

# Chapter 6

## The Partner Proliferation Problem in Disaster Response Networks

Sara Hasani, Ramzi El-Haddadeh and Emel Aktas

**Abstract** The extraordinary conditions of a major disaster require mobilization of all available resources. This necessity, together with the stretch in the response budget in the public sector and the difficulty of raising funds in the private sector, draws various humanitarian actors with widely diverse capabilities into the affected area. This phenomenon is called the proliferation of actors, or the partner proliferation problem. This problem can have serious counterproductive effects on disaster operations, such as unmanaged independent efforts that lead to a duplication and confusion of effort. The disaster response phase generally lacks the contributions of a long-term outlook and pre-planning, which are adopted in existing long-term structures such as supply chains. The aim of this paper is to provide a structured review of the partner proliferation problem in the response phase and to suggest alternative courses of action for restructuring the disaster response network. Drawing on the concept of Virtual Organizations, the paper concludes that short-term collaboration is a suitable structure for the response phase. Short-term collaboration in the response phase is complementary to long-term collaborations such as supply chains in the recovery, mitigation, and preparedness phases of the disaster cycle. To that end, a conceptual framework is provided for re-structuring the disaster response network to align with the other phases of disaster management. Finally, further research is suggested to develop a decision making tool for partner configuration to meet the specific requirements of a disaster response network.

**Keywords** Disaster response · Partner proliferation · Short-term collaboration · Virtual organization · Disaster collaboration life cycle

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S. Hasani (✉)  
Business School, University of Bedfordshire, Luton, UK  
e-mail: Sara.hasani@beds.ac.uk

R. El-Haddadeh  
Brunel University, Uxbridge, UK

E. Aktas  
School of Management, Cranfield University, Bedford, UK  
e-mail: emel.aktas@cranfield.ac.uk

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## 6.1 Introduction

Many cases of failure have been reported in disaster response operations due to the challenges faced by humanitarian partners (e.g. Haiti Earthquake in 2010 and the Indian Ocean Tsunami in 2004). One of these challenges is the partner proliferation problem that is the product of the extreme requirements of a disaster where all available sources are mobilized (Tierney and Trainor 2004) and any available partner is encouraged to participate in the response operations. This reaction suddenly stretches the response budget in the public sector (i.e. UN, Red Cross, governments) and multiplies the funds raised by the private sector (i.e. NGOs) (Rolland et al. 2010). Then, the overstretched humanitarian network struggles to channel the funding and resources in an effective manner. The result is the emergence of inexperienced actors in the response operation, such as companies joining in the activities outside their area of expertise with an attempt to improve their public image (Telford et al. 2006; Careem et al. 2006). It also brings in partners who range from competent to incompetent, reputable to disreputable, opportunistic to committed, and well established to just-formed, in addition to individuals and tourists who are eager to help. This oversupply of uncoordinated and inexperienced partners is referred to as the proliferation of actors (Inomata 2006). The actors enter the disaster-affected area in a chaotic pattern (Comfort 2007), which contributes to the proliferation problem.

The proliferation of actors is of special importance because the existence of various partners with different mandates, agendas, levels of professionalism, expertise and resources presents a major challenge to operational coordination. It also poses various threats to ethical and socio-economical issues in the affected area. A number of these actors have moved beyond life-saving activities and tried to make changes in the social environment and attempted conflict resolution. For example, many of them have created their own armed security forces or are in close relations with the military (Metcalf 2012). This also brings about issues where a range of allegations of financial fraud and ethical misconduct of aid workers are reported along with sexual exploitation, abuse, and bullying (Odihp.org 2014; Valburn 2012; Edition. CNN.com 2014).

These issues signal a necessity to deal with the proliferation problem with a wider approach than existing guidelines such as resource scheduling techniques (Rolland et al. 2010), reputation management systems for efficient selection of partners (Javaid et al. 2013), and diagnosis of the severity of the disaster (Hasani et al. 2014).

Although all types of dysfunctions in disaster situations have counterproductive effects on the entire disaster management operation and add negative value to the system (Telford et al. 2006), the proliferation problem in particular damages the quality of the response (Reineck 2010). This threatens the reputation of humanitarian aid organizations (Reineck 2010) and can destroy trust in the long-term. Entrance of inexperienced actors increases the load on the affected populations, local authorities, and coordination structures for information or services. It also increases the costs due to multiple offices tasked with similar activities and associated overheads, and leads to a counterproductive duplication and confusion of effort. In this

situation the partners may compete over donations, funding, facilities, and publicity instead of taking advantage of each other's capabilities (Kent 2004, Telford et al. 2006, Balcik et al. 2010).

To help foster improved cooperation, the present study first articulates the challenges associated with the proliferation of partners and then synthesizes a series of solutions based on the existing literature, identified through a structured review in Scopus and analyzed in terms of the problems addressed, the methodologies used, and the key findings reached. To that end this paper elaborates the scope of the proliferation problem by defining the growth of disasters and the chaotic pattern of partners' entering the disaster area. Then the challenges facing the resolution of the proliferation problem are listed, followed by a few possible solutions. Investigating one of the possible solutions (restructuring) gives rise to a comparison between the existing short-term structures. The authors then build upon the existing literature to synthesize a conceptual model for restructuring the four phases of disaster management with emphasis on the similarities between the disaster response network and virtual organizations as a short-term manifestation of collaborative networks. Finally the article suggests directions for future research.

## 6.2 Problem Definition

Disasters are defined as intense forms of collective stress caused by a disaster agent (Britton 1986) and resulting in '*a disruption that physically affects a system as a whole and threatens its priorities and goals*' (van Wassenhove 2006, p. 476). The intense negative impacts of a disaster on people, goods, services, and the environment make the community incapable of coping (Kovács and Spens 2009) and in need of assistance from governments and international agencies.

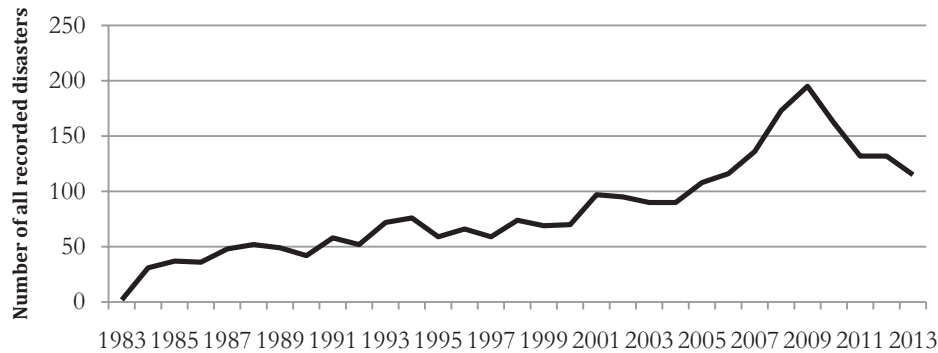
A disaster can occur naturally or due to human activities, including 'slow onset' disasters such as famine and 'sudden onset' disasters such as earthquakes. Man-made disasters could be of an environmental nature (e.g. chemical leaks) or induced by political conflict (e.g. refugee crisis). Table 6.1 shows different types of disasters (van Wassenhove 2006).

