: Codebook

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Number of Codes: 123, commented: 120

Code Info		Comment
ACT	■	Element of an heterogeneous actor-network; a socio-technical hybrid.
ACT-boats		Fisher boats destroyed/restored as livelihood item
ACT-coastal regulation act		Indian Governmental Act issued in 2005 following Tsunami 2004
ACT-contract		Contract of relief programme
ACT-disaster management act		Indian Governmental Act issued 2005 following the disaster of Tsunami 2004
ACT-donors		Organizations und humans that transfered money to support disaster management after Tsunami 2004
ACT-global NGO		Non-governmental organization of global operational structure in reach of activities, standards and resources
ACT-gov		Actors that belong to the Indian Government, here often district collectors in Tamil Nadu state districts
ACT-houses		Houses destroyed by Tsunami and then under reconstruction attracting the interest of a majority of relief actors
ACT-intermediary NGO		NGO that has an intermediary position between global and local Indian NGO
ACT-local NGO		NGO routet in a local region culturally and economically

ACT-local-people	■	Actors from local communities
ACT-mail	■	Material actors in electronical or postal mail form
ACT-media	■	Material actors being media devices f.ex. newspaper, radio, social media
ACT-military	■	Military units in relief activities
ACT-NGO	■	Non-governmental actors in heterogeneous relief networks aligning with governmental, military, for-profit and technical actors.
ACT-police	■	Human and non-human actors belonging to local police structures
ACT-private company	■	Corporate network actors with a for-profit orientation
ACT-reports	■	Documents carrying relief information within heterogeneous actor-networks
ACT-telefone	■	Technical actor enabling ad hoc and mobile communication, a cellphone or a landline telephone.
CI	■	Critical incident which changes activities and plans in real-time.
CI medicare	■	Incident or activity adressing medical needs
CI-boat repair	■	Incidental problems with quality of produced boats and catamarans
CI-child trafficking	■	Incidental local occurrence of child trafficking
CI-competition	■	Incidental competition of actors in real time disaster management
CI-contact overload pressure	■	Incidental pressure on actor by contact overloads (IT and physical communication)
CI-contract	■	Incidental contract signing for relief and rehabilitation projects between relief actors

CI-cooperation	▪	Cooperation activity or incident impacting one or more organizations
CI-cooperation need assesment	▪	Incidental investigation in local and cooperation needs
CI-decision making	▪	Incident of decision making impacting ongoing plans
CI-different goals in reconstruction	▪	Incidental appearance of different goals of heterogeneous actors
CI-distribution	▪	Incidental distribution problem or solution
CI-donor travel	▪	Incidental visit of global donor organization at local site
CI-doubling self-help groups	▪	Incidental appointment of parallel self-help structures doubling existing activities
CI-duplication	▪	Incidental replication of relief activity in a place where it already exists
CI-ending relief action	▪	End of one or more relief components
CI-fear of sea	▪	Occurrence of post traumatic stress in fisher families
CI-inauguration	▪	[no entry]
CI-innovative action	▪	Incident of an innovative action undertaken by network-actors
CI-lack of coordination	▪	Situation of absence of coordination impacting actors activities
CI-lack of information	▪	Situation of absence of information impacting actors activities
CI-lack of management capacity	▪	Situation of absence of management capacity impacting relief activites
CI-lack of resources	▪	Situation of absence of tangible or intangible resources

CI-legal barriers	▪	Incidental confrontation between legal structures and actors activities
CI-LFT workshop	▪	[no entry]
CI-local people disaccord	▪	Incidental situation of dissacord between local community and other relief actors
CI-money overload	▪	Incidents related to an overload of funds and donations
CI-money spoiling selfrelience	▪	Behaviour or perception that financial input changed behaviour in affected villages
CI-new partner	▪	Inclusion and change of new partners in a dynamic network
CI-NGO influx	▪	Incident of high influx of NGO in a local region
CI-opposition to government	▪	Incidental dissaccord between governmental and non-governmental actors
CI-punctual dirdis	▪	Punctual directedness and distance to implementing network-actors
CI-rising market prices	▪	Issues and incidents related to rising market prices in reconstruction
CI-skilled labour fluct	▪	Incidents of real time fluctuation of skilled labour in relief
CI-solution	▪	Incidental solution for a problem in the reconstruction process
CI-starting relief action	▪	Incidental beginning of a relief activity
CI-starting workshop	▪	Incidental start-up inauguration in relief network 1
CI-time pressure housing delay	▪	Issues related to delay in housing reconstruction or prolonged life in temporary shelters
CI-urgent	▪	Time sensitive ad hoc action

CI-visibility		Issues related to visibility practices
COLLAB-CHALLENGE		Real-time challenge for multiple actors that have to collaborate under goal uncertainty and without central management.
COLLAB-CHALLENGE-competition		Collaboration challenge involving competition between actors
COLLAB-CHALLENGE-confusion		Collaboration challenge due to or provoking confusion
COLLAB-CHALLENGE-long-term		Collaboration challenge related to long-term relief
COLLAB-CHALLENGE-rel		Collaboration challenge involving interreligious question
DIMA		All activities related to expected, occuring or past disasters.
DIMA-effects		Effects and outcomes of global-local disaster management
DIMA-exp		Experiences of organizations and networks in disaster management
DIMA-interest		Interest actors or networks pursue in disaster management.
DIMA-limits		Limits of disaster management by one or more actors or networks
DIMA-resources		Resources enabling disaster management
DIMA-stages		Activities in and perceptions on disaster management related to phases in long-term relief
DIS-effects		Disaster impact of Tsunami 2004
DIS-exp		Real time experiences of different actors
HEALTH-phys		All accounts on health issues that relate to physiological problems

HEALTH-psy	□	All accounts of health issues in disaster management related to psychological problems
INNOACT	■	Innovative activities in real-time disaster management.
INNOACT-distribution	□	Innovative activity related to distribution problems in relief
INNOACT-eshiporient	□	Innovative activity in relief increasing entrepreneurial orientation
INNOACT-forprofit	□	Innovative activity in relief related to business
INNOACT-gender	□	Innovative activity in relief related to gender aspects
INNOACT-learning	□	Innovative activities related to learning processes in relief
INNOACT-medicare	□	Innovative activities in relief related to the medical field
INNOACT-NGOactivity	□	Innovative activity by a non-governmental actor
INNOACT-startup	□	Innovative activity involving start-ups
NETDYN	■	Network dynamic between actors in real time collaboration
NETDYN-capBuild	□	Network relations between actors that foster capacity building on institutional level
NETDYN-capBuild-Housing	□	Network relations fostering capacity building in housing
NETDYN-capBuild-Res	□	Network relations providing resources for capacity building
NETDYN-capBuild-Train	□	Network relations contributing to training and capacity building
NETDYN-churchNGO	□	Network relations between religious and NGO actors

NETDYN-coordination		Networked processes of coordination
NETDYN-distrust		Network relations showing distrust between actors
NETDYN-emerge		Network relations enhancing network emergence
NETDYN-globloc		Real-time collaboration in global-local relief networks.
NETDYN-govNGO		Real time cooperation in networks between governmental and NGO actors
NETDYN-inklus		Dynamic of network inclusion of unusual actors
NETDYN-leadership		Network dynamics related to leadership and governance
NETDYN-locNeed		Network dynamic arising around local needs
NETDYN-missing local knowledge		Network dynamics arising around missing local knowledge
NETDYN-NGOexclusion		Network processes that exclude NGO
NETDYN-NGOLocCom		Network processes between local community and NGO
NETDYN-NGONGO		Network dynamics between different NGO actors
NETDYN-scale-up		Network dynamics related to organizational up scaling
NETDYN-trust		Network dynamics related to trust between actors
NGO-STRAT		The way an organization collaborates and influences the relief process.
NGO-STRAT-advocacy		[no entry]
NGO-STRAT-community development		Activity advancing NGO relief strategy towards community building

NGO-STRAT-coordination	■	Activity advancing NGO relief strategy towards better coordination
NGO-STRAT-differences	■	Situation marking differences in NGO relief strategies
NGO-STRAT-entrepreneurship	■	Activity advancing NGO relief strategy towards entrepreneurship
NGO-STRAT-equal rights	■	Activity advancing NGO relief strategy towards equal rights
NGO-STRAT-expKnow	■	Activity advancing NGO relief strategy based on expert knowledge
NGO-STRAT-gender	■	Activity advancing NGO relief strategy towards gender rights
NGO-STRAT-media-behaviour	■	Activity related to NGO relief strategy regarding use of media
NGO-STRAT-multiple donors	■	Activity indicating NGO relief strategy of multiple donor inclusion
NGO-STRAT-scale	■	Activity related to will or unwill of NGO to scale up in relief
REAL TIME-plan	■	Account of real time planning in relief
SUSTAINABILITY	■	Sustainable outcomes of disaster management meeting the triple bottom-line.
SUSTAINABILITY-eship	■	Activities that aim at or yield in sustainability and entrepreneurial orientation or activity
SUSTAINABILITY-resilience	■	Activities related to sustainable outcomes of disaster management, especially resilience of local structures
TIMELINE	■	Disaster management activities related to a timeline, chronological orientation of actors
VIS	■	Visibility or invisibility of artifacts, organizational actors and activities

