

Disaster Response Supply Chain Management (SCM): Integration of Humanitarian and Defence Logistics by Means of SCM

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Introduction

The changing nature of conflict, climate change, increasing competition for access to energy and natural resources, extreme poverty and poor governance do not only enhance the threat of disasters – the truth is that the impact of these factors is quite frequently severe.¹ Although, in 2008, the total number of disasters decreased compared to previous years, the disasters that occurred were characterised by a much more devastating impact. Referring to this, the United Nations International Strategy for Disaster Reduction (UNISDR) (2009) has recently published the following alarming data: in 2008, 321 disasters – e.g., cyclone Nargis, which moved across Myanmar, as well as earthquakes and floods that struck various areas of the world – killed 235,816 people, affected 211 million others and cost a total of US \$ 181 billion.²

The explanations above illustrate the omnipresence, variety and intensity of disasters. Furthermore, they reveal the associated consequences and the relevance of humanitarian assistance in terms of disaster response.³ Disaster response focuses on preserving life, preventing and alleviating human suffering and maintaining human dignity wherever necessary and in cases where governments and local actors are overwhelmed, unable or unwilling to act.⁴

¹ See European Commission (2008), p. 4.

² See UNISDR (2009), pp. 1 f.

³ See European Commission (2008), p. 4.

⁴ See European Commission (2008), p. 6.

In order to ensure a rapid and effective continuity of supply⁵, disaster response requires the highest logistical exigence. The circumstances prior to the emergence of a disaster are often characterised by a lack of logistical structures and, therefore, do not permit individuals to capitalise on the potential of modern supply chain management. Consequently, logistical activities related to disaster response focus less on the optimisation of supply chains than on their design, establishment and stabilisation.⁶

A huge number of actors have dedicated themselves to the mission of disaster response and basically pursue the same objective.⁷ Nonetheless, these actors fundamentally differ with respect to their motivations, mandates, missions and working methods.⁸ As a result, coordination among these various actors is often missing.⁹ Yet, respective literature seems to lack a comprehensive discussion of potential, alternative arrangements or of the problem's underlying determining factors.

The main goal of this article is the conceptual design of various models of supply chains that might generally be adopted in terms of disaster response. The article is divided into four sections. Section one will be dedicated to the classification of disasters in order to draw attention to their individual characters. Section two will focus on the classification of consequences resulting from disasters. Based upon this is the assumption that a generic supply chain in terms of disaster response is not useful. Furthermore, potential supply chain models will be highlighted in section three. In section four, various types of coordination will be identified and discussed with reference to their respective adequacy. Finally, the findings will be reflected and prospects for possible future research activities will be indicated.

⁵ See Beamon (2008), p. 11.

⁶ See Pettit/Beresford (2005), p. 313.

⁷ See Tufinkgi (2006), p. 134.

⁸ See Joint Warfare Publication 3-52 (2002), p. 3-6; Tufinkgi (2006), p. 134; van Wassenhove (2006), p. 483.

⁹ See Mackinlay (1996), p. 32.

Classification of Disasters

The term disaster¹⁰ is characterised as an event responsible for a breakdown in the normal functioning of a system (community) that has a significant adverse impact on people, their work, infrastructure and environment, overwhelming the local response capability.¹¹ Disasters differ in terms of their character – some divergent forms will be identified and described in the course of the following paragraphs.

The most popular attribute used in describing disasters is its cause.¹² On the one hand, natural disasters result from uncontrollable forces of nature and may be of geological (e.g. earthquakes, tsunamis, volcanic eruptions or landslides) or climatic (e.g. cyclones, floods, drought or forest fires) origin.¹³ On the other hand, man-made disasters result from human intervention and may include biological and biochemical terrorism, nuclear events, fire, explosions, armed conflicts and acts of war.¹⁴ Based on a disaster's cause, conclusions can be drawn concerning the associated consequences. Thus, the extent of the damage resulting from natural disasters can be estimated at quite an early stage, whereas absolutely the opposite is the case with the extent of damage arising from man-made disasters.¹⁵

Because disasters of the same type (e.g. earthquakes) might have different impacts depending on where they occur, classifying also needs to be done on this basis. Hence, another criterion can be seen as the geographical position of a disaster or, rather, its underlying population

¹⁰ In general usage, different terms exist in order to describe identical or similar events. See Tufinkgi (2006), pp. 10ff. Due to this fact, the terms “emergency”, “hazard” and “catastrophe” can be seen as synonyms for the term “disaster” within this article.