This study focuses on natural 'sudden onset disasters' because they have rapidly increased in frequency and severity during the past decades (Fig. 6.1). Sudden onset disasters "occur with little or no warning and often cause excessive injuries and deaths far surpassing the national response capacities" (World Health Organization 2013, p. 10) while slow-onset disasters "*emerge gradually over time, often based on a confluence of different events*" (OCHA 2011, p. 3).

Figure 6.1 illustrates the number of natural sudden-onset disasters from 1983 to 2013. The total number of natural sudden onset disasters registered in the last decade (1449) is more than the disasters registered during 1983–2003 (1234). This growth is mainly associated with geographical and socio-economic reasons. For example climate change is likely to induce more weather-related disasters such as flash floods and landslides. In addition, the urban migration leads to poorly

**Table 6.1** Categories of disasters. (Source: van Wassenhove 2006)

	Natural	Man-made
Sudden-onset	e.g. Earthquake, tsunami	e.g. Chemical leak, nuclear attack
Slow-onset	e.g. Famine, Drought	e.g. Refugee crisis, environmental crisis

**Fig. 6.1** The growth of worldwide natural sudden onset disasters recorded in OCHA database since 1983. (Compiled from relief web (2013))

structured settlements being built on exposed stretches of seismic faults, flooding plains or landslide-prone slopes by the vulnerable population (CRED, ISDR, cited by BBC 2004). Although the improved technical methods of recording and sharing information during the past decade could have contributed to the increase of available data, further research is required to identify the extent of this effect which is out of the scope of this paper.

However, the literature addressing negative impacts of natural onset disasters on humans and social, ecological, and economic environments appears to be insufficient in volume. Out of the 348,551 articles found since 1856, which contain either of the keywords “natural onset disaster(s), tsunami, flash flood, earthquake, volcano, eruption, and cyclone”, 83.7% are just related to the sciences such as earth sciences or engineering, which solely investigate the characteristics of the phenomena itself. The titles related to the areas of interest in this research such as decision sciences, management, economics and in part social sciences accumulates to 18,273 titles which is approximately 5% of the total titles found in the literature search. However the interest of scholars has been exponentially increasing during the last decades as can be seen from a quick comparison in Table 6.2 that shows how the number of articles published on the related subjects has increased over time.

Table 6.2 shows that the articles published on the related subject areas have more than tripled from 545 titles in 2004 to 1785 titles in 2014. It also shows that the articles published in decision sciences containing the above keywords have increased almost 20 times from 14 articles in 2004 to 266 articles in 2014; an increase higher than any other subject area, suggesting a recognition of the need for research on the subject.

Disasters have negative impacts on humans and social, ecological, and economic environments. These impacts are impossible to eliminate but can be alleviated

**Table 6.2** Comparison between articles published in 2004 and 2014

Subject	Year	
	2004	2014
Social sciences	430	1297
Business and management	78	117
Economics	23	105
Decision sciences	14	266
Total	545	1785

and minimized with effective disaster management (Moe and Pathranarakul 2006). However, experiences in the Haiti Earthquake in 2010 and the Indian Ocean Tsunami in 2004 reveal various failures. For example, 2500 people died of cholera in Haiti in the presence of 12,000 humanitarian organizations (Karunakara 2010). This was partly associated with the lack of safe drinking water and the fact that 7 months after the disaster 30% of camps did not have any kind of toilet (Heikkinen 2012). This occurred in the context of donations of USD 1482 per capita (Metcalf et al. 2011), which exceeded the GDP per capita of the country (USD 669 per capita, Worldbank 2014) in that year. During the Indian Ocean Tsunami, competition among aid workers to spend huge private donations led to a misallocation of resources and duplications of activities (Wright 2005). These negative impacts can be reduced if the partners are carefully selected according to the requirements of each particular disaster. That is why this research focuses on the partner proliferation problem and possible ways of addressing it.

What is more, response operations face various challenges such as mass scale effects in large geographical areas and population, and severe damages to people and property. In addition, the involvement of multiple parties, the time pressure for rescue operations and decision-making, severe resource shortages and vast unpredictability are amongst the biggest challenges facing humanitarian logistics operations (Jiang et al. 2012). Various scholars emphasize deficiencies in preparedness and planning and inadequacy of prepared rescuers (Benjamin et al. 2011; Kovács and Spens 2009). Others point out the proliferation of actors in the disaster situation (Reinecke 2010; Telford et al. 2006; Balcik et al. 2010). The majority of these challenges are faced due to the lack of relevant criteria including the standards and indicators, the weak collaboration and the inadequate infrastructure (Kovács and Spens 2009). Also, the uncertainty in demand and supply and the difficulty of inventory forecasting (Balcik et al. 2010) associated with the opportunistic behavior of partners (Pettit and Beresford 2009) together with high employee turn-over (Reinecke 2010; Telford et al. 2006) complicate the situation. The low recognition of the role of logistics (Kovács and Spens 2009) in humanitarian operation further aggravates the problem.

Despite the awareness of practitioners and scholars of the complications and issues related to the proliferation of actors in the disaster response phase, the extent of the negative effects of these challenges on the disaster operation is understudied. Also, the efforts to provide specific guidelines to tackle these challenges are limited



to few studies. For example, Farazmand (2007, 2009) introduces the concept of surprise management as a solution to the challenges facing humanitarian operations. He basically draws upon the failure of the response operation during Hurricane Katrina and suggests engagement of citizens and adaptive collaboration. However, this solution lacks an adoptable guideline or framework to which the practitioners could refer and operationalize the surprise management. On the other hand, Rolland et al. (2010) provides a decision support system for resource scheduling in the response and recovery phases and Javaid et al. (2013) develops a reputation management system for the efficient selection of partners. Finally, the authors of this study proposed in an earlier paper a decision support system for diagnosing the severity of the disaster using the limited data available in the early hours (Hasani et al. 2014).