Appendix E: List of code families

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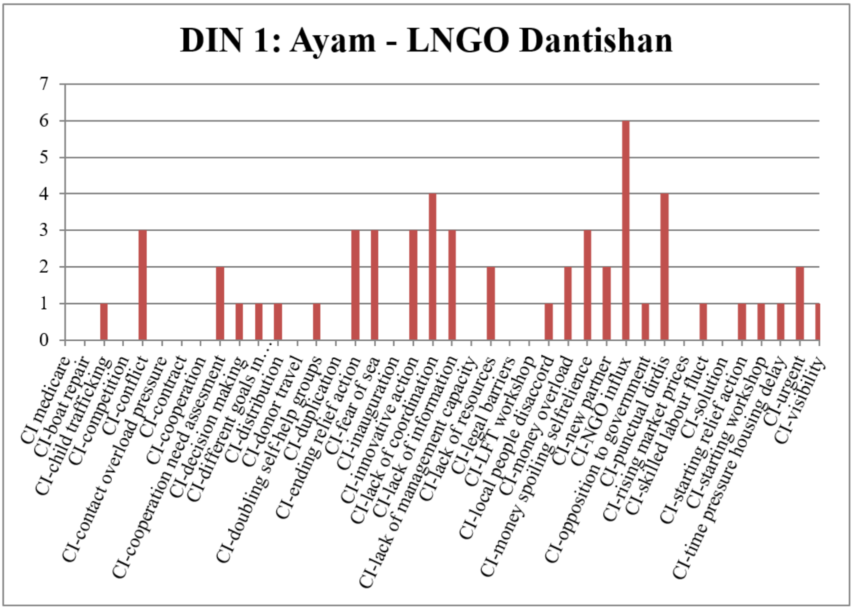
List of 2 code families of the codes ACT and CI

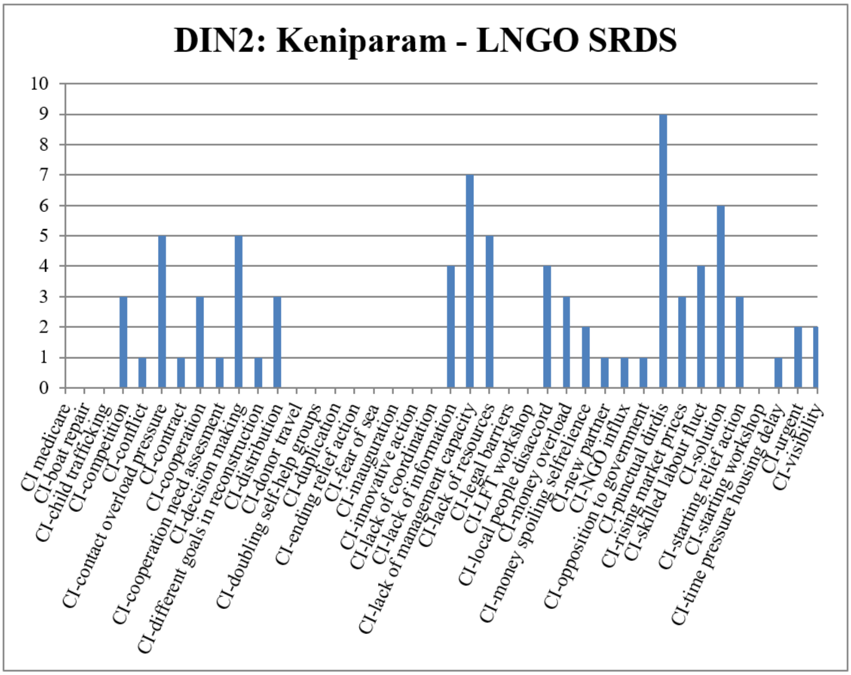
Code Family	Codes
ACT-non-org	• ACT-boats • ACT-coastal regulation act • ACT-disaster management act • ACT-donors • ACT-gov • ACT-mail • ACT-media • ACT-reports • ACT-telefone
ACT-org	• ACT-global NGO • ACT-intermediary NGO • ACT-local NGO • ACT-military • ACT-NGO • ACT-police • ACT-private company
CI-conflict	• CI-child trafficking • CI-doubling self-help groups • CI-legal barriers • CI-opposition to government
CI-net-dyn	• CI-competition • CI-contact overload pressure • CI-contract • CI-cooperation • CI-cooperation need assesment • CI-decision making • CI-different goals in reconstruction • CI-distribution • CI-donor travel • CI-lack of coordination • CI-lack of information • CI-local people disaccord

	• CI-new partner • CI-punctual dirdis
CI-psysoc	• CI medicare • CI-fear of sea • CI-money spoiling selfrelience • CI-visibility
CI-resources	• CI-boat repair • CI-duplication • CI-lack of management capacity • CI-lack of resources • CI-money overload • CI-rising market prices • CI-skilled labour fluct
CI-success	• CI-innovative action • CI-LFT workshop • CI-solution
CI-temp	• CI-ending relief action • CI-inauguration • CI-NGO influx • CI-starting relief action • CI-starting workshop • CI-time pressure housing delay • CI-urgent

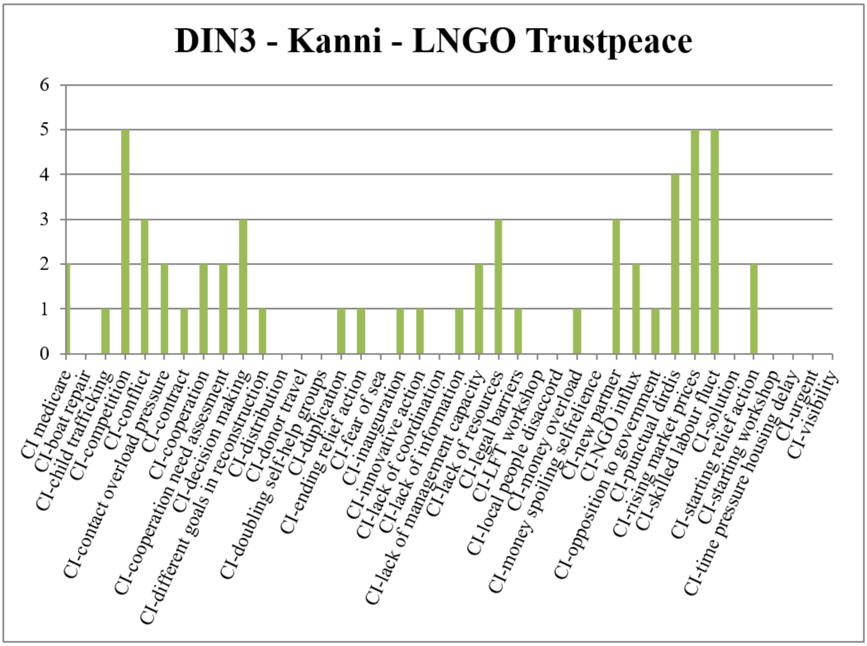
Appendix F1: Cross-tabulation of CIs and LNGOs/DINs in Ayam



Appendix F2: Cross-tabulation of CIs and LNGOs/DINs in Keniparam



Appendix F3: Cross-tabulation of CIs and LNGOs/DINs in Kanni



Summary

In a global society, boundaries of time and space are blurring, increasing mobility and digital networks accelerate our lives in many fields to ‘global time’. The consequence is an increasing degree of unpredictability and multi-stakeholder environments that are more dynamic than before.

Traditional planning and strategic management stem from the past century, and rely on central actor instead of network actor perspectives. Leadership in public and in corporate management still starts from these planning and decision-making concepts tailored to hierarchical cooperation and predictable environments. This leadership immobilises innovation processes, it blocks ad hoc collaboration and network emergence in urgent response situations. Thus, real-time processes increasingly reveal a managerial misfit for heterogenous actors in dynamic innovation processes.

Observation of the developments mentioned above led to the following problem statement (PS).

PS: *How is it possible to collaborate for successful dynamic innovation processes?*

A process study on sustainable, innovative collaboration in an exemplary, and highly dynamic, field was undertaken. Successful collaboration patterns from dynamic innovation networks (DINs) which arose during global-local disaster management following the 2004 Tsunami were explored. Five research questions (RQs) were asked in response to the PS.

Chapter 1 presented the problem statement (PS) and formulated five research objectives related to the five RQs that guide the reader's way through the chapters. Chapter 2 showed why traditional management theory hinders ad hoc collaboration; chapter 3 explained the design of an incident-sensitive and time-sensitive methodology for exploring non-linear innovation processes; chapter 4 documented the cross-case process analysis that was used to detect dynamic network patterns; in chapter 5, the thesis aimed to identify the innovation strategies that the different DINs deploy in sustainable global relief; chapter 6 developed a new real-time foresight method (RTF) to enable practitioners to switch from traditional management and planning to network governance of dynamic innovation processes. The conclusions are given in chapter 7 together with a perspective on future research.