¹¹ See PAHO (2000), p. 4; PAHO (2001), p. 1.

¹² See Berren/Beigel/Ghertner (1980), pp. 104f.; Veenema (2003), p. 4.

¹³ The term “natural disaster” erroneously implies that such a disaster results from natural risks. Nonetheless, it has to be noted that human action makes a significant contribution with respect to the emergence of such disasters. See Eikenberg (2000), p. 4.

¹⁴ See Veenema (2003), p. 4; Joint Warfare Publication 3-52 (2002), p. 1-6.

¹⁵ See Tufinkgi (2006), p. 30.

density.¹⁶ A disaster striking an area characterised by a low population density may perhaps be merely a temporary inconvenience in the lives of those living nearby, damage infrastructure or affect the telephone service. Whereas, in contrast, the same type of disaster, if it strikes an area with a high population density, may result in the loss of human lives and major material possessions, such as homes.¹⁷

In spite of this, another attribute considered in the classification of disasters is the speed of their onset. Sudden-onset disasters give little room for forecasting and generally cause immediate losses and disruptions. Due to their underlying element of surprise, earthquakes, floods or hurricanes might be considered sudden-onset disasters. Contrary to them, slow-onset disasters are usually characterised by forecast lead-times varying from several days to weeks. Therefore, they have a high probability of being predicted. Drought, famine or pandemics might be considered slow-onset disasters.¹⁸

Yet another – a final – criterion should be considered: the occurrence and the correlated frequency of a disaster's emergence.¹⁹ The inclination to merge these criteria results from the fact that the more frequent the occurrence, the higher the likelihood of its occurring will be. Thus, areas that lie close to a geographical fault or also port cities handling explosives are more endangered of disasters, regarding their occurrence as well as their frequency²⁰, while other areas may well enjoy a relatively low disaster occurrence and frequency.

Based on the criteria identified and discussed, the undertaken classification of disasters illustrates the extensive spectrum and, moreover, underlines the unique character of each disaster. Thus, the integration of the five criteria alone – cause, population density, speed of onset, occurrence and frequency of emergence – gives way to a total of

¹⁶ See Veenema (2003), p. 5.

¹⁷ See Berren/Beigel/Ghertner (1980), p. 106.

¹⁸ See Tufinkgi (2006), p. 31.

¹⁹ See Veenema (2003), p. 5; Tobin/Montz (1997), p. 14.

²⁰ See Dynes (1970), p. 52.

sixteen different types of disasters.²¹ The results of the analysis so far can be summarised in the following table:

Table 1: Classification of disasters

		Slow-onset		Sudden-onset	
Natural	Low population density	I	II	III	IV
	High population density	V	VI	VII	VIII
Man-made	Low population density	IX	X	XI	XII
	High population density	XIII	XIV	XV	XVI
		Low frequency	High frequency	Low frequency	High frequency
		Low occurrence		High occurrence	

Source: modified from Berren/Beigel/Ghertner (1980), p. 105.

The table gives a clear overview of the diversity of disasters. As the type of disaster is crucial in determining the appropriate type of reaction in terms of disaster response,²² the following conclusion might be drawn: To create an effective response following the emergence of a disaster, the disaster’s individual character must be considered.

Supply Chains as a Tool of Disaster Response

In general, the emergence of a disaster causes a demand in terms of disaster response. This, in turn, calls for designing, establishing and

²¹ In spite of the criterions described in this article, there can be identified further ones. *Dynes* (1970) includes e.g., predictability, controllability and duration of disasters. See *Dynes* (1970), pp. 51ff.

