Real-time foresight : preparedness for dynamic innovation networks

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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)

[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

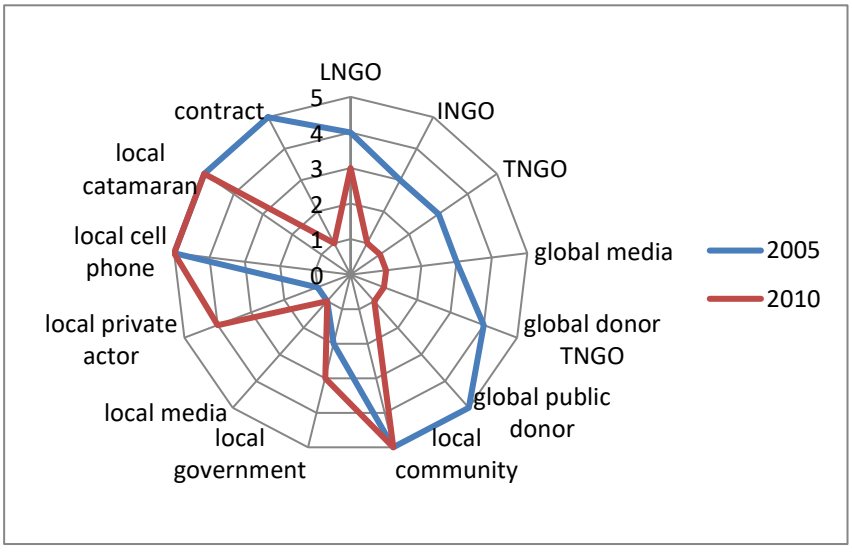

Figure 4-1: Real-time network activity in Ayam

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

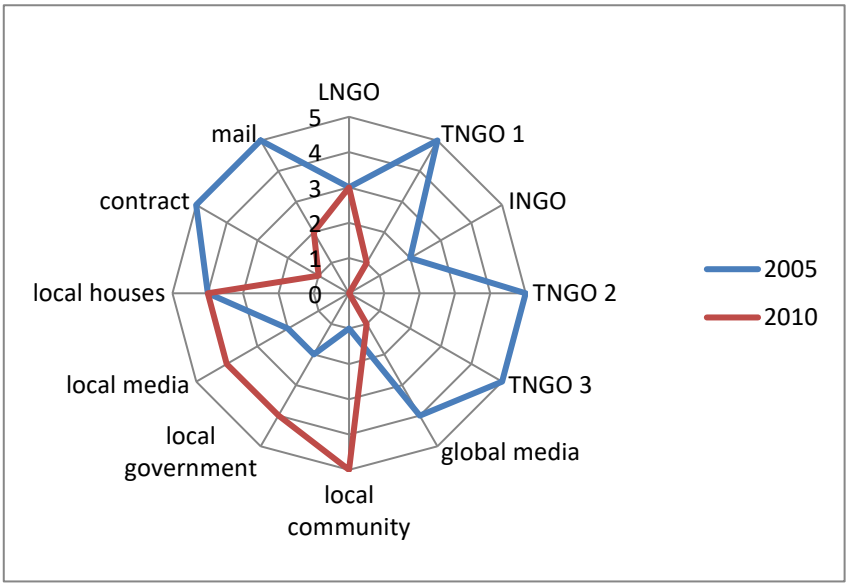

Figure 4-2: Real-time network activity in Keniparam

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

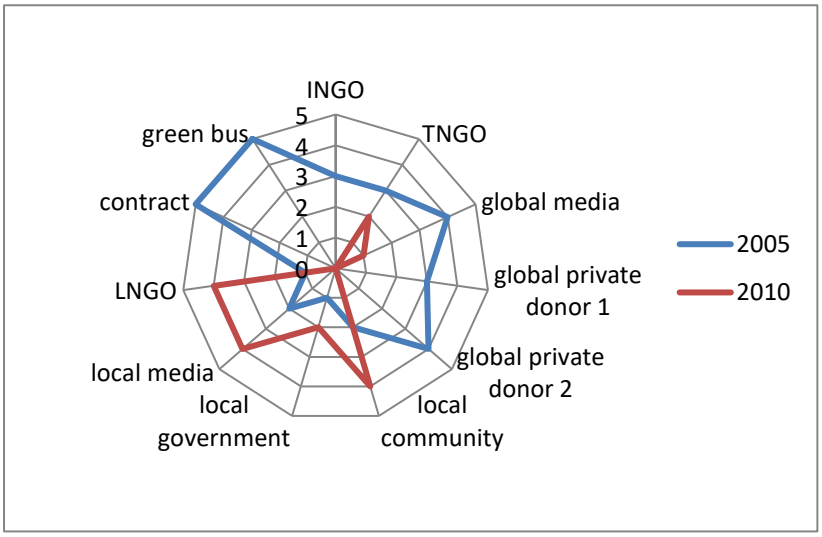

Figure 4-3: Real-time network activity in Kanni

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 • INGO, unusual actor (A)	• Local community • Global media • Local media • Cell phone (B) • 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,

[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.