The research objectives were implemented chapter by chapter in answer to the following research questions. The RQs are listed below, together with the research outcomes.

RQ1: *Why do strategic management and foresight fail in ad hoc collaboration?*

Traditional concepts of foresight, strategic management and network theory were revisited in terms of their impact on conceptual management problems of real-time collaboration (Chapter 2). The findings led to the formulation of the research rationale for this study.

RQ2: *How is it possible to adequately explore successful ad hoc collaboration in DINs?*

The selection of the research method (Chapter 3) and sampling were described in this section and the empirical part of the thesis was explained. The qualitative research process (GTM) was described as involving waves of data collection and data analysis in the context of long-term innovation processes in global relief. The chapter ended with a methodological rigour check.

RQ3: *Which network patterns facilitate real-time innovation processes?*

Three cases of real-time collaboration towards sustainable ends were showcased and explored in detail using ANT (actor-network theory), CIT (critical incident technique) and GTM (grounded theory methods). The rapidly emerging network collaborations and their successful evolution over the years were retraced from multiple global and local actor perspectives. The combination of ANT and CIT allowed for the detection of successful DIN patterns, and of punctual and continuous dynamics in non-linear long-term innovation processes.

Five collaborative network patterns were identified as dynamic, collaborative governance structures (Chapter 4) of a successful ad hoc collaboration. These dynamic network patterns are complementary to traditional strategic management in predictable environments. They read as follows: (1) the early and continuous identification of heterogeneous network actors in alignment of interests, (2) the early development of a shared vision that encourages visibility, commitment, monitoring and sequential goal setting, (3) mindful use of boundary objects as intermediaries, (4) punctual directedness and distance among network-actors, (5) local integration by network orientation towards focal actors.

RQ4: *Which network strategies are used by DINs in global relief?*

The study investigated the innovation strategies of the three DINs (Chapter 5) and found that there were variance of three types of network:

(a) the protective network, (b) capacity building network, and (c) global advocacy network. The LNGO profiles strongly influenced successful collaboration strategies, and it was the polar dimensions of (1) media alertness and (2) readiness of an LNGO to scale up that made a difference in ad hoc collaboration. Related to this finding, a tool was offered to improve matching in asymmetric global-local disaster management for sustainable and innovative relief.

RQ5: *How should a well-qualified management team plan and manage dynamic innovation processes?*

Chapter 6 developed a new RTF: the five dynamic network patterns were transformed into managerial principles. As a further application, two robust real-time evaluation tools (RTETs) to identify and measure the performance of dynamic innovation networks in real-time were constructed.

Qualitative studies in social science result in new knowledge that helps to model or measure social phenomena. The managerial method developed here is one of conceptual concern. It advances theory building from vertical to lateral dynamic process management and co-production. It confirms the assumption that investigating collective action with individual actor approaches is first an analytical and then becomes a practical mistake (Arendt & Jaspers, 1955; Ostrom, 1990; Scarry, 2012). The real-time foresight method (RTF) developed here switches (Castells, 2000) strategic management into a collective innovation management. It tries to integrate contingency and chaotic complexity into effective innovation management (Sarasvathy, 2001; Ries, 2011) for the networked and digital society that we live in today.

Real-time foresight (RTF) replaces traditional planning where entrepreneurs from public, corporate or civil aspects of society start collaboration without initially predictable goals and working rules. RTF and the real-time evaluation tools of DINs may be useful for transnational global players as well as for start-up companies, and also for assessment in incubators, in post-disaster areas, in markets, in schools and even in parliaments. Collaborative innovation processes are always a challenge, and each time actors have to start a journey into the unexpected. While many future challenges are unforeseeable today, preparedness for dynamic innovation networks assures actors that they will be able to master the challenge in networked ways.

Samenvatting

In onze huidige wereldwijde samenleving zijn de grenzen van ruimte en tijd vervaagd. Toenemende mobiliteit en digitale netwerken versnellen ons leven in veel gebieden naar een “globale ruimte” van plaats en tijd. Het gevolg daarvan is dat de onvoorspelbaarheid toeneemt en dat leef- en werkomgeving een hogere dynamiek kent dan ooit te voren en veel meer “stakeholders” heeft.

Het traditioneel *plannen* van activiteiten en het daarbij behorende strategische management stammen uit de vorige eeuw, en berusten op een centrale regelaar in plaats van een netwerk-regelaar met wijde perspectieven. Toch zien we nog steeds dat leiderschap in publieke omgevingen en in corporate management begint vanuit de oude hierboven genoemde planning en vanuit de beslissingsconcepten die toegesneden zijn op een hiërarchische samenwerking en voorspelbare omgevingen. Zulk een leiderschap “immobiliseert” innovatieprocessen; het blokkeert ad hoc samenwerking en het ontstaan van nieuwe netwerken in situaties die om directe actie vragen. Het is derhalve niet verwonderlijk dat in toenemende mate *real-time* processen een management *misfit* blootleggen bij dynamische innovatieprocessen met heterogene partners.

Het onderkennen van ontwikkelingen als hierboven vermeld is de grondslag voor de probleemstelling (PS) van dit onderzoek.

PS: Hoe dient samenwerking plaats te vinden om te komen tot succesvolle dynamische innovatieprocessen?

Om de PS te beantwoorden hebben we een studie uitgevoerd naar innovatieve samenwerking die *sustainable* is en zich afspeelt in een uitzonderlijk veld met een hoge dynamiek. Wij hebben gezocht naar samenwerkingspatronen die voorkwamen in dynamische innovatienetwerken

(DINs) na de Tsunami in 2004. Daarbij concentreren we ons op succesvolle globale-locale disaster-management structuren. Voor de beantwoording van de PS hebben we vijf onderzoeksvragen (OVs) geïdentificeerd.

In hoofdstuk 1 formuleren we de probleemstelling (PS) en vijf onderzoeksdoelen, die gerelateerd zijn aan de vijf onderzoeksvragen. De OVs zijn leidend voor de beschrijving van het onderzoek. In hoofdstuk 2 tonen we aan waarom de traditionele management theorie ad hoc samenwerking in de weg staat. Vervolgens beschrijven we in hoofdstuk 3 het ontwerp van een incident-gevoelige alsmede tijd-gevoelige methodologie die in staat is niet-lineaire innovatieprocessen te onderzoeken. In hoofdstuk 4 voeren we een *cross-case* proces-analyse uit om dynamische netwerkpatronen te ontdekken. Daarna identificeren we in hoofdstuk 5 vanuit de analyse innovatieve strategieën die de verschillende DINs leiden naar een *sustainable* en wereldwijde hulpverlening. In hoofdstuk 6 ontwikkelen we een nieuwe *real-time foresight* methode (RTF). Deze RTF stelt ons in staat om gemakkelijk te switchen van traditioneel management en traditionele planning naar een netwerk-bestuur van dynamische innovatieprocessen. Onze conclusies formuleren we in hoofdstuk 7, te zamen met een perspectief op het toekomstige onderzoek.

De onderzoeksdoelen worden per hoofstuk behandeld en geïmplementeerd in overeenstemming met de OVs. Hieronder formuleren we de OVs en geven we de door ons gevonden antwoorden (het resultaat van ons onderzoek).

OV1: Waarom falen strategisch management en *foresight* in ad hoc samenwerkingen?

In hoofdstuk 2 worden de traditionele concepten van *foresight*, strategische management, en netwerk-theorie opnieuw onderzocht naar hun impact op de conceptuele management-uitdagingen bij *real-time* samenwerking. Het antwoord leidt tot de onderzoeks rationale van de dissertatie.

OV2: Hoe onderzoeken we op een adequate en succesvolle manier ad hoc samenwerking in dynamische innovatienetwerken?

In hoofdstuk 3 worden de keuze van de onzerzoeksmethode en de *sampling* uitvoerig beschreven. Voorts wordt het empirische deel van de dissertatie besproken. Het kwalitatieve onderzoeksproces berust op GTM (zie verderop) en wordt beschreven aan de hand van de gevolgde fasen van data-verzameling en data-analyse. Dit gebeurt in de context van lange-termijn innovatieprocessen die tot een globale hulpverlening leiden. Het hoofdstuk eindigt met een methodologische *check* op de nauwkeurighied van het onderzoek.

OV3: Welke netwerkpatronen faciliteren *real-time* innovatieprocessen?

In hoofdstuk 4 worden drie casus van *real-time* samenwerking naar *sustainable* doelen beschreven en in detail onderzocht met gebruikmaking van ANT (actor-neural theory), CIT (critical incident technologie) en GTM (grounded theory methods).