In part, this chapter is a response to the call by Moe and Pathranarakul (2006) who emphasized the necessity to minimize the negative effects of disasters and to Altay and Green (2006) who pointed out the lack of a network structure to facilitate the response phase of disasters. Although various papers are published especially in the past 2 years in response to these calls, the majority of them are concerned with the pre- and post-disaster phases including mitigation, recovery and preparedness (Crawford et al. 2014; Doocy et al. 2014; Hardy et al. 2013; Malhotra and Vetkatesh 2013; Karunasena 2011). A limited number of articles focusing on the response phase using collaborative partners investigate how the partners who actually responded to the disaster are different from the ones who were planned to participate (Guo and Kapucu 2015). This shows that emergency norms prevail over the bureaucratic norms (Schneider 2011), which is another confirmation of the fact that pre-planning and a long-term outlook in the response phase is extremely problematic. Basically, the partners in an existing disaster response are a part of the collaborative structure and the performance of a disaster response is increasingly being assessed by comparisons between planned versus actual networks (Guo and Kapucu 2015; Hu et al. 2014; Hu and Kapucu 2014; Kapucu and Demiroz 2011; Choi and Kim 2007; Choi and Brower 2006). However, the above articles mostly focus on reporting the discrepancies between the planned and actual structures/partners without providing a guideline for dealing with these differences. A solution for controlling or reducing the discrepancies between the expected partners and the actual proliferated partners is missing. Although there are some studies which provide guidelines for scheduling and task allocation during the response phase (Fiedrich et al. 2000; Nourjou et al. 2014a, 2014b) or provide metrics for amending the partner coordination, the research focusing on the response phase and specifically addressing the proliferation problem is yet to be fully developed. To that end the present chapter addresses the partner proliferation problem in disaster response networks as one of the most recurring problems in humanitarian operations. In line with this problem, the research question of this chapter is:

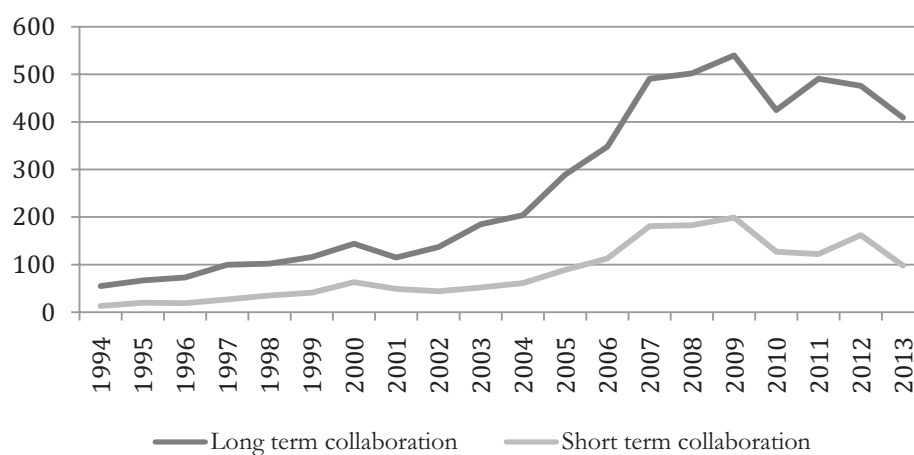
What collaborative structures are suitable to accommodate the partner proliferation problem within the special characteristics of a disaster?

To answer this question, an extensive literature review was undertaken in different search engines in the area of business, management and decision-making. The

Scopus collection retrieved 7094 results during 1947 to 2013 focusing on collaborative networks. The result shows a growth in the amount of literature focusing on collaborative networks since 1994 (when Kanter first coined the term), jumping from 22 articles in 1994 to 3033 during the next 20 years. The scholars in the areas of engineering, social sciences and business and management have produced more material on the collaboration subject than other areas. A quick comparison of these works shows the distinction between short-term and long-term collaboration during the past two decades.

Figure 6.2 shows that although both branches of literature have grown during the past years, long-term collaboration has attracted more interest. Long-term collaboration has been the subject of extensive literature reviews (Wu and Barnes 2011; Aissaoui et al. 2007, de Boer et al. 2001) because traditional collaboration networks such as supply chains, joint ventures, strategic alliances, and franchises usually have a long-term outlook (Gallear et al. 2012). However, the literature is missing a holistic literature review on collaboration with a short-term outlook such as virtual organizations, inter-organizational projects, product development projects, outsourcing projects, and temporary alliances.

The majority of the articles on long-term collaborations mainly focus on how to successfully manage the operation phase of an already formed collaboration. The experts display far less interest in the initiation phase. This finding is of special interest because the initiation phase is where the partners are selected and configured. This phase is very important in the configuration of a disaster response network (DRN) and dealing with the partner proliferation problem. That is why the authors' focus is on efficiently structuring the disaster response network to reduce the rush of available partners into the disaster area. The literature review reveals a difference between the approaches taken to tackle collaboration in the response phase using long-term structures such as supply chains and short-term structures such as virtual organizations or public projects. It also provides a basis for developing a conceptual framework applicable to restructuring the disaster response network (DRN). The



**Fig. 6.2** The growth of collaboration studies with the focus on short/long term collaboration. (Source: Author)

authors argue that one of the reasons for failure in disaster response network configuration is the incompatibility of the disaster response situation with the existing collaborative structures used for managing the response operation.

The uncertainty and the lack of information (Tomasini and van Wassenhove 2009), together with the damaged infrastructure (Jiang et al. 2012), unequal and ineffective distribution of demand and supply and their respective fluctuations (Comfort et al. 2004, Tierney and Trainor 2004), and unsteady flow of the financial resources obtained by fund-raising from occasional donors (Oloruntoba and Gray 2006) all make the planning and the long-term outlook almost impossible. Also long-term approaches in business are usually profit-based whilst in disaster situations the non-financial factors such as the time value of commodities are much more critical than the associated costs (Oloruntoba and Gray 2006; Pettit and Beresford 2009), which makes the conventional profit-based values less appropriate. Therefore, due to the lack of control and information in disaster situations, the existing structures such as supply chains or project-based collaborations might fall short in practice because these structures necessitate a certain amount of knowledge about the required and available resources, the budget, and the time. These data are generally unknown in disaster situations due to the unstable nature of the disaster response network. This lack of data and planning opportunity in the response phase is of particular importance when dealing with the proliferation problem because the data required for shortlisting the partners are insufficient or even non-existent until the actual disaster strikes. To that end a method is required to enable the decision makers to select the partners in a short period of time. One of the solutions to this problem is restructuring the response network to accommodate the characteristics of the disaster situation with a non-financial short-term outlook, which has the capability to work with the minimum data available and without much pre-planning.