²² See *Davidson/Hayes/Landon* (1996), p. 4; *PAHO* (1999), p. 1.

stabilising adequate supply chains.²³ This kind of response can be seen as essential in the process of ensuring or, rather, re-establishing continuity in the supply of basic necessities to the affected population at the right place as quickly as possible.²⁴ Disaster response supply chains are typically characterised by zero lead times, highly unpredictable demand patterns, improper logistics and infrastructure facilities, unreliable information, and the presence of alternate supply chains operating in parallel.²⁵ Moreover, such supply chains usually are made up of huge numbers of actors to provide disaster response efforts, having different motives, roles, mandates and work methods as well as origins, history, geographical, cultural and political backgrounds.²⁶

Thus, it can be safely assumed that disaster response is determined by a multitude of elements and restrictions and does not permit the design, establishment and stabilisation of a generic supply chain. According to the approach chosen in the previous section, several relevant criteria will be identified and discussed in the course of the following paragraphs.

As mentioned above, disaster response supply chains include a huge number of actors that can be subdivided into different organisational groups. In this way, one group represents United Nations agencies, while others work for other international public organisations. This type of organisation has to be clearly distinguished from international private organisations, such as the International Committee of the Red Cross. Donor agencies, such as the World Bank, represent an additional group of organisations. The large number of non-government organisations, which differ in terms of their size, resource base, the thematic and geographic focus of their activities, and other criteria²⁷ may be subsumed as a final organisation group. These actors, bundled together, reflect the collective referred to as civilian organisations.²⁸ In addition,

²³ See Hale (1999), p. 8; Pettit/Beresford (2005), p. 313.

²⁴ See OECD (1999), p. 10; Chandra (2006).

²⁵ See Chandra (2006); Beamon (2004), pp. 78f.; Rodman (2004), p. 11.

²⁶ See Joint Warfare Publication 3-52 (2002), p. 3-6; Tufinkgi (2006), p. 134; van Wassenhove (2006), p. 483; Eriksson (2000), p. 4.

²⁷ See Davidson/Hayes/Landon (1996), pp. 6f., 34f.

²⁸ See OCHA (2008), p. 8.

there is a tendency for armed forces operating around the world to go beyond traditional military activities and take on humanitarian and development-related tasks.²⁹ Therefore, another group comprised of military organisations can be identified.³⁰ Like civilian organisations, the involvement of military organisations in activities that relate to disaster response is multidimensional and varies according to the nationality, the service and the number of military parties.³¹

Based on the differentiation undertaken between actors associated with civilian and military organisations, another criterion classifying disaster response supply chains can be deduced. In this way, each type of organisation possesses certain capabilities in terms of assets, resources, et cetera, that are virtually unique to their character.³² In conclusion, the relevance of both civilian and military organisations in providing disaster response supply chains can be assumed. The following table gives an idea of these particular capabilities:

²⁹ See SIPRI (2008), p. 9; Tufinkgi (2006), p. 144.

³⁰ See OCHA (2008), p. 8.

³¹ See Davidson/Hayes/Landon (1996), p. 35.

³² See Eriksson (2000), p. 15.

Table 2: Capabilities of civil and military supply chains

Type of organisation	Capabilities
Civil	<ul style="list-style-type: none"> - Caring for the affected population through the distribution of nutrition and water - Technical reconstruction of major infrastructure (e.g., main transport routes, railroads) - Political reconstruction (e.g., police, political and economic institutions)
Military	<ul style="list-style-type: none"> - Establishment of a secure environment (whereby civil organisations and personnel are able to resume disaster response) - Rapid access to and availability of strategic and tactical transport resources and routes (e.g., by means of air and maritime transport) - Rapid analysis of the disaster-affected area through the provision by air) - Rapid access to a ready-made organisation

Source: Davidson/Hayes/Landon (1996), p. 12f.; Eriksson (2000), p. 15; Pettit/Beresford (2005), p. 320; Tufinkgi (2006), p. 144; UNHCR (1995).

Another criterion that can be used to classify disaster response supply chains is their scope. National response, on the one hand, may be coordinated by the nation affected by the disaster itself, an effort that would include both the national government and local organisations.³³ Such a disaster response can be tailored to the cultures and lifestyles of the affected population and can eliminate much of the logistical burden associated with transporting and storing supplies that come from outside the region.³⁴ Nonetheless, the consequences resulting from disasters often exceed the coping mechanisms and aid resources of single nations.³⁵ The establishment of supply chains, therefore, has to go

³³ See Joint Warfare Publication 3-52 (2002), p. 2-8.