De razendsnelle opkomst van de netwerksamenwerking en de succesvolle evolutie gedurende de laatste decennia is onderzocht vanuit veelzijdige globale en locale handelingsperspectieven. De contributie van ANT en CIT heeft gezorgd voor de identificatie van succesvolle DIN-patronen, nauwkeurige (punktliche(!) en continue *dynamics* in een niet-lineair lange-termijn innovatieproces).

Het resultaat van dit hoofstuk is vijf samenwerkende netwerkpatronen die leiden tot de formulering van drie dynamische samenwerkings governance-structuren voor succesvolle ad hoc samenwerking. De vijf patronen worden als volgt aangeduid: (1) de vroegtijdige en voortdurende identificatie van heterogene netwerk-actoren waarbij aansluiting bij de belangen van alle partijden goed in het oog wordt gehouden, (2) de vroegtijdige ontwikkeling van een gedeelde visie die zorgt voor zichtbaarheid, *commitment*, monitoring en een sequentiële wijze van het formuleren van doelstellingen, (3) weloverwogen gebruik van mogelijk grensverschijnselen als essentiële intermediaire actores, (4) duidelijke directe aansturing van de netwerk-actoren en tevens het afstand bewaren van de netwerk-actoren, en (5) locale integratie door de netwerk-orientatie die is gericht op lokale actoren.

OV4: Welke netwerkstrategieën worden gebruikt door DINs die leiden tot wereldwijde hulpverlening?

In hoofdstuk 5 onderzoeken we de innovatiestrategieën van de drie DINs. We vinden dat er drie typen netwerk zijn, te weten (a) een *protective network*; (b) een *capacity building network* en (c) een *global advocacy network*. De LNGO profiles beïnvloeden de succesvolle samenwerkingsstrategieën in hoge mate. Door de uitzonderlijke dimensies van de LNGO, zoals (1) hun media alertheid en (2) hun bereidheid om tot opschaling over te gaan, is duidelijk vooruitgang geboekt in ad hoc samenwerking. Door deze “vondst” is een tool ontwikkeld die de matching verbetert in een asymmetrische *global-local disaster management* voor *sustainable* en innovatieve hulpverlening.

OV5: Hoe dient een goed gekwalificeerd management team dynamische innovatieprocessen te *plannen* en te *managen*?

In hoofdstuk 6 ontwikkelen we een nieuwe RTF. De vijf dynamische netwerkpatronen worden omgezet in "beginselen" voor mangers. Voorts wordt er een toepassing ontwikkeld in de vorm van twee robuuste *real-time* evaluatie-*tools* (RTETs) om de performance van de DINs in real-time te identificeren en te meten.

In het algemeen kunnen we stellen dat kwalitatieve onderzoeken in de sociale wetenschap leiden tot nieuwe kennis die helpt om sociale fenomenen te modelleren of te meten. De *managerial method* die wij hebben ontwikkeld, heeft een duidelijk conceptuele basis. Het spoort theorie-vorming aan. De verticale (hiërarchische) management stijl wordt vervangen door een veelzijdig, dynamisch management proces en door coproductie. Deze methode bevestigt de veronderstelling dat het onderzoeken van collectieve actores met individuele handelingsbevoegdheden in eerste instantie een analytische en vervolgens een praktische fout is (Arendt & Jaspers, 1955; Ostrom, 1990; Scarry, 2012). De *real-time foresight* (RTF) methode die in deze dissertatie is ontwikkeld "transformeert" ("switches" volgens Castells (2000)) strategisch management naar een "collectief innovatie-management".

Het tracht *contingency* en chaotische complexiteit te integreren in een effectief innovatie-management (Sarasvathy, 2001; Ries, 2011) ten behoeve van de digitale netwerk samenleving waarin wij tegenwoordig leven.

RTF vervangt de traditionele planning , waar ondernemers vanuit publieke, corporate, of civiele organisaties de samenwerking begrenzen zonder van te voren vastgelegde doelen en hulpverleningsregels. RTF en de *real-time evaluation tools* kunnen nuttig zijn voor transnationale, globale actoren en ook voor start-up bedrijven. Daarnaast kunnen ze gebruikt worden voor beoordelingen van incubators in *past-disaster* gebieden, op wereldmarkten, in scholen en zelfs in parlementen. Samenwerkende innovatieprocessen zijn iedere keer weer een uitdaging en de actores moeten dan telkens opnieuw een tocht naar het onbekende overwegen. Terwijl heel veel toekomstige uitdagingen vandaag de dag niet zijn te voorzien, geeft de bereidheid om DINs te gebruiken de hulpverleners de zekerheid dat zij de uitdagingen kunnen overwinnen door de DINs.

Curriculum Vitae

Christina Weber was born in Stuttgart on July, 20th 1971. She studied sociology at the University of Bielefeld, Germany, and gained her diploma with honours. Her thesis was on the alteration of the nation state at the example of European environmental policy.

She began her professional life at GESIS (Leibniz Institute for Social Sciences), Mannheim, in 2002 as a scientific assistant for CUI (computer-assisted text- and content analysis), then from 2005 onwards made her voluntary engagement with developmental cooperation a professional mandate and worked for the Karl Kuebel Foundation for the Child and Family (KKS), Bensheim. There she managed programmes for rural development and sustainable agriculture, micro saving and disaster management with Indian and global partners.

Since March 2008, she has worked for the Strascheg Centre for Entrepreneurship (SCE), at Munich University of Applied Sciences, first in communication and entrepreneurship education, then as head of communication, and since 2013 as head of the SCE research department.

Her main research interests are dynamic innovation networks, actor-network theory (ANT), collective governance, entrepreneurship education, foresight, and disaster management. As a sociologist, she has strong experience in qualitative methods of social research, and still has a passion for collaborative European research programmes (for example, in the NITIM network) and the new development of big data.

Curriculum Vitae

List of Publications

Some ideas and figures in the thesis previously appeared in the following publications.

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2016

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15. Martijn van Otterlo (UT) *The Logic of Adaptive Behavior: Knowledge Representation and Algorithms for the Markov Decision Process Framework in First-Order Domains*
16. Henriette van Vugt (VU) *Embodied agents from a user's perspective*
17. Martin Op 't Land (TUD) *Applying Architecture and Ontology to the Splitting and Allying of Enterprises*
18. Guido de Croon (UM) *Adaptive Active Vision*
19. Henning Rode (UT) *From Document to Entity Retrieval: Improving Precision and Performance of Focused Text Search*
20. Rex Arendsen (UvA) *Geen bericht, goed bericht. Een onderzoek naar de effecten van de introductie van elektronisch berichtenverkeer met de overheid op de administratieve lasten van bedrijven*
21. Krisztian Balog (UvA) *People Search in the Enterprise*
22. Henk Koning (UU) *Communication of IT-Architecture*
23. Stefan Visscher (UU) *Bayesian network models for the management of ventilator-associated pneumonia*
24. Zharko Aleksovski (VU) *Using background knowledge in ontology matching*

25. Geert Jonker (UU) *Efficient and EquiTable Exchange in Air Traffic Management Plan Repair using Spender-signed Currency*
26. Marijn Huijbregts (UT) *Segmentation, Diarization and Speech Transcription: Surprise Data Unraveled*
27. Hubert Vogten (OU) *Design and Implementation Strategies for IMS Learning Design*
28. Ildiko Flesch (RUN) *On the Use of Independence Relations in Bayesian Networks*
29. Dennis Reidsma (UT) *Annotations and Subjective Machines - Of Annotators, Embodied Agents, Users, and Other Humans*
30. Wouter van Atteveldt (VU) *Semantic Network Analysis: Techniques for Extracting, Representing and Querying Media Content*
31. Loes Braun (UM) *Pro-Active Medical Information Retrieval*
32. Trung H. Bui (UT) *Toward Affective Dialogue Management using Partially Observable Markov Decision Processes*
33. Frank Terpstra (UvA) *Scientific Workflow Design; theoretical and practical issues*
34. Jeroen de Knijf (UU) *Studies in Frequent Tree Mining*
35. Ben Torben Nielsen (UvT) *Dendritic morphologies: function shapes structure*

2009

1. Rasa Jurgelenaite (RUN) *Symmetric Causal Independence Models*
2. Willem Robert van Hage (VU) *Evaluating Ontology-Alignment Techniques*
3. Hans Stol (UvT) *A Framework for Evidence-based Policy Making Using IT*
4. Josephine Nabukenya (RUN) *Improving the Quality of Organisational Policy Making using Collaboration Engineering*
5. Sietse Overbeek (RUN) *Bridging Supply and Demand for Knowledge Intensive Tasks - Based on Knowledge, Cognition, and Quality*
6. Muhammad Subianto (UU) *Understanding Classification*
7. Ronald Poppe (UT) *Discriminative Vision-Based Recovery and Recognition of Human Motion*
8. Volker Nannen (VU) *Evolutionary Agent-Based Policy Analysis in Dynamic Environments*
9. Benjamin Kanagwa (RUN) *Design, Discovery and Construction of Service-oriented Systems*