### **6.3 Challenges Facing the Resolutions of the Partner Proliferation Problem**

Various scholars have proposed methods to reduce problems associated with the proliferation of partners. The majority of these methods emphasize restructuring the disaster response network either by adopting a collaborative structure (Telford et al. 2006; Balcik et al. 2010) or by shortlisting and selecting fewer beneficiaries (Telford et al. 2006), e.g. selecting certain organizations (Moore et al. 2003) which are able to effectively collaborate (Kovács and Spens 2009). However further guidance on the methods for selection, restructuring and configuration of effective partners are yet to be developed (Kovács and Spens 2009 Moore et al. 2003). The lack of guidance for how to restructure and select partners in order to reduce the proliferation problem can be explained by two main root causes: the lack of information sharing among all disaster response partners and the existing financial-based approach that requires all disaster response units to conduct operations within the boundaries of their allocated budget or raised funds.



First, the lack of control and sharing of information poses a challenge to humanitarian response operations due to the uncertainties associated with a disaster situation (Tomasini and van Wassenhove 2009). Without information, existing structures such as supply chains or project-based collaborations are likely to be inadequate in practice since they have been designed for a more structured and predictable environment. There are practices of allocating surge capacities and mobilization of all available resources in the prominent response organizations such as the UN and the Red Cross. Although these organizations are designed to respond to the uncertainty embedded in a disaster situation, the unsuccessful experiences of large scale disasters such as the Indian Ocean Tsunami and the Haiti Earthquake mentioned earlier signal the necessity for improved management of information resources.

In existing collaborative structures, the efficiency of the system is based on knowledge of where, when and how much goods and services should be delivered. These data are generally unknown in disaster situations due to the unstable nature of the disaster response network (van Wassenhove 2006). Also, the available data in the early hours after a disaster strike are generally incomplete due to the lack of time and the access to the affected area. This turbulence and unpredictability (Pettit and Beresford 2009) generates a challenging environment for planning and long-term management. For example, damaged infrastructure (Jiang et al. 2012) results in ineffective distribution of supply (Comfort et al. 2004; Tierney and Trainor 2004), making it even more difficult to meet the already fluctuated demand with the unsteady supply. Another challenge is the unpredictable flow of financial resources, which are obtained by fund-raising from occasional donors (Oloruntoba and Gray 2006). These issues are in contrast with a long-term planning approach where the budget of the project, the required tasks, and the available resources are either clearer or more predictable.

Second, the financial-based approach fails to address the special characteristics of the disaster response network. For example in a market environment, profit-based collaborative structures such as supply chains rely on the customers at the receiving end as the source of income and aim to maximize their profit while minimizing costs. However, in disaster situations non-profit factors such as the time value of commodities and critical ethical imperatives are much more important (Oloruntoba and Gray 2006; Pettit and Beresford 2009, IFRC Code of Conduct). In this situation, the donors are the source of income, not the actual receivers of the aid. In addition, the central goals of saving lives of the affected population or maintaining the dignity of people do not produce any monetary value and may bring about financially unjustifiable costs. These issues are in contrast with the principles of a financial-based approach and require a new method, which can address the efficiency of the system based on non-profit measures.

Due to the above challenges, there is a need to adopt a structure that is capable of dealing with the non-profit, ethical and short-term characteristics of the disaster situation. However, a network structure for dealing with partner proliferation (Telford et al. 2006; Balcik et al. 2010), and in particular to facilitate the resolution of disasters, is missing (Altay and Green 2006). In the absence of a suitable partnering structure for disaster response networks, different forms of collaboration networks

have been suggested. For example, following the popularity of long-term structures for disaster management in the literature (Maon et al. 2009; Eßig and Tandler 2010; Tatham and Spens 2011) the humanitarian community adopted a supply chain concept as their network structure. Examples include the International Federation of Red Cross and Red Crescent Societies and the World Food Program (Wassenhove et al. 2005). On the other hand, other scholars suggest temporary structures such as high reliability virtual organizations (Grabowski und Roberts 2011) and public projects (Moe and Pathranarakul 2006). This split signals a necessity to investigate the characteristics of each structure to identify the suitable structures for a disaster response network.

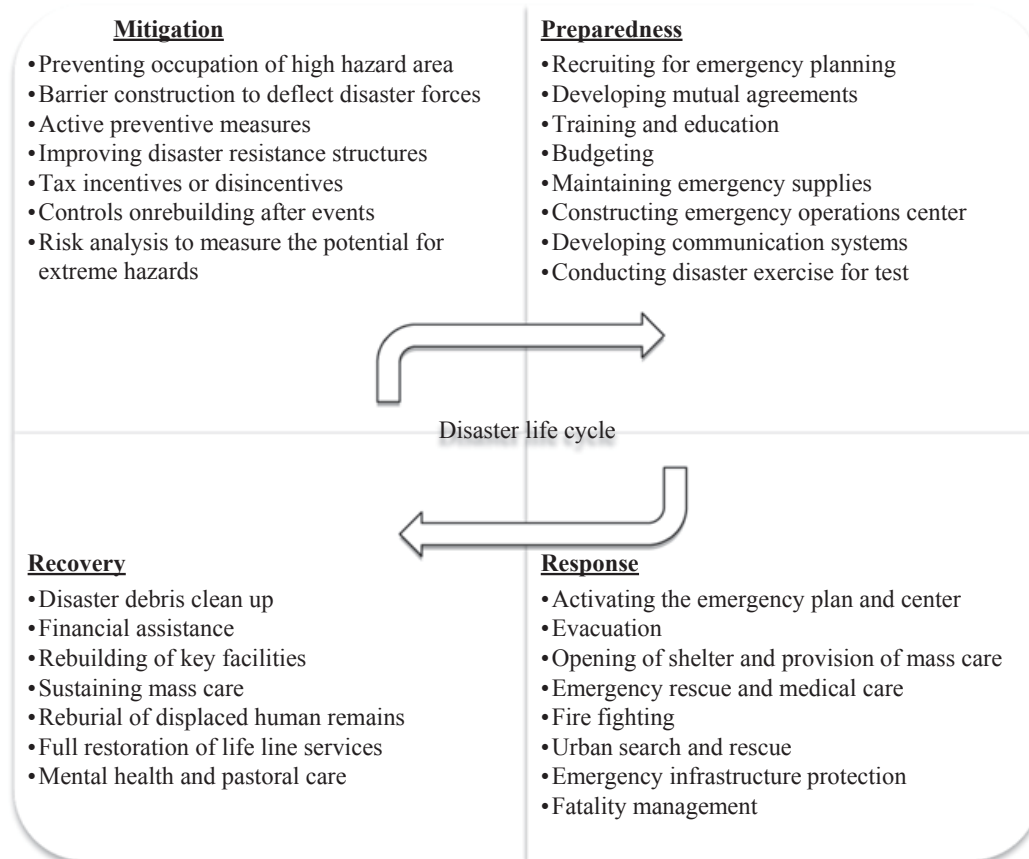
The following section argues that both short-term and long-term structures should be adopted in combination. To justify this argument, we draw upon the literature to support and further develop the idea that different phases of the disaster management life cycle require different network structures.

