Real-time foresight : preparedness for dynamic innovation networks

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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	Disaster management in three successful DINs of global-local collaboration; comparative cases for an exploration of dynamic network patterns.
	Constant context	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

[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).

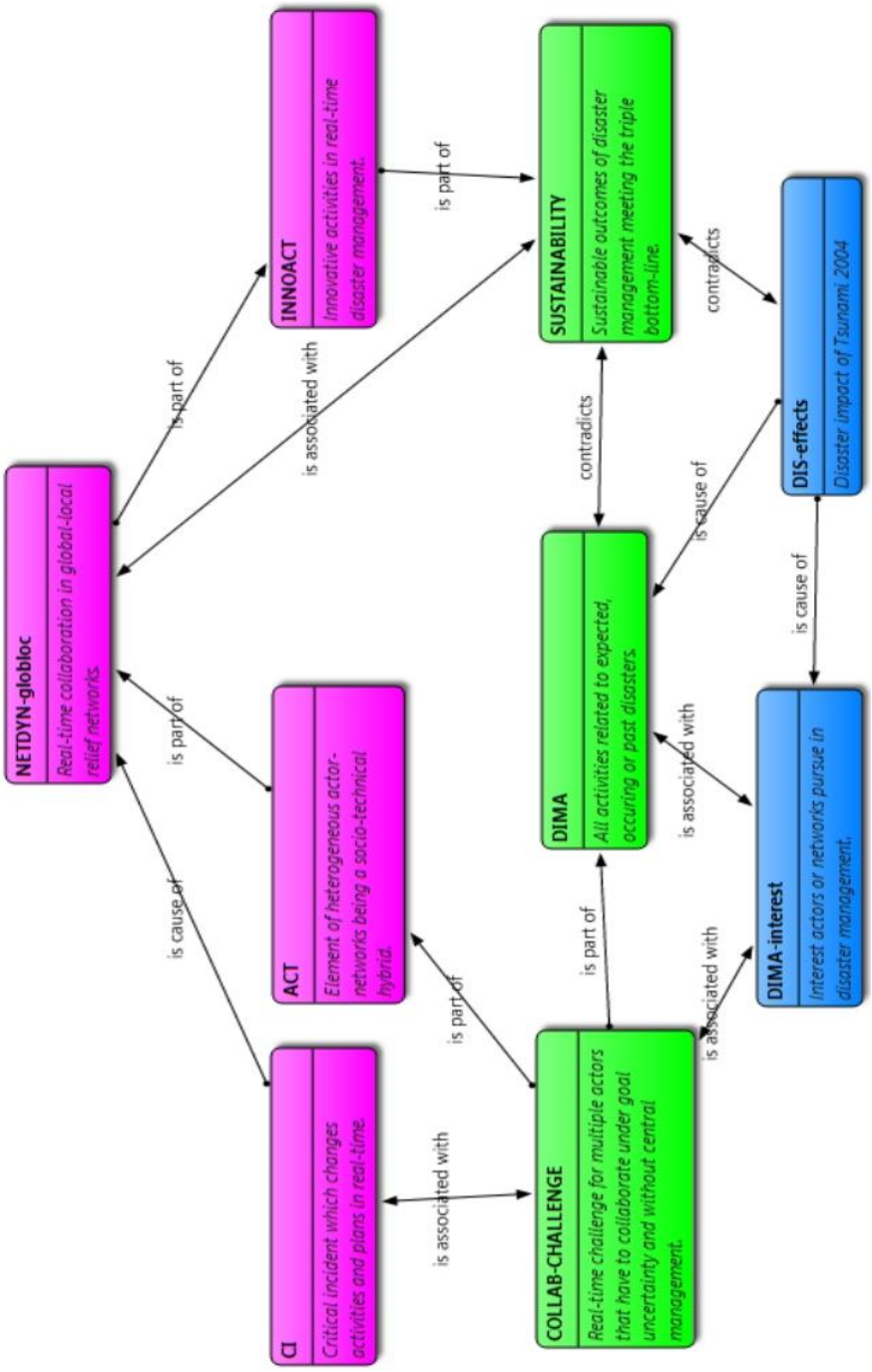

Figure 3-1: Coding framework for successful ad hoc collaboration in relief

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.

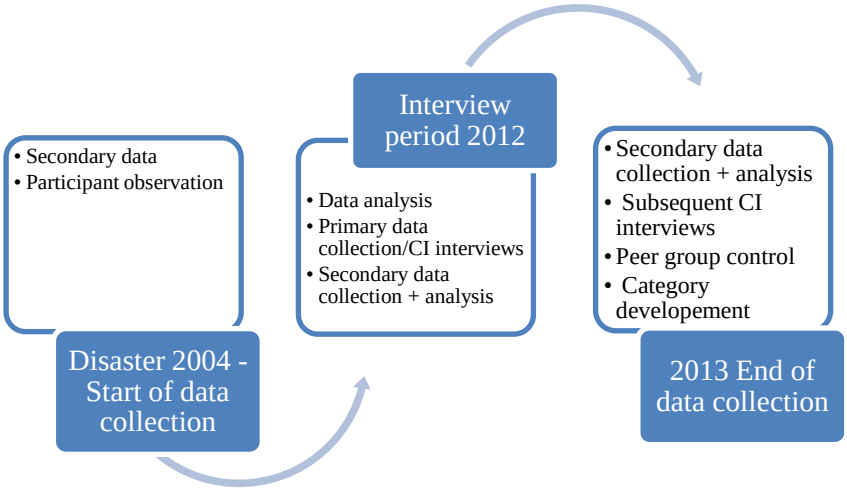

Figure 3-2: Three waves of data collection in accordance with GTM

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