³⁴ See Rodman (2004), pp. 22f.

³⁵ See Joint Warfare Publication 3-52 (2002), p. 2-8.

beyond the level of national response up to that of international response. As national response often takes place as a first step, disaster response is typically characterised by an incremental extension of the scope of the supply chains. Thus, disaster-affected nations usually turn to their neighbours first in order to benefit from the proximity of the assets and the probably shared understanding in terms of political, social, religious, and geographical characteristics.³⁶ Within this context, it should be noted that no one besides the disaster-ridden nation itself retains the primary responsibility for protecting their population and that, therefore, the decision to request or accept international disaster response offers is its own.³⁷

A huge number of guidelines may be considered as the final criterion. Due to its restrictive character, the configuration of a disaster response supply chain strongly depends upon guidelines. In particular, this includes “The Use of Military and Civil Defence Assets in Disaster Relief” (Oslo Guidelines), “The Use of Military and Civil Defence Assets in Support of United Nations Humanitarian Activities in Complex Emergencies” (MCDA Guidelines), “The Use of Armed Escorts for Humanitarian Convoys” and “Civil-Military Relationships in Complex Emergencies”.³⁸ In general, these non-binding guidelines address principles, mechanisms and procedures adopted by civilian organisations that have to do with the involvement of military organisations in disaster response. As civil organisations are typically in favour of preserving the humanitarian space, their main objective can be seen as the rejection of the involvement of military organisations. Nevertheless, the guidelines indicated above create room for maneuvering, which allows civilian organisations to decide which military assets are to be used in a specific situation. In this context, the issues mentioned below should be taken into consideration:

³⁶ See SIPRI (2008), p. xi.

³⁷ See OCHA (2007), p. 13; Tufinkgi (2006), p. 137;

European Commission (2008), p. 5; Davidson/Hayes/Landon (1996), p. 5.

³⁸ See UNDAC (2006), p. 9; OCHA (2008).

- The use of military assets has to be verified in detail. The involvement of military organisations is to be seen as a “last resort” and situations in which the military is to become involved have to meet two conditions: a comparable civilian alternative must be lacking and it must be the case that only military support can meet the critical “humanitarian gap”³⁹ in question. In conclusion, military assets have to be unique in terms of capability and availability.⁴⁰
- Disaster response involving assets provided by military organisations must retain a civilian nature and character. Disaster response must, therefore, remain under the overall authority and control of civilian organisations.⁴¹
- Military organisations supporting disaster response should offer their resources at no cost to the disaster-affected nation.⁴²

Despite this, disaster response generally has to be carried out in accordance with the following humanitarian principles that significantly determine the readiness, capability and configuration of disaster response supply chains:

- Humanity: Human suffering must be addressed wherever it is found, with particular attention being paid to the most vulnerable in the population, i.e. children, women and the elderly. The dignity and rights of all victims must be respected and protected.
- Impartiality/independence: Humanitarian assistance⁴³ must be provided without discrimination based on ethnic origin, gender,

³⁹ A humanitarian gap can be defined as an acknowledged discrepancy between the disaster response needs that an aid organisation is being asked to satisfy and the resources available to meet those needs. See Joint Warfare Publication 3-52 (2002), p. 1-4; OCHA (2007), p. 7.

⁴⁰ Within this context, it has to be noted that military assets are acknowledged as a tool complementing disaster response. See OCHA (2007), p. 4. Due to their complementary character, both civil and military assets can therefore be seen as important assets in facilitating an effective disaster response.

⁴¹ See OCHA (2008), p. 26.

⁴² See OCHA (2007), p. 8.

nationality, political opinions, race or religion. Efforts to provide for a disaster-affected population must be guided solely by need, and priority must be given to the most urgent cases of distress.