10. Jan Wielemaker (UvA) *Logic programming for knowledge-intensive interactive applications*
11. Alexander Boer (UvA) *Legal Theory, Sources of Law & the Semantic Web*
12. Peter Massuthe (TU/e), Humboldt-Universitaet zu Berlin) *Operating Guidelines for Services*
13. Steven de Jong (UM) *Fairness in Multi-Agent Systems*
14. Maksym Korotkiy (VU) *From ontology-enabled services to service-enabled ontologies (making ontologies work in e-science with ONTO-SOA)*
15. Rinke Hoekstra (UvA) *Ontology Representation - Design Patterns and Ontologies that Make Sense*
16. Fritz Reul (UvT) *New Architectures in Computer Chess*
17. Laurens van der Maaten (UvT) *Feature Extraction from Visual Data*
18. Fabian Groffen (CWI) *Armada, An Evolving Database System*
19. Valentin Robu (CWI) *Modeling Preferences, Strategic Reasoning and Collaboration in Agent-Mediated Electronic Markets*
20. Bob van der Vecht (UU) *AdjusTable Autonomy: Controling Influences on Decision Making*
21. Stijn Vanderlooy (UM) *Ranking and Reliable Classification*
22. Pavel Serdyukov (UT) *Search For Expertise: Going beyond direct evidence*
23. Peter Hofgesang (VU) *Modelling Web Usage in a Changing Environment*
24. Annerieke Heuvelink (VU) *Cognitive Models for Training Simulations*
25. Alex van Ballegooij (CWI) *"RAM: Array Database Management through Relational Mapping"*
26. Fernando Koch (UU) *An Agent-Based Model for the Development of Intelligent Mobile Services*
27. Christian Glahn (OU) *Contextual Support of social Engagement and Reflection on the Web*
28. Sander Evers (UT) *Sensor Data Management with Probabilistic Models*
29. Stanislav Pokraev (UT) *Model-Driven Semantic Integration of Service-Oriented Applications*
30. Marcin Zukowski (CWI) *Balancing vectorized query execution with bandwidth-optimized storage*
31. Sofiya Katrenko (UvA) *A Closer Look at Learning Relations from Text*
32. Rik Farenhorst (VU) and Remco de Boer (VU) *Architectural Knowledge Management: Supporting Architects and Auditors*

33. Khiet Truong (UT) *How Does Real Affect Affect Affect Recognition In Speech?*
34. Inge van de Weerd (UU) *Advancing in Software Product Management: An Incremental Method Engineering Approach*
35. Wouter Koelewijn (UL) *Privacy en Politiegegevens; Over geautomatiseerde normatieve informatie-uitwisseling*
36. Marco Kalz (OUN) *Placement Support for Learners in Learning Networks*
37. Hendrik Drachsler (OUN) *Navigation Support for Learners in Informal Learning Networks*
38. Riina Vuorikari (OU) *Tags and self-organisation: a metadata ecology for learning resources in a multilingual context*
39. Christian Stahl (TU/e), Humboldt-Universitaet zu Berlin) *Service Substitution - A Behavioral Approach Based on Petri Nets*
40. Stephan Raaijmakers (UvT) *Multinomial Language Learning: Investigations into the Geometry of Language*
41. Igor Berezhnyy (UvT) *Digital Analysis of Paintings*
42. Toine Bogers (UvT) *Recommender Systems for Social Bookmarking*
43. Virginia Nunes Leal Franqueira (UT) *Finding Multi-step Attacks in Computer Networks using Heuristic Search and Mobile Ambients*
44. Roberto Santana Tapia (UT) *Assessing Business-IT Alignment in Networked Organisations*
45. Jilles Vreeken (UU) *Making Pattern Mining Useful*
46. Loredana Afanasiev (UvA) *Querying XML: Benchmarks and Recursion*

2010

1. Matthijs van Leeuwen (UU) *Patterns that Matter*
2. Ingo Wassink (UT) *Work flows in Life Science*
3. Joost Geurts (CWI) *A Document Engineering Model and Processing Framework for Multimedia documents*
4. Olga Kulyk (UT) *Do You Know What I Know? Situational Awareness of Co-located Teams in Multidisplay Environments*
5. Claudia Hauff (UT) *Predicting the Effectiveness of Queries and Retrieval Systems*
6. Sander Bakkes (UvT) *Rapid Adaptation of Video Game AI*
7. Wim Fikkert (UT) *Gesture interaction at a Distance*

8. Krzysztof Siewicz (UL) *Towards an Improved Regulatory Framework of Free Software. Protecting user freedoms in a world of software communities and eGovernments*

9. Hugo Kielman (UL) *A Politiele gegevensverwerking en Privacy, Naar een effectieve waarborging*

10. Rebecca Ong (UL) *Mobile Communication and Protection of Children*

11. Adriaan Ter Mors (TUD) *The world according to MARP: Multi-Agent Route Planning*

12. Susan van den Braak (UU) *Sensemaking software for crime analysis*

13. Gianluigi Folino (RUN) *High Performance Data Mining using Bio-inspired techniques*

14. Sander van Splunter (VU) *Automated Web Service Reconfiguration*

15. Lianne Bodenstaff (UT) *Managing Dependency Relations in Inter-Organisational Models*

16. Sicco Verwer (TUD) *Efficient Identification of Timed Automata, theory and practice*

17. Spyros Kotoulas (VU) *Scalable Discovery of Networked Resources: Algorithms, Infrastructure, Applications*

18. Charlotte Gerritsen (VU) *Caught in the Act: Investigating Crime by Agent-Based Simulation*

19. Henriette Cramer (UvA) *People's Responses to Autonomous and Adaptive Systems*

20. Ivo Swartjes (UT) *Whose Story Is It Anyway? How Improv Informs Agency and Authorship of Emergent Narrative*

21. Harold van Heerde (UT) *Privacy-aware data management by means of data degradation*

22. Michiel Hildebrand (CWI) *End-user Support for Access to\\ Heterogeneous Linked Data*

23. Bas Steunebrink (UU) *The Logical Structure of Emotions*

24. Dmytro Tykhonov (TUD) *Designing Generic and Efficient Negotiation Strategies*

25. Zulfiqar Ali Memon (VU) *Modelling Human-Awareness for Ambient Agents: A Human Mindreading Perspective*

26. Ying Zhang (CWI) *XRPC: Efficient Distributed Query Processing on Heterogeneous XQuery Engines*

27. Marten Voulon (UL) *Automatisch contracteren*

28. Arne Koopman (UU) *Characteristic Relational Patterns*

29. Stratos Idreos (CWI) *Database Cracking: Towards Auto-tuning Database Kernels*
30. Marieke van Erp (UvT) *Accessing Natural History - Discoveries in data cleaning, structuring, and retrieval*
31. Victor de Boer (UvA) *Ontology Enrichment from Heterogeneous Sources on the Web*
32. Marcel Hiel (UvT) *An Adaptive Service Oriented Architecture: Automatically solving Interoperability Problems*
33. Robin Aly (UT) *Modeling Representation Uncertainty in Concept-Based Multimedia Retrieval*
34. Teduh Dirgahayu (UT) *Interaction Design in Service Compositions*
35. Dolf Trieschnigg (UT) *Proof of Concept: Concept-based Biomedical Information Retrieval*
36. Jose Janssen (OU) *Paving the Way for Lifelong Learning; Facilitating competence development through a learning path specification*
37. Niels Lohmann (TU/e) *Correctness of services and their composition*
38. Dirk Fahland (TU/e) *From Scenarios to components*
39. Ghazanfar Farooq Siddiqui (VU) *Integrative modeling of emotions in virtual agents* Mark van Assem (VU) *Converting and Integrating Vocabularies for the Semantic Web*
40. Mark van Assem (VU) *Converting and Integrating Vocabularies for the Semantic Web*
41. Guillaume Chaslot (UM) *Monte-Carlo Tree Search*
42. Sybren de Kinderen (VU) *Needs-driven service bundling in a multi-supplier setting - the computational e3-service approach*
43. Peter van Kranenburg (UU) *A Computational Approach to Content-Based Retrieval of Folk Song Melodies*
44. Pieter Bellekens (TU/e) *An Approach towards Context-sensitive and User-adapted Access to Heterogeneous Data Sources, Illustrated in the Television Domain*
45. Vasilios Andrikopoulos (UvT) *A theory and model for the evolution of software services*
46. Vincent Pijpers (VU) *e3alignment: Exploring Inter-Organisational Business-ICT Alignment*
47. Chen Li (UT) *Mining Process Model Variants: Challenges, Techniques, Examples*
48. Withdrawn
49. Jahn-Takeshi Saito (UM) *Solving difficult game positions*

50. Bouke Huurnink (UvA) *Search in Audiovisual Broadcast Archives*
51. Alia Khairia Amin (CWI) *Understanding and supporting information seeking tasks in multiple sources*
52. Peter-Paul van Maanen (VU) *Adaptive Support for Human-Computer Teams: Exploring the Use of Cognitive Models of Trust and Attention*
53. Edgar Meij (UvA) *Combining Concepts and Language Models for Information Access*