## 6.4 Disaster Response Networks (DRN)

Drabek (1986) was the first to analyze over 1000 disasters and articulate the four phases of the disaster cycle: (1) preparedness (planning and warning), (2) response (evacuation and emergency), (3) recovery (restoration and reconstruction), and (4) mitigation (perceptions and adjustment). A summary of the typical activities of the disaster life cycle (Altay and Green 2006) is presented in Fig. 6.3.

Many sources use this cycle for describing disaster management (UNICEF 2005; Altay and Green 2006; Benjamin et al. 2011). However, there is a difference between the life cycle used for long-term and short-term structures. For example, Howden (2009) uses this life cycle for addressing a supply chain of disaster management while Moe and Pathranarakul (2006) use it for addressing a disaster management project. Recently, Noran (2011) tries to distinguish between the two by suggesting a combination in which the short-term preparation, response and recovery stages are structured as a virtual organization with a short-term outlook, while mitigation and long-term preparation are managed as a long-term structure. He examines the subject through the enterprise architecture lens to build a “business model” and compares this structure with commercial peer structures where the collaboration forms a virtual organization to bid, win and combine the resources to complete each project promptly. However he does not show how the two structures and their life cycle could fit together and provide a continuous cycle of operations, nor does he address the ethical considerations. The current chapter complements this work by comparing the life cycles of both long- and short-term structures and provides a conceptual model to show where the disaster management life cycle fits within the combined and non-profit short-term/long term structure.

The life cycle of virtual organizations has been extensively modeled (Jägers et al. 1998; Jagdev and Thoben 2001; Sitek 2007, Sitek et al. 2010). It includes three phases: the initiation phase when partner selection takes place, the operation phase

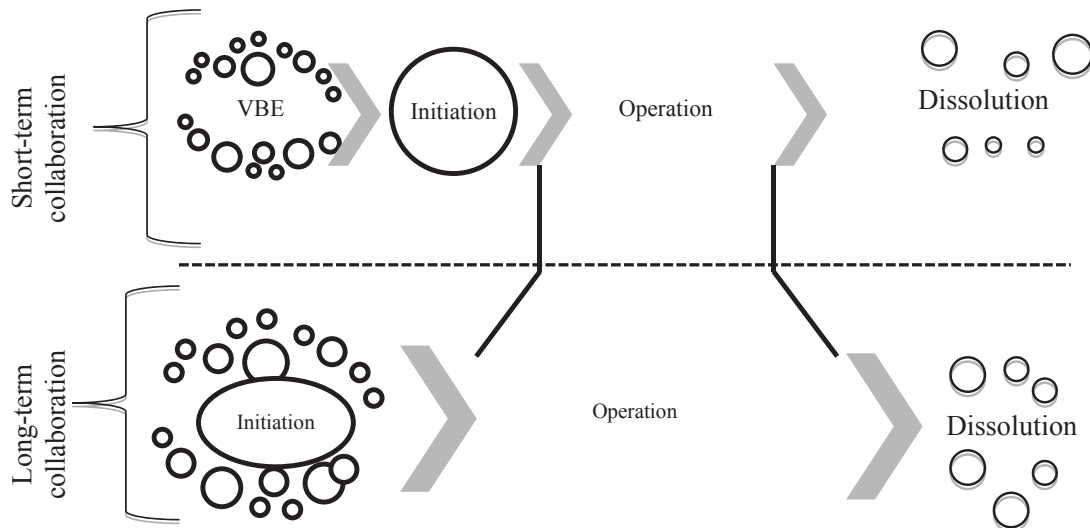


**Fig. 6.3** Typical activities of a disaster life cycle. (Source: Altay and Green (2006))

when day-to-day activities take place and the dissolution phase when the objectives of the collaboration are accomplished or the need for collaboration disappears and the partnership dissolves (Fig. 6.4).

Figure 6.4 shows that in a long-term collaboration (for example supply chain) the initiation phase is followed by operations leading to a dissolution phase. However in this structure, the operation phase is much longer than the operation phase in short-term collaboration. Also the dissolution phase in the long-term collaboration may result in partners not working together for the same collaboration but staying in closer contact for future undertakings.

On the other hand, the short-term collaboration (for example virtual organization) starts from a Virtual Breeding Environment (VBE). “A virtual breeding environment is a long-term pool of potential partners, which provides the environment for the establishment of cooperation agreements, common infrastructures, common ontologies, and mutual trust, which are the facilitating elements when building a new virtual enterprise” (Camarinha-Matos and Afsarmanesh 2003, p. 157). Following demand creation, the initial phase including preparation and configuration tasks (Sitek 2007, Sitek et al. 2010; Ermilova and Afsarmanesh 2006, 2007) is conducted to select a subset of VBE (Camarinha-Matos and Afsarmanesh 2003). Initiation is followed by a short period of day-to-day operations (Sitek et al. 2010) until the market declines and virtual organization dissolves. The virtual organization will



**Fig. 6.4** Comparison between short-term and long-term collaboration life cycle. (Adopted from: Sitek 2007, Sitek et al. 2010; Thoben and Jagdev 2001)

assemble and update its breeding environment, which will facilitate the virtual organization partner selection in the next opportunity.

The difference between the two structures is mainly in the length of the operation phase. Also the VBE is a prominent theme in the emergence of a virtual organization, which gives rise to a quick initiation process. Due to these differences, the application of short-term and long-term structures should be different in a disaster response network. This is further explored below under a discussion of long-term and short-term structures.