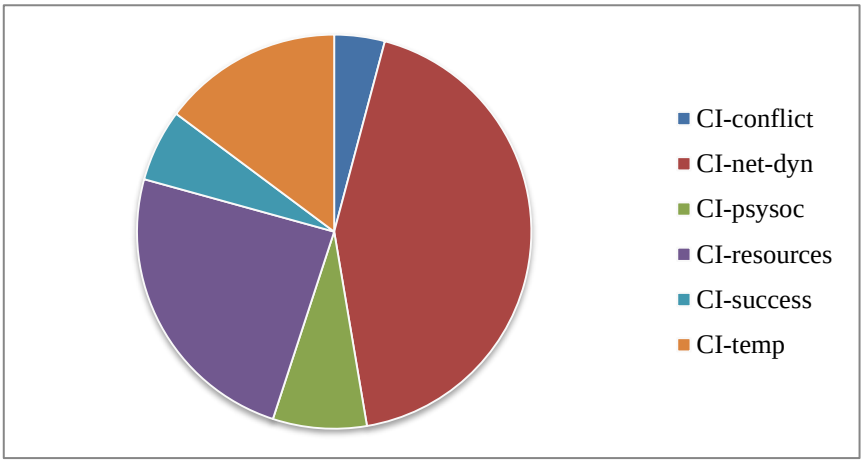

Figure 4-4: Main challenges for collaborative management in global relief

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.

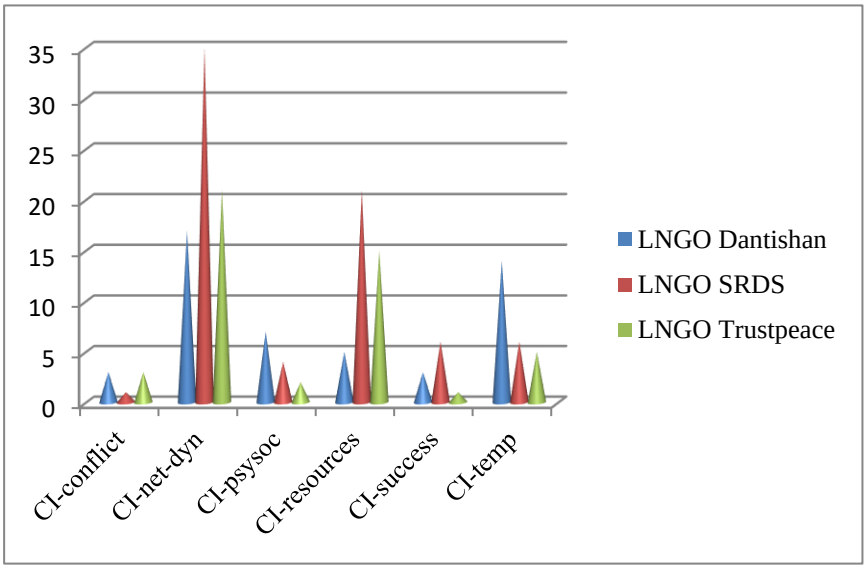

Figure 4-5: Cross tabulation of CIs by LNGOs and CI code families

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, intermediary, 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, intermediary 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).

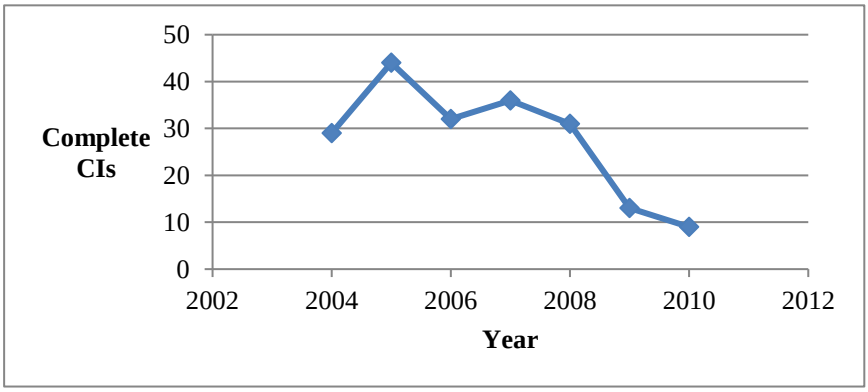

Figure 4-6: Timeline of CI occurrence over 7 years (Ayam)

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.