2011

1. Botond Cseke (RUN) *Variational Algorithms for Bayesian Inference in Latent Gaussian Models*
2. Nick Tinnemeier (UU) *Organizing Agent Organisations. Syntax and Operational Semantics of an Organisation-Oriented Programming Language*
3. Jan Martijn van der Werf (TU/e) *Compositional Design and Verification of Component-Based Information Systems*
4. Hado van Hasselt (UU) *Insights in Reinforcement Learning; Formal analysis and empirical evaluation of temporal-difference learning algorithms*
5. Base van der Raadt (VU) *Enterprise Architecture Coming of Age - Increasing the Performance of an Emerging Discipline.*
6. Yiwen Wang (TU/e) *Semantically-Enhanced Recommendations in Cultural Heritage*
7. Yujia Cao (UT) *Multimodal Information Presentation for High Load Human Computer Interaction*
8. Nieske Vergunst (UU) *BDI-based Generation of Robust Task-Oriented Dialogues*
9. Tim de Jong (OU) *Contextualised Mobile Media for Learning*
10. Bart Bogaert (UvT) *Cloud Content Contention*
11. Dhaval Vyas (UT) *Designing for Awareness: An Experience-focused HCI Perspective*
12. Carmen Bratosin (TU/e) *Grid Architecture for Distributed Process Mining*
13. Xiaoyu Mao (UvT) *Airport under Control. Multiagent Scheduling for Airport Ground Handling*
14. Milan Lovric (EUR) *Behavioral Finance and Agent-Based Artificial Markets*
15. Marijn Koolen (UvA) *The Meaning of Structure: the Value of Link Evidence for Information Retrieval*

16. Maarten Schadd (UM) *Selective Search in Games of Different Complexity*
17. Jiyin He (UvA) *Exploring Topic Structure: Coherence, Diversity and Relatedness*
18. Mark Ponsen (UM) *Strategic Decision-Making in complex games*
19. Ellen Rusman (OU) *The Mind's Eye on Personal Profiles*
20. Qing Gu (VU) *Guiding service-oriented software engineering - A view-based approach*
21. Linda Terlouw (TUD) *Modularization and Specification of Service-Oriented Systems*
22. Junte Zhang (UvA) *System Evaluation of Archival Description and Access*
23. Wouter Weerkamp (UvA) *Finding People and their Utterances in Social Media*
24. Herwin van Welbergen (UT) *Behavior Generation for Interpersonal Coordination with Virtual Humans On Specifying, Scheduling and Realizing Multimodal Virtual Human Behavior*
25. Syed Waqar ul Qounain Jaffry (VU) *Analysis and Validation of Models for Trust Dynamics*
26. Matthijs Aart Pontier (VU) *Virtual Agents for Human Communication - Emotion Regulation and Involvement-Distance Trade-Offs in Embodied Conversational Agents and Robots*
27. Aniel Bhulai (VU) *Dynamic website optimization through autonomous management of design patterns*
28. Rianne Kaptein (UvA) *Effective Focused Retrieval by Exploiting Query Context and Document Structure*
29. Faisal Kamiran (TU/e) *Discrimination-aware Classification*
30. Egon van den Broek (UT) *Affective Signal Processing (ASP): Unraveling the mystery of emotions*
31. Ludo Waltman (EUR) *Computational and Game-Theoretic Approaches for Modeling Bounded Rationality*
32. Nees-Jan van Eck (EUR) *Methodological Advances in Bibliometric Mapping of Science*
33. Tom van der Weide (UU) *Arguing to Motivate Decisions*
34. Paolo Turrini (UU) *Strategic Reasoning in Interdependence: Logical and Game-theoretical Investigations*
35. Maaike Harbers (UU) *Explaining Agent Behavior in Virtual Training*

36. Erik van der Spek (UU) *Experiments in serious game design: a cognitive approach*
37. Adriana Burlutiu (RUN) *Machine Learning for Pairwise Data, Applications for Preference Learning and Supervised Network Inference*
38. Nyree Lemmens (UM) *Bee-inspired Distributed Optimization*
39. Joost Westra (UU) *Organizing Adaptation using Agents in Serious Games*
40. Viktor Clerc (VU) *Architectural Knowledge Management in Global Software Development*
41. Luan Ibraimi (UT) *Cryptographically Enforced Distributed Data Access Control*
42. Michal Sindlar (UU) *Explaining Behavior through Mental State Attribution*
43. Henk van der Schuur (UU) *Process Improvement through Software Operation Knowledge*
44. Boris Reuderink (UT) *Robust Brain-Computer Interfaces*
45. Herman Stehouwer (UvT) *Statistical Language Models for Alternative Sequence Selection*
46. Beibei Hu (TUD) *Towards Contextualized Information Delivery: A Rule-based Architecture for the Domain of Mobile Police Work*
47. Azizi Bin Ab Aziz (VU) *Exploring Computational Models for Intelligent Support of Persons with Depression*
48. Mark Ter Maat (UT) *Response Selection and Turn-taking for a Sensitive Artificial Listening Agent*
49. Andreea Niculescu (UT) *Conversational interfaces for task-oriented spoken dialogues: design aspects influencing interaction quality*

2012

1. Terry Kakeeto (UvT) *Relationship Marketing for SMEs in Uganda*
2. Muhammad Umair (VU) *Adaptivity, emotion, and Rationality in Human and Ambient Agent Models*
3. Adam Vanya (VU) *Supporting Architecture Evolution by Mining Software Repositories*
4. Jurriaan Souer (UU) *Development of Content Management System-based Web Applications*
5. Marijn Plomp (UU) *Maturing Interorganisational Information Systems*
6. Wolfgang Reinhardt (OU) *Awareness Support for Knowledge Workers in Research Networks*

7. Rianne van Lambalgen (VU) *When the Going Gets Tough: Exploring Agent-based Models of Human Performance under Demanding Conditions*
8. Gerben de Vries (UvA) *Kernel Methods for Vessel Trajectories*
9. Ricardo Neisse (UT) *Trust and Privacy Management Support for Context-Aware Service Platforms*
10. David Smits (TU/e) *Towards a Generic Distributed Adaptive Hypermedia Environment*
11. J.C.B. Rantham Prabhakara (TU/e) Process Mining in the Large: Preprocessing, Discovery, and Diagnostics
12. Kees van der Sluijs (TU/e) *Model Driven Design and Data Integration in Semantic Web Information Systems*
13. Suleman Shahid (UvT) *Fun and Face: Exploring non-verbal expressions of emotion during playful interactions*
14. Evgeny Knutov (TU/e) *Generic Adaptation Framework for Unifying Adaptive Web-based Systems*
15. Natalie van der Wal (VU) *Social Agents. Agent-Based Modelling of Integrated Internal and Social Dynamics of Cognitive and Affective Processes.*
16. Fiemke Both (VU) *Helping people by understanding them - Ambient Agents supporting task execution and depression treatment*
17. Amal Elgammal (UvT) *Towards a Comprehensive Framework for Business Process Compliance*
18. Eltjo Poort (VU) *Improving Solution Architecting Practices*
19. Helen Schonenberg (TU/e) *What's Next? Operational Support for Business Process Execution*
20. Ali Bahramisharif (RUN) *Covert Visual Spatial Attention, a Robust Paradigm for Brain-Computer Interfacing*
21. Roberto Cornacchia (TUD) *Querying Sparse Matrices for Information Retrieval*
22. Thijs Vis (UvT) *Intelligence, politie en veiligheidsdienst: verenigbare grootheden?*
23. Christian Muehl (UT) *Toward Affective Brain-Computer Interfaces: Exploring the Neurophysiology of Affect during Human Media Interaction*
24. Laurens van der Werff (UT) *Evaluation of Noisy Transcripts for Spoken Document Retrieval*
25. Silja Eckartz (UT) *Managing the Business Case Development in Inter-Organisational IT Projects: A Methodology and its Application*