### *Long-Term Structures*

The subject of supply chains has attracted great attention from scholars focusing on partner selection in disaster management. A variety of approaches to long-term structure for partner configuration are exhibited in the literature review papers (Weber et al. 1991; Holt 1998; Degraeve et al. 2000; De Boer et al. 2001; Wu and Barnes 2011). Disaster operations in the customary structures for disaster response such as supply chains are performed before, during, and after a disaster with the goal of preventing the loss of human life, reducing the disaster's impact on the economy, and returning to a state of normality (Altay and Green 2006). However, due to a lack of control and insufficient information in a disaster situation, these approaches which consider supply chain as the suitable structure for disaster response may fall short in practice. For example the supply chain structure is put forward as a model based on the assumption that 80% of disaster operation activities involve logistics (van Wassenhove 2006). Therefore a supply chain structure is suitable for managing disaster response operations (Balcik et al. 2010). However

there are various arguments against the suitability of these long-term structures for all phases of disaster situations. A huge amount of a disaster's financial resources depend upon fund-raising from occasional donors and therefore cannot guarantee a steady flow of funds. Also, the demand and supply are rarely equal or distributed effectively (Comfort et al. 2004; Tierney and Trainor 2004) and they dramatically fluctuate during the course of disaster response operation (van Wassenhove 2006). Also the lack of standards and indicators, inadequate training, lack of collaboration, low recognition of logistics and inadequate infrastructure (Kovács and Spens 2009; Benjamin et al. 2011) necessitates a clear restructuring of the disaster response network in ways that all phases of a disaster's life cycle can be based on, including short-term. Following this mind-set, scholars have recently started to employ temporary organizational structures (Simpson and Hancock 2009) for some phases and long-term structures for other phases of the life cycle.

### *Short-Term Structures*

Another suggestion, limited to few studies, is the use of short-term structures to address the temporary nature of response operations in addition to addressing the conflict of objectives associated with the proliferation of heterogeneous partners (Jiang et al. 2012). For example, some scholars see the response operations as a public project targeting the alleviation of poverty and elevating living conditions of people. While some consider this public project involves prediction, planning and execution (Moe and Pathranarakul 2006) in the long-term, others argue that the ad-hoc collaboration processes of disaster response cannot be planned ahead because activities such as individual citizen contributions and volunteering are not business-oriented (Camarinha-Matos and Afsarmanesh 2008; Nolte and Boegnigk 2012).

Apart from the long-term/short-term segregation, some scholars also explore horizontal/vertical cooperation between entities. This cooperation can operate at the same level in the market, hence the horizontal cooperation (Schulz and Blecken 2010) or involve different actors along the value chain of one industry, which would be the vertical cooperation. Both horizontal and vertical cooperation can be short-term or long-term depending on the needs of the partners, but it is more likely that vertical cooperation has a long-term focus. Horizontal cooperation could be compared to virtual organizations and may have a short-term focus as well as a long-term focus when companies are in strong partnerships.

Working across organizations has been long recognized as a necessity in public management (Friend et al. 1974). However, in recent years more companies have adopted collaboration in response to a volatile and competitive business environment (Camarinha-Matos and Afsarmanesh 2008) to increase their survival chances and gain a competitive edge (Romero et al. 2009). An extreme case of a collaboration network is the virtual organization as a temporary alliance of independent enterprises (Camarinha-Matos and Afsarmanesh 2005) which is formed in response to a single market opportunity (Martinez et al. 2001) and dissolves with the market's



decline (Brown and Zhang 1999). In fact, the virtual organization structure is a method used by traditional companies to access external resources (Jägers et al. 1998) and a niche market (Brown and Zhang 1999) by collaborating with others. According to Jägers et al. (1998), the idea of a virtual organization has emerged from lean and agile manufacturing with a shift of focus to inter-organizational relationships. Drucker (1988) heralded the first signs of organizations with characteristics similar to those of virtual organizations. He signaled the emergence of a new generation of organizations. However, the expression ‘Virtual Corporation’ (Davidow and Malone 1992; Byrne 1993) was coined later in the literature. Virtual organizations are agile supply chains with a shift in focus from intra-enterprise performance to inter-relationship between companies (Corvello and Migliarese 2007). We refer the reader to Thoben and Jagdev (2001) for a comparison of supply chains and virtual organizations.

Here we argue that to accommodate various phases of the disaster life cycle, different structures are required. Supporting this perspective, Noran (2011) not only suggests a short-term virtual structure for managing preparation, response, and recovery in disaster networks, but also a long-term structure to manage mitigation and long-term preparation. This suggestion of using virtual organizations as the short-term structure for disaster response phase has also been adopted by others. For example, Javaid et al. (2013) state that the nature of disasters requires short-term collaboration between the partners of a virtual organization. To that end, we explore below the suitability of a virtual organization structure for a DRN.

## 6.5 Suitability of Virtual Organizations for Disaster Response Networks

To provide evidence that a virtual organization is a suitable structure for the short-term stages of a disaster operation, we compare the characteristics of virtual organizations and disaster response networks to show that they are both temporary alliances of independent organizations. They both share resources and information to collectively access the damaged regions (analogous with “market”) and provide for a one-time created demand. Using networks as their structure, they can decentralize and cover various sub-tasks in accordance with their heterogeneous nature, while dynamically adapting to the turbulent situation. When the demand declines due to the progress of disaster response operation, they can dissolve and become independent entities again. These common characteristics are highlighted in Table 6.3.

Table 6.3 illustrates that in both structures, time and cost effectiveness is crucial. The temporary network is created to cross boundaries of individual organizations and allow collective access to resources including donations. The network structure of individual yet mutually dependent and equally important partners emphasizes the lack of hierarchy. Instead, the uncertainty and highly unpredictable changes in the environment are addressed by spontaneous, complex, dynamic and flexible actions. In virtual organizations as well as disaster response networks the attempt

**Table 6.3** Overlaps between characteristics of VO and DRN

Shared characteristics between VO and DRN	Literature on virtual organizations	Literature on disaster response networks
Cost/Time Effectiveness	Tan et al. (2008); Brown and Zhang (1999)	Nolte and Boenigk (2012); Comfort (2007); Tierney and Trainor (2004)
Collective access to resources/donation	Tan et al. (2008)	Nolte and Boenigk (2012)
Temporariness	Tan et al. (2008); Jägers et al. (1998); Brown and Zhang (1999)	Comfort et al. 2004; Nolte and Boenigk (2012)
Lack of hierarchy	Tan et al. (2008); Brown and Zhang (1999); Jägers et al. (1998); Martinez et al. 2001)	Moe et al. 2007; Tierney and Trainor (2004)
Network structure	Jägers et al. (1998); Corvello and Migliarese (2007)	Nolte and Boenigk (2012); Tierney and Trainor (2004)
Independent participants	Tan et al. (2008); Jägers et al. (1998);	Nolte and Boenigk (2012); Tierney and Trainor (2004)
Spontaneity	Jägers et al. (1998); Brown and Zhang (1999)	Tierney and Trainor (2004)
Dynamism	Jägers et al. (1998);	Nolte and Boenigk 2012
Uncertainty	Jägers et al. (1998); Brown and Zhang (1999)	Tierney and Trainor (2004)
Participants equality	Jägers et al. (1998);	Tierney and Trainor (2004)
Boundary crossing	Jägers et al. (1998);	Nolte and Boenigk (2012)
Mutual dependency	Jägers et al. (1998); Brown and Zhang (1999)	Tierney and Trainor (2004)
Geographical dispersion of actors	Martinez et al. (2001)	Nolte and Boenigk (2012)
Niche market demand	Jägers et al. (1998); Brown and Zhang (1999); Martinez et al. (2001)	Tierney and Trainor (2004)
High partner turn over	Brown and Zhang (1999)	Tierney and Trainor (2004)
Unpredictable changes	Jägers et al. (1998); Corvello and Migliarese (2007)	Tierney and Trainor (2004)
Flexibility	Brown and Zhang (1999)	Nolte and Boenigk (2012)
Time Constrains	Brown and Zhang (1999)	Nolte and Boenigk (2012)
Complexity	Corvello and Migliarese (2007)	Nolte and Boenigk (2012)
Decomposable tasks	Martinez et al. (2001)	Tierney and Trainor (2004)