- Neutrality: Humanitarian assistance must be provided without engagement in hostilities or the taking of sides in political, religious or ideological controversies.⁴⁴

As compared to the generic guidelines outlined above, further guidelines that are only sporadically applied can also be identified. Thus, disaster-prone nations like Indonesia, China or North Korea do not, as a rule, accept the involvement of military organisations within the context of disaster response – regardless of the impact resulting from a disaster. The Indian Ocean tsunami disaster in 2004 may serve as an adequate example. Even given the enormity of the challenges resulting from that type of disaster, the Indonesian government did not establish any criteria for the selection of foreign assets and, eventually, imposed a 90-day limit on the use of military assets.⁴⁵ In contrast, the Myanmar government acted far more restrictively during the natural disaster that struck in 2008, where foreign military as well as civilian organisations were met with high reluctance.⁴⁶ One can only speculate on the reasons for that kind of attitude, but this probably comes from the history of the Myanmar government and its refusal of any suggestions coming from the Western world.⁴⁷

Identification and Discussion of various Supply Chain Models

The remarks made in the previous section do not only show the diversity of predominating factors that determine the design and the establishment

⁴³ Within this article, the term “humanitarian assistance“ is to be seen as a synonym of the term “disaster response“.

⁴⁴ See OCHA (2007), p. 7; Auswärtiges Amt (2007), p. 4.

⁴⁵ See SIPRI (2008), p. 25.

⁴⁶ See o.V. (2008a).

⁴⁷ See o.V. (2008c).

of disaster response supply chains – on the basis of these ideas, it also has to be assumed that one organisation will hardly be able to meet the humanitarian needs resulting from the emergence of a disaster.⁴⁸ Thus, the emergence of a disaster often results in an exorbitant influx of goods and individuals into the disaster-affected area from outside that is difficult to manage.⁴⁹ This kind of situation can be considered a “stampede” of organisations that provide disaster response⁵⁰ and, in the process, also bring about mutual detriment in terms of their respective activities.⁵¹ The reason for this lies in an absence or a lack of universal acceptance of central coordination mechanisms.⁵²

Consequently, coordination is required between all organisations providing disaster response so that rapid and effective aid delivered to the disaster-affected population as well as the aid’s continuity can be assured.⁵³ The concept of supply chain management may provide a fitting approach to resolving this problem. Originally introduced in the private sector during the eighties, supply chain management is characterised by the connection of companies at the levels of materials, information and finances.⁵⁴ As single organisations often act as elements of company-wide supply chains, coordination between all of them is required.⁵⁵ Due to the need for coordination within disaster response supply chains, as previously indicated, the article will therefore address the following issues:

- When and under which conditions should disaster response be carried out?
- Who is, or which actors are, relevant?

⁴⁸ See Eriksson (2000), pp. 4f., p. 16; UNHCR (1995).

⁴⁹ See Tufinkgi (2006), p. 149.

⁵⁰ See Tufinkgi (2006), p. 21.

⁵¹ See Auswärtiges Amt (2009), p. 5.

⁵² See Tufinkgi (2006), p. 185.

⁵³ See Tufinkgi (2006), p. 149; Schulz (2009), p. 4; Russell (2005), pp. 76f.

⁵⁴ See Croom/ Romano/ Giannakis (2000), p. 69.

⁵⁵ See Wildemann (2005), p. 1.

- How and by using which design should disaster response be applied?⁵⁶

Considering this, the effort of identifying various models – or rather combinations – within the range of civilian and military supply chains and discussing them with respect to their character, adequacy and restrictions in the context of disaster response, is a logical next step.⁵⁷

Configuration of Civilian Supply Chains

Considering the remarks made so far, the first model to be contemplated should be a purely civilian supply chain concept (model 1). Based on the common predominating guidelines, such a type of supply chain constitutes the ideal case in terms of disaster response.⁵⁸ Thereby, the following framework conditions are assumed: that disaster response initiated by a disaster-affected nation will be provided as a first step by civilian organisations only. Despite the fact that civilian disaster response supply chains are widely recommended their adequacy has to be verified by taking the next steps. Thus, the common guidelines implicitly rely on the assumption that the resources and capabilities provided by civilian organisations are able to meet humanitarian needs.⁵⁹

⁵⁶ See van Wassenhove (2006), p. 483.