26. Emile de Maat (UvA) *Making Sense of Legal Text*
27. Hayrettin Gürkök (UT) *Mind the Sheep! User Experience Evaluation & Brain-Computer Interface Games*
28. Nancy Pascall (UvT) *Engendering Technology Empowering Women*
29. Almer Tigelaar (UT) *Peer-to-Peer Information Retrieval*
30. Alina Pommeranz (TUD) *Designing Human-Centered Systems for Reflective Decision Making*
31. Emily Bagarukayo (RUN) *A Learning by Construction Approach for Higher Order Cognitive Skills Improvement, Building Capacity and Infrastructure*
32. Wietske Visser (TUD) *Qualitative multi-criteria preference representation and reasoning*
33. Rory Sie (OU) *Coalitions in Cooperation Networks (COCOON)*
34. Pavol Jancura (RUN) *Evolutionary analysis in PPI networks and applications*
35. Evert Haasdijk (VU)*Never Too Old To Learn - On-line Evolution of Controllers in Swarm-and Modular Robotics*
36. Denis Ssebugwawo (RUN)*Analysis and Evaluation of Collaborative Modeling Processes*
37. Agnes Nakakawa (RUN)*A Collaboration Process for Enterprise Architecture Creation*
38. Selmar Smit (VU) *Parameter Tuning and Scientific Testing in Evolutionary Algorithms*
39. Hassan Fatemi (UT) *Risk-aware design of value and coordination networks*
40. Agus Gunawan (UvT) *Information Access for SMEs in Indonesia*
41. Sebastian Kelle (OU) Game Design Patterns for Learning
42. Dominique Verpoorten (OU) *Reflection Amplifiers in self-regulated Learning*
43. Withdrawn
44. Anna Tordai (VU) *On Combining Alignment Techniques*
45. Benedikt Kratz (UvT) *A Model and Language for Business-aware Transactions*
46. Simon Carter (UVA) *Exploration and Exploitation of Multilingual Data for Statistical Machine Translation*
47. Manos Tsagkias (UVA) *Mining Social Media: Tracking Content and Predicting Behavior*

48. Jorn Bakker (TUE) *Handling Abrupt Changesin Evolving Time-series Data*
49. Michael Kaisers (UM) *Learning against Learning - Evolutionary dynamics of reinforcement learning algorithms in strategic interactions*
50. Steven van Kervel (TUD) *Ontologogy driven Enterprise Information Systems Engineering*
51. Jeroen de Jong (TUD) *Heuristics in Dynamic Scheduling; a practical framework with a case study in elevator dispatching*

2013

1. Viorel Milea (EUR) *News Analytics for Financial Decision Support*
2. Erietta Liarou (CWI) *MonetDB/DataCell: Leveraging the Column-store Database Technology for Efficient and Scalable Stream Processing*
3. Szymon Klarman (VU) *Reasoning with Contexts in Description Logics*
4. ChetanYadati (TUD) *Coordinating autonomous planning and scheduling*
5. Dulce Pumareja (UT) *Groupware Requirements Evolutions Patterns*
6. Romulo Goncalves (CWI) *The Data Cyclotron: Juggling Data and Queries for a Data Warehouse Audience*
7. Giel van Lankveld (UT) *Quantifying Individual Player Differences*
8. Robbert-Jan Merk (VU) *Making enemies: cognitive modeling for opponent agents in fighter pilot simulators*
9. Fabio Gori (RUN) *Metagenomic Data Analysis: Computational Methods and Applications*
10. Jeewanie Jayasinghe Arachchige (UvT) *A Unified Modeling Framework for Service Design*
11. Evangelos Pournaras (TUD) *Multi-level Reconfigurable Self-organisation in Overlay Services*
12. Marian Razavian (VU) *Knowledge-driven Migration to Services*
13. Mohammad Safiri (UT) *Service Tailoring: User-centric creation of integrated IT-based homecare services to support independent living of elderly*
14. Jafar Tanha (UVA) *Ensemble Approaches to Semi-Supervised Learning Learning*
15. Daniel Hennes (UM) *Multiagent Learning - Dynamic Games and Applications*

16. Eric Kok (UU) *Exploring the practical benefits of argumentation in multi-agent deliberation*
17. Koen Kok (VU) *The PowerMatcher: Smart Coordination for the Smart Electricity Grid*
18. Jeroen Janssens (UvT) *Outlier Selection and One-Class Classification*
19. Renze Steenhuizen (TUD) *Coordinated Multi-Agent Planning and-Scheduling*
20. Katja Hofmann (UvA) *Fast and Reliable Online Learning to Rank for Information Retrieval*
21. Sander Wubben (UvT) *Text-to-text generation by monolingual machine translation*
22. Tom Claassen (RUN) *Causal Discovery and Logic*
23. Patricio de Alencar Silva (UvT) *Value Activity Monitoring*
24. Haitham Bou Ammar (UM) *Automated Transfer in Reinforcement Learning*
25. Agnieszka Anna Latoszek-Berendsen (UM) *Intention-based Decision Support. A new way of representing and implementing clinical guidelines in a Decision Support System.*
26. Alireza Zarghami (UT) *Architectural Support for Dynamic Homecare Service Provisioning.*
27. Mohammad Huq (UT) *Inference-based Framework Managing Data Provenance*
28. Frans van der Sluis (UT) *When Complexity becomes Interesting: An Inquiry into the Information eXperience*
29. Iwan de Kok (UT) *Listening Heads*
30. Joyce Nakatumba (TUE) *Resource-Aware Business Process Management: Analysis and Support*
31. Dinh Khoa Nguyen (UvT) *Blueprint Model and Language for Engineering Cloud Applications*
32. Kamakshi Rajagopal (OUN) *Networking For Learning; The role of Networking in a Lifelong Learner's Professional Development*
33. Qi Gao (TUD) *User Modeling and Personalization in the Microblogging Sphere*
34. KienTjin-Kam-Jet (UT) *Distributed Deep Web Search*
35. Abdallah El Ali (UvA) *Minimal Mobile Human Computer*
36. Than Lam Hoang (TUe) *Pattern Mining in Data Streams*
37. Dirk Börner (OUN) *Ambient Learning Displays*
38. Eelco den Heijer (VU) *Autonomous Evolutionary Art*

39. Joop de Jong (TUD) *A Method for Enterprise Ontology based Design of Enterprise Information Systems*
40. Pim Nijssen (UM) *Monte-Carlo Tree Search for Multi-Player Games*
41. Jochem Liem (UVA) *Supporting the Conceptual Modelling of Dynamic Systems: A Knowledge Engineering Perspective on Qualitative Reasoning*
42. Léon Planken (TUD) *Algorithms for Simple Temporal Reasoning*
43. Marc Bron (UVA) *Exploration and Contextualization through Interaction and Concepts*

2014

1. Nicola Barile (UU) *Studies in Learning Monotone Models from Data*
2. Fiona Tuliyano (RUN) *Combining System Dynamics with a Domain Modeling Method*
3. Sergio Raul Duarte Torres (UT) *Information Retrieval for Children: Search Behavior and Solutions*
4. Hanna Jochmann-Mannak (UT) *Websites for children: search strategies and interface design - Three studies on children's search performance and evaluation*
5. Jurriaan van Reijsen (UU) *Knowledge Perspectives on Advancing Dynamic Capability*
6. Damian Tamburri (VU) *Supporting Networked Software Development*
7. Arya Adriansyah (TUE) *Aligning Observed and Modeled Behavior*
8. Samur Araujo (TUD) *Data Integration over Distributed and Heterogeneous Data Endpoints*
9. Philip Jackson (UvT) *Toward Human-Level Artificial Intelligence: Representation and Computation of Meaning in Natural Language*
10. Ivan Salvador Razo Zapata (VU) *Service Value Networks*
11. Janneke van der Zwaan (TUD) *An Empathic Virtual Buddy for Social Support*
12. Willem van Willigen (VU) *Look Ma, No Hands: Aspects of Autonomous Vehicle Control*
13. Arlette van Wissen (VU) *Agent-Based Support for Behavior Change: Models and Applications in Health and Safety Domains*
14. Yangyang Shi (TUD) *Language Models With Meta-information*
15. Natalya Mogles (VU) *Agent-Based Analysis and Support of Human Functioning in Complex Socio-Technical Systems: Applications in Safety and Healthcare*

16. Krystyna Milian (VU) *Supporting Trial Recruitment and Design by Automatically Interpreting Eligibility Criteria*
17. Kathrin Dentler (VU) *Computing Healthcare Quality Indicators Automatically: Secondary Use of Patient Data and Semantic Interoperability*
18. Mattijs Ghijsen (VU) *Methods and Models for the Design and Study of Dynamic Agent Organisations*
19. Vincius Ramos (TUE) *Adaptive Hypermedia Courses: Qualitative and Quantitative Evaluation and Tool Support*
20. Mena Habib (UT) *Named Entity Extraction and Disambiguation for Informal Text: The Missing Link*
21. Kassidy Clark (TUD) *Negotiation and Monitoring in Open Environments*
22. Marieke Peeters (UT) *Personalized Educational Games - Developing Agent-Supported Scenario-based Training*
23. Eleftherios Sidirourgos (UvA/CWI) *Space Efficient Indexes for the Big Data Era*
24. Davide Ceolin (VU) *Trusting Semi-structured Web Data*
25. Martijn Lappenschaar (RUN) *New Network Models for the Analysis of Disease Interaction*
26. Tim Baarslag (TUD) *What to Bid and When to Stop*
27. Rui Jorge Almeida (EUR) *Conditional Density Models Integrating Fuzzy and Probabilistic Representations of Uncertainty*
28. Anna Chmielowiec (VU) *Decentralized k-Clique Matching*
29. JaapKabbedijk (UU) *Variability in Multi-Tenant Enterprise Software*
30. Peter de Kock (UvT) *Anticipating Criminal Behaviou*
31. Leo van Moergestel (UU)*Agent Technology in Agile Multiparallel Manufacturing and Product Support*
32. Naser Ayat (UvA) *On Entity Resolution in Probabilistic Data*
33. Tesfa TegegneAsfaw (RUN) *Service Discovery in eHealth*
34. Christina Manteli (VU) *The Effect of Governance in Global Software Development: AnalyzingTransactive Memory Systems*
35. Joost van Oijen (UU) *Cognitive Agents in Virtual Worlds: A Middleware Design Approach*
36. Joos Buijs (TUE) *Flexible Evolutionary Algorithms for Mining Structured Process Models*
37. Maral Dadvar (UT) *Experts and Machines United Against Cyberbullying*
38. Danny Plass-Oude Bos (UT) *Making Brain-computer Interfaces Better: Improving Usability Through Post-processing*