is to respond to the disaster-created demand (analogous to the niche market demand), by allocating decomposed tasks to geographically dispersed partners under time constraints to allow a collective access to resources/donations. VO here is the representative of a short-term structure with a temporary nature and so is a DRN. In other words, due to the shared characteristics between the two, this research argues that DRN can be well adopted into a temporary structure of a VO without the objective of making profit or achieving commercial gains. To better illustrate how the DRN with a VO structure could fit within the long-term structure of the disaster management life cycle, the disaster collaboration life cycle conformity model is put forward in Fig. 6.5.

Short-term collaboration in Fig. 6.5 shows where the short-term phases of disaster management fit within the collaboration. It illustrates that the disaster strike creates demand for humanitarian aid, necessitating preparation and configuration tasks (Sitek et al. 2010; Ermilova and Afsarmanesh 2006, 2007) in the initial phases. This includes selecting a subset of partners out of the virtual breeding environment (Camarinha-Matos and Afsarmanesh 2003), which is a pool of potential partners. The life cycle continues with the day-to-day operation (Sitek et al. 2010) of the disaster response network and dissolves when the need for humanitarian aid is diminished and the community is capable of coping with the situation on their own resources.

Long-term collaboration in Fig. 6.5 shows preparation, mitigation, and recovery phases between humanitarian partners. The operation of these three phases also follows a process of selecting suitable partners for long-term collaboration, similar to partner selection for a supply chain. The combination of the two life cycles gives rise to a conceptual model for disaster operation structure along the four phases of the disaster cycle.

To summarize, the disaster collaboration life cycle conformity model suggests that short-term and long-term collaboration in a DRN need to work in tandem. The long-term structures such as supply chains are suitable for structuring the majority of the disaster life cycle including recovery, mitigation, and preparation, whereas the response phase associated with the immediate aftermath of the disaster should adopt short-term structures such as virtual organizations. Unlike the immediate aftermath, there is time for gathering accurate data, planning, prediction, and implementation in recovery, mitigation, and preparation phases. Therefore in these phases the established networks such as supply chains can effectively form and operate. The response phase however requires a structure, which can form immediately and act upon uncertain data, because the community is under shock and in need of urgent help. For this phase, a virtual organization structure is more effective.

To further examine the suitability of virtual organizations to a DRN, we compare the life cycles of the two. The overlap between characteristics of virtual organiza-

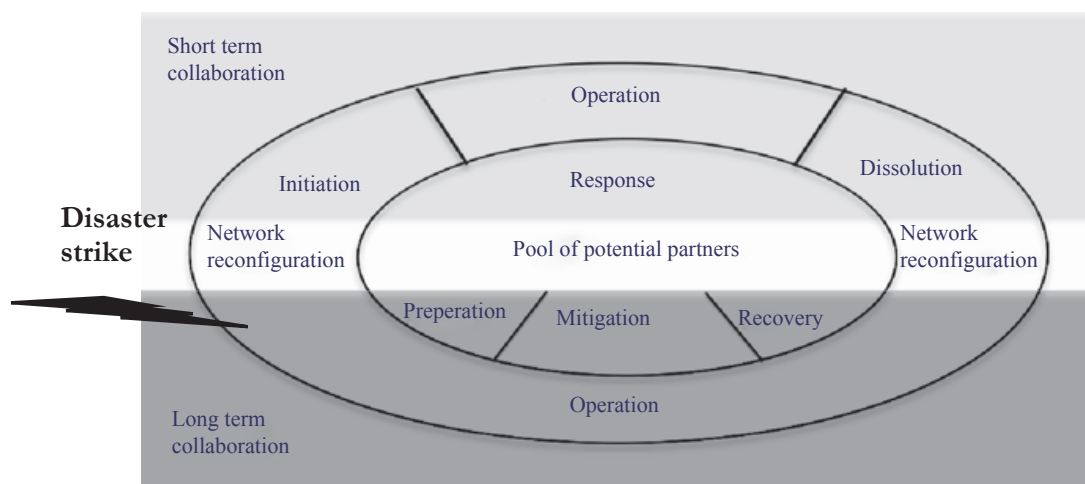


Fig. 6.5 Disaster collaboration life cycle conformity model. (Source: Authors)

tions and the disaster life cycle indicates that a virtual organization structure can accommodate the response phase requirements. To further clarify where the disaster response network and virtual organization overlap, Fig. 6.6 illustrates both life cycles.

The left side of Fig. 6.6 shows the life cycle of the VO and the right side shows the life cycle of the DRN. The middle column shows the period of the life cycle including before, during and after the business opportunity emerges (VO) or the disaster strikes (DRN). On the left side of Fig. 6.6, a sudden change in the environment such as a business opportunity creates demand for product and services. This kicks off the life cycle of a VO and it requires a network reconfiguration from a pool of potential partners. The result creates the response phase operated by a VO (short-term collaboration) within the three-phase life cycle (initiation, operation and dissolution). After dissolution of the VO, the network may be reconfigured into a long-term collaboration structure such as supply chains. The collaboration will initiate, assemble and update the pool of potential partners to facilitate partner selection the next time this is needed. This structure restarts when the market creates another demand.

On the right side of Fig. 6.6, the life cycle starts when a disaster strikes and creates demand for a humanitarian response. This is followed by the initiation and formation of the incident-specific network of partners who organize the response. When the demand for humanitarian response decreases, the specific network of humanitarian partners is dissolved and the recovery phase is started. This is followed by mitigation and preparedness, which keep the long-term network of partners up-to-date and better prepared for the next time they are called to respond to a disaster.