⁵⁷ Contrary to the example described above (Myanmar), it will be assumed in this article that a disaster-affected nation will basically accept the disaster response provided by organisations.

⁵⁸ See OCHA (2007), p. 4; OCHA (2008), p. 12.

⁵⁹ See OCHA (2007), p. 4; OCHA (2008), p. 12.

Configuration of Military Supply Chains

There is a tendency for armed forces operating around the world to go beyond traditional military activities and take on humanitarian and development-related tasks.⁶⁰ The spectrum of operations conducted by military organisations is illustrated in the following figure:

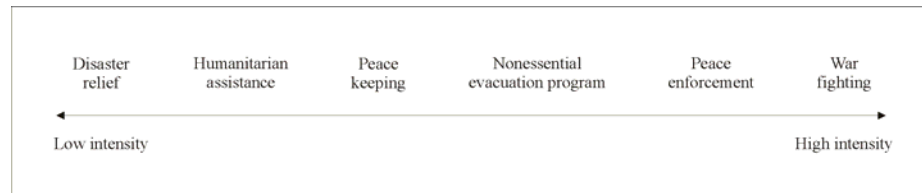


Figure 1: Spectrum of operations exercised by military organizations.
Source: Cross (2003), p. 219.

The disasters illustrated as aligned towards the left are characterised by a predominance of civilian supply chains, whereas the presence of military supply chains grows with the increased complexity resulting from a disaster. Therefore, peacekeeping missions are considered as a type of disaster response that, due to its complexity, is primarily the responsibility of military organisations.⁶¹ This will be focused on more in detail with the help of a current example.

Germany and other nations contribute to universal peace and international security within the framework of the United Nations.⁶² Therefore, several international operations have been embarked upon by German military forces.⁶³ The International Security Assistance Force (ISAF), stationed in Afghanistan, can be characterised as a NATO-led peacekeeping operation mandated by the United Nations. The operation was initiated through an appeal made by the Afghan government to the international community and authorised by the United Nations

⁶⁰ See OCHA (2008), p. 6.

⁶¹ See o.V. (2003a).

⁶² See BMVg (2009), p. 20.

⁶³ See o.V. (2009).

(Resolution 1386, 20 December 2001). In terms of disaster response, the operation, which among others includes German military forces, focuses on strengthening the Afghan government against terrorism and enhancing the quality of life of the affected population by means of civil reconstruction.⁶⁴ In order to execute the underlying spectrum of operations, adequate military supply chains need to be established.

The figure below shows in detail the supply chain regarding spare parts established by the German military forces. Subdivided into its particular information and material flows, the selected military supply chain highlights the organisations involved, ranging from first-tier suppliers up to German soldiers based in Afghanistan:

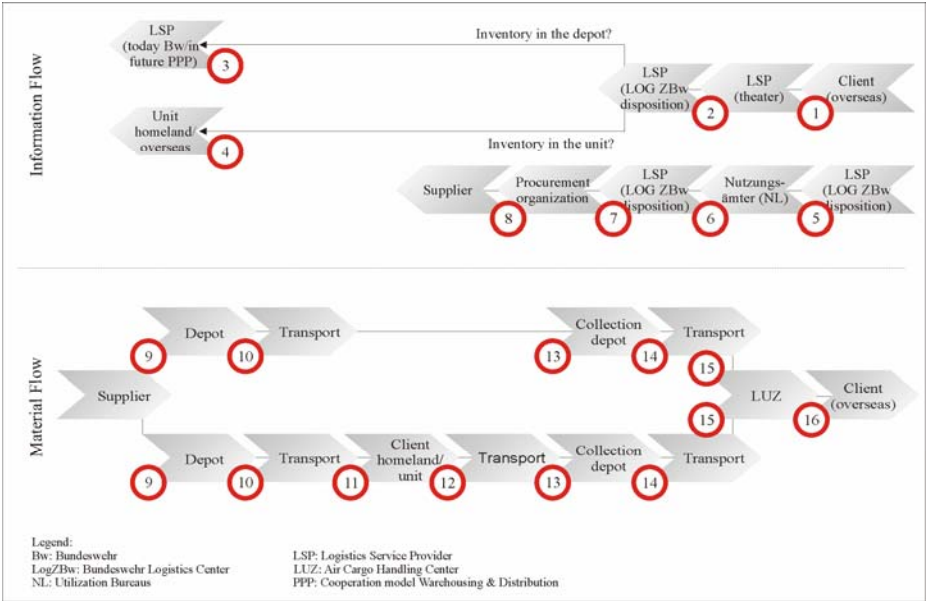


Figure 2: A representative supply chain for German military forces within their ISAF-mission in Afghanistan.
 Source: modified from Dorobek/Eßig/Klein-Schmeink (2009), p. 188.

⁶⁴ See BMVg (2009), pp. 28ff.

Due to the significant complexity resulting from this type of disaster response a predominance of military supply chains can be identified. However, a few civilian supply chains carrying out disaster response decoupled from the activities of military organisations also exist. The co-existence of civilian and military supply chains (model 2) often results from differing objectives pursued by the different organisations.⁶⁵ Thus, civilian aid organisations like *Welthungerhilfe*, *Gesellschaft für technische Zusammenarbeit*, *Deutscher Entwicklungsdienst* or *Kreditanstalt für Wiederaufbau* took the deliberate decision not to cooperate with military organisations or rather to use military assets⁶⁶ while accepting the associated consequences.⁶⁷

Integration of Civilian and Military Supply Chains

Regardless of the models of supply chains identified so far, disaster response provided without the assistance of military organisations is continually declining⁶⁸ as a consequence of the humanitarian gap that disaster response often lacks.⁶⁹ Due to their unique resources and capabilities, military organisations are hardly recommended as actors in disaster response. Therefore, mere co-existence has to be overcome, to be replaced by an integration of the civilian and the military supply chains. Depending on their character and intensity, there are two different types of integration.⁷⁰ Based on the specific situation, the adequacy of the particular type of coordination should be considered, with the focus lying on the following questions:⁷¹

- Are the military forces involved in combat operations?

⁶⁵ See OCHA (2008), p. 8.

⁶⁶ See o.V. (2005).

⁶⁷ See o.V. (2005); o.V. (2003b); o.V. (2008b). According to UNDAC (2006) the co-existence of civilian and military supply chains can principally be seen in nations, where a conflict-situation with a failed government exists. See UNDAC (2006), p. 5.

⁶⁸ See UNDAC (2006), p. 1.

⁶⁹ See p. 7.

⁷⁰ See OCHA (2008), p. 8.

⁷¹ See UNDAC (2006), pp. 3ff.

- Do the military forces have a legal or constitutional role in disaster relief or reconstruction?
- Is there any military force based in the disaster-affected nation?
- Do the military forces have direct contact with the population?
- How does the disaster-affected population view the military forces deployed into their nation?

Based on this exemplary list of questions, one type of civil-military supply chain can be discerned as a cooperative collaboration concept (model 3). According to this model, disaster response results from activities conjointly provided by civilian and military organisations alike – sharing strategies, objectives, mutual acceptance and acknowledgement of humanitarian principles.⁷²

Where cooperation between civilian and military organisations is not considered appropriate, opportune or possible despite a verified humanitarian gap,⁷³ another type of supply chain has to be resorted to. Towards this end, another civil-military supply chain type can be configured by adapting the concept of outsourcing (model 4).

Outsourcing, widely spread in the private sector, relies on the transfer of internal tasks provided to external companies, which then are responsible for executing the associated processes.⁷⁴ Therefore, the concept of outsourcing brings about the segmentation of civil-military supply chains into a single process made up of steps exercised by either civilian or military organisations – though not in cooperation with the another. Process steps that cannot be provided by entirely civilian supply chains due to their lack of required resources or capabilities could then be transferred to military organisations by outsourcing. The figure below summarises the identified models of possible supply chains that could be applied during disaster response:

⁷² See OCHA (2008), pp. 8f.

⁷³ See OCHA (2008), p. 8.

⁷⁴ See Dillerup/Foschiani (1996), p. 39.