39. Jasmina Marić (UvT) *Web Communities, Immigration and Social Capital*

40. Walter Omona (RUN) *A Framework for Knowledge Management Using ICT in Higher Education*

41. Frederic Hogenboom (EUR) *Automated Detection of Financial Events in News Text*

42. Carsten Eijckhof (CWI/TUD) *Contextual Multidimensional Relevance Models*

43. Kevin Vlaanderen (UU) *Supporting Process Improvement using Method Increments*

44. Paulien Meesters (UvT) *Intelligent Blauw. Met als ondertitel: Intelligence-gestuurde politiezorg in gebiedsgebonden eenheden*

45. Birgit Schmitz (OUN) *Mobile Games for Learning: A Pattern-Based Approach*

46. Ke Tao (TUD) *Social Web Data Analytics: Relevance, Redundancy, Diversity*

47. Shangsong Liang (UvA) *Fusion and Diversification in Information Retrieval*

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1. Niels Netten (UvA) *Machine Learning for Relevance of Information in Crisis Response*

2. Faiza Bukhsh (UvT) *Smart auditing: Innovative Compliance Checking in Customs Controls*

3. Twan van Laarhoven (RUN) *Machine learning for network data*

4. Howard Spoelstra (OUN) *Collaborations in Open Learning Environments*

5. Christoph Bösch (UT) *CryptographicallyEnforced Search Pattern Hiding*

6. Farideh Heidari (TUD) *Business Process Quality Computation – Computing Non-Functional Requirements to Improve Business Processes*

7. Maria-Hendrike Peetz (UvA) *Time-Aware Online Reputation Analysis*

8. Jie Jiang (TUD) *Organisational Compliance: An agent-based model for designing and evaluating organisational interactions*

9. Randy Klaassen (UT) *HCI Perspectives on Behavior Change Support Systems*

10. Henry Hermans (OUN) *OpenU: design of an integrated system to support lifelong learning*

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14. Bart van Straalen (UT) *A cognitive approach to modeling bad news conversations*
15. Klaas Andries de Graaf (VU) *Ontology-based Software Architecture Documentation*
16. Changyun Wei (UT) *Cognitive Coordination for Cooperative Multi-Robot Teamwork*
17. André van Cleeff (UT) *Physical and Digital Security Mechanisms: Properties, Combinations and Trade-offs*
18. Holger Pirk (CWI) *Waste Not, Want Not! - Managing Relational Data in Asymmetric Memories*
19. Bernardo Tabuenca (OUN) *Ubiquitous Technology for Lifelong Learners*
20. Loïs Vanhée (UU) *Using Culture and Values to Support Flexible Coordination*
21. Sibren Fetter (OUN) *Using Peer-Support to Expand and Stabilize Online Learning*
22. Zhemin Zhu (UT) *Co-occurrence Rate Networks - Towards separate training for undirected graphical models*
23. Luit Gazendam (VU) *Cataloguer Support in Cultural Heritage*
24. Richard Berendsen (UVA) *Finding People, Papers, and Posts: Vertical Search Algorithms and Evaluation*
25. Steven Woudenberg (UU) *Bayesian Tools for Early Disease Detection*
26. Alexander Hogenboom (EUR) *Sentiment Analysis of Text Guided by Semantics and Structure*
27. Sándor Héman (CWI) *Updating compressed column-stores*
28. Janet Bagorogoza (TiU) *Knowledge Management and High Performance; The Uganda Financial Institutions Model for HPO*
29. Hendrik Baier (UM) *Monte-Carlo Tree Search Enhancements for One-Player and Two-Player Domains*
30. Kiavash Bahreini (OUN) *Multimodal Emotion Recognition in E-Learning*
31. Yakup Koç (TUD) *On Robustness of Power Grids*
32. Jerome Gard (LU) *Corporate Venture Management in SME's*

33. Janatti K. Bagorogoza (TUD) *Knowledge Management and high performance*

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1. Syed Saiden Abbas (RUN) *Recognition of Shapes by Humans and Machines*
2. Michiel Christiaan Meulendijk (UU) *Optimizing medication reviews through decision support: prescribing a better pill to swallow*
3. Maya Sappelli (RUN) *Kowledge Work in context: user centered knowledge worker support*
4. Laurens Rietveld (VU) *Publishing and consuming linked data*
5. Evgeny Sherkhonov (UVA) *Expanded Acyclic Queries: Containment and an application in explaining missing answers*
6. Michel Wilson (TUD) *Robust scheduling in an uncertain environment*
7. Jeroen de Man (VU) *Measuring and modeling negative emotions for virtual training*
8. Matje van de Camp (TiU) *A link to the past: constructing historical social networks from unstructured data*
9. Archana Nottamkandath (VU) *Trusting crowdsourced information on cultural artefacts*
10. George Karafotias (VUA) *Parameter Control for evolutionary algorithms*
11. Anne Schuth (UVA) *Search engines that learn from their users*
12. Max Knobbout (UU) *Logics for modeling and verifying normative multi-agent systems*
13. Nana Baah Gyan (VU) *The web, speech technologies and rural development in West Africa – an ICT4D approach*
14. Ravi Khadka (UU) *Revisiting legacy software system modernization*
15. Steffen Michels (RUN) *Hybrid probabilistic logics – theoretical aspects, algorithms and experiments*
16. Guangliang Li (UVA) *Socially intelligent autonomous agents that learned from human reward*
17. Berend Weel (VU) *Towards embodied evolution of robot organisms*
18. Albert Moreno Penuela (VU) *Refining statistical data on the web*
19. Julia Efremova (TU/e) *Mining social structures from genealogic data*
20. Daan Odijk (UVA) *Context & semantics in news & web search*

21. Alejandro Moreno Celleri (UT) *From traditional to interactive playspaces: automatic analysis of player behavior in the interactive playground*
22. Grace Lewis (VU) *Software architecture strategies for cyber-foraging systems*
23. Fei Cai (UVA) *Query auto completion in information retrieval*
24. Brend Wanders (UT) *Repurposing and probabilistic integration of data: an iterative and data model independent approach*
25. Julia Kiseleva (TU/e) *Using contextual information to understand searching and browsing behavior*
26. Dilhan Thilakarathne (VU) *In or out of control: exploring computational models to study the role of human awareness and control in behavioral choices, with applications in aviation and energy management domains*
27. Wen Li (TUD) *Understanding geo-spatial information on social media*
28. Mingxin Zhang (TUD) *Large-scale agent based social simulation – a study on epidemic prediction and control*
29. Nicolas Höning (TUD) *Peak reduction in decentralized electricity systems – markets and prices for flexible planning*
30. Ruud Mattheij (UvT) *The eyes have it*
31. Mohammad Khelgati (UT) *Deep web content monitoring*
32. Eelco Vriezekolk (UT) *Assessing telecommunication service availability risks for crises organisations*
33. Peter Bloem (UVA) *Single sample statistics, exercices in learning from just one example*
34. Dennis Schunselaar (TUE) *Configurable process trees: elicitation, analysis, and enactment*
35. Zhaochun Ren (UT) *Monitoring social media:summarization, classification and recommendation*
36. Daphne Karreman (UT) *Beyond R2D2: the design of nonverbal interaction behavior optimized for robot-specific morphologies*
37. Giovanni Sileno (UvA) *Aligning law and action – a conceptual and computational inquiry*
38. Andrea Minuto (UT) *Materials that matter – smart materials meet art & interaction design*
39. Merijn Bruijnes (UT) *Believable suspect agents – response and interpersonal style selection for an artificial suspect*
40. Christian Detweiler (TUD) *Accounting for values in design*

41. Thomas King (TUD) *Governing governance: a formal framework for analyzing institutional design and enactment governance*
42. Spyros Martzoukos (UVA) *Combinatorial and compositional aspects of bilingual aligned corpora*
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45. Bram van de Laar (UT) *Experiencing brain-computer interface control*
46. Jorge Gallego Perez (UT) *Robots to make you happy*
47. Christina Weber (UL) *Real-time foresight*