It is noteworthy to mention that these phases are seldom mutually exclusive or independent; rather, overlaps and interrelations enable them to operate concurrently (Shaluf 2008; Moan et al. 2009). For example, there is no crisp separation between

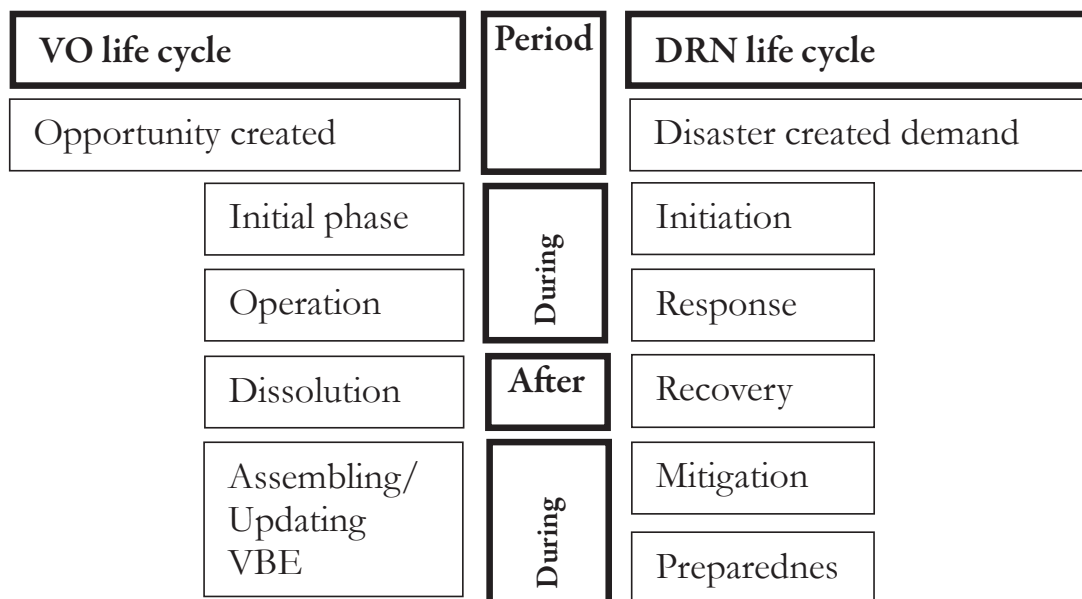


Fig. 6.6 The overlap between VO and DRN life cycle phases. (Source: Authors)

mitigation and recovery as the cycle progresses from recovery to mitigation, similar to preparedness and response because the disaster network must be built quickly given the situation before the disaster strike (Moan et al. 2009).

## 6.6 Discussion, Conclusions, and Limitations

This paper focuses on the partner proliferation problem in DRN as one of the most recurring problems in humanitarian operations. A literature review revealed growing interest in the possibilities of restructuring the DRN. To investigate this, we highlight the challenges facing the disaster response operation. These challenges are mainly associated with the lack of reliable data, which make long-term outlook and pre-planning extremely difficult. Instead, a short-term outlook toward collaboration is investigated and an example of a short-term structure, the virtual organization (VO), is compared to DRN to outline its compatibility (Table 6.3). The result shows that their characteristics match in multiple aspects and suggests that a VO structure is a good candidate for restructuring the DRN.

For further investigation, long-term and short-term collaborations are compared (Fig. 6.4) to see where their different phases fit within each other's life cycle. The result is matched to the disaster life cycle, where a conformity model is created (Fig. 6.5). The latter shows that the three phases of the disaster life cycle (preparation, recovery, and mitigation) could be well supported within the framework of a long-term collaboration. On the other hand, the response phase of the disaster life cycle could be well supported within a short-term collaborative structure. Figure 6.6 shows how specific phases of the disaster life cycle could fit in a particular type of short-term collaboration, namely the virtual organization. Based on this analysis, we conclude that a VO is a suitable structure for addressing the proliferation problem in DRN. The main reasons are twofold: (1) the VO structure supports a short-term and temporary approach to operations that can be triggered by a sudden disaster-created demand, and (2) the potential to work with minimum planning and to respond to the sudden changes in the environment makes VO a suitable candidate for restructuring the DRN with its many uncertainties.

The analysis of literature and current practice reveals additional information on the severity and the consequences of the proliferation problem. It highlights the scope of this problem due to the growth of natural onset disasters in recent decades and shows that although scholars are aware of the extent of the negative consequences of the proliferation problem, there are no generally agreed upon frameworks to tackle this problem. Only a few suggestions are put forward to reduce the proliferation problem, including restructuring the disaster response network either by adopting a collaborative structure or by shortlisting and selecting fewer beneficiaries. In addition, while there are studies emphasizing the discrepancies between the planned partners and unexpected partners in the disaster response, a framework to address these discrepancies is yet to be developed.



Building upon these studies, the present paper argues that one of the reasons for the proliferation of partners is the inadequacy of existing collaborative structures to cope with the unpredictable, non-profit based, ethically constrained situation of a disaster aftermath where basically few data are available and many principles of business efficiency do not hold. To address this, the present study revisits the characteristics and the life cycle of existing structures including long-term (e.g. supply chain) and short-term (e.g. virtual organization) collaboration. A comparison between the two structures and the characteristics and the life cycle of the DRN gives rise to a conceptual model for re-structuring the DRN within the disaster life cycle. The model suggests that the virtual organization as a short-term manifestation of collaboration is a suitable structure for the response phase, while long-term collaboration structures such as supply chains can be best used for the management of mitigation, recovery and preparedness phases of a disaster response operation.

There are important limitations to these conclusions. The model presented here is a conceptual model and its practicality is yet to be examined. Also, the restructuring suggested here is only one of many possible solutions to the proliferation problem and further investigation is required to identify and analyze other potential solutions. It is also noteworthy to point out that while this research can lead to motivations and techniques for the selection of partners, the political task and ethical constraints of dealing with the non-shortlisted beneficiaries and the stakeholders they represent is out of the scope of the present research.

Another key future challenge is to provide specific guidance for restructuring the network, including (1) how and on what basis should we configure the VBE or the pool of partners, (2) how and on what basis should we select the humanitarian partners required for virtual organization under the time pressure of the disaster aftermath, (3) how to dissolve the virtual organization when the humanitarian aid demand declines after the disaster, and (4) how to deal with the convergence problem with the entrance of unexpected partners. The above challenges are the subject of ongoing research by the authors intending to develop a decision support tool. This study is part of an extensive research on the configuration of humanitarian partners in a disaster response network, which includes prediction of the human impact of disasters and scenario-based decision-making models.

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