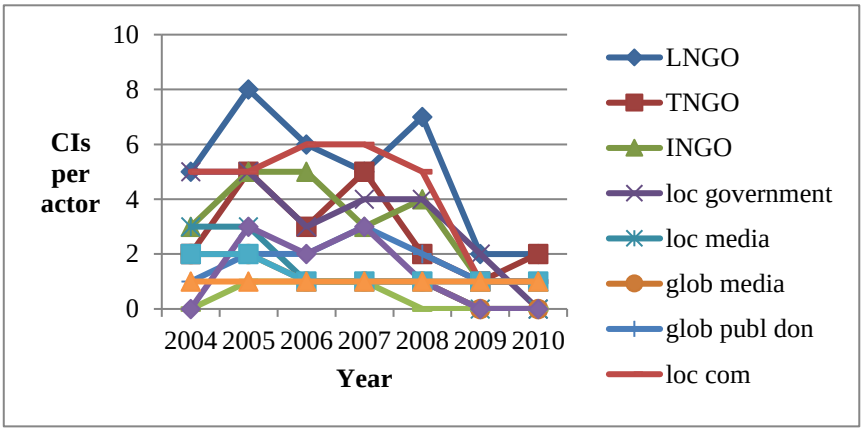

Figure 4-7: Timelines of CI occurrence by actors over 7 years (Ayam)

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

Actor \ Year	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 disaccord 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 disaccord 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 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 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 prices CI medicare	CI rising market prices CI Skilled labor fluctuation CI solution CI boat repair CI local people disaccord	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 disaccord	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.

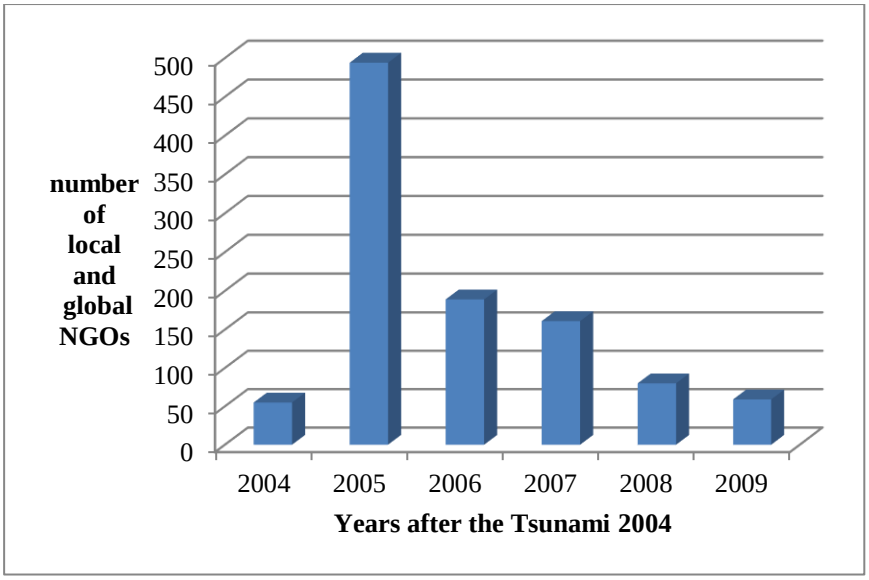

Figure 4-8: Influx of NGOs to Tamil Nadu after 2004 Tsunami (TNTRC report)

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*

[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.

[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).

[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.

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[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.

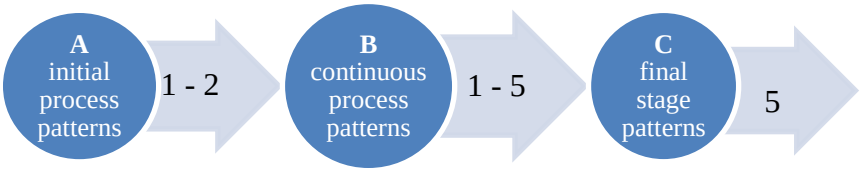

Figure 4-9: The collaborative management process

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 eco-

systems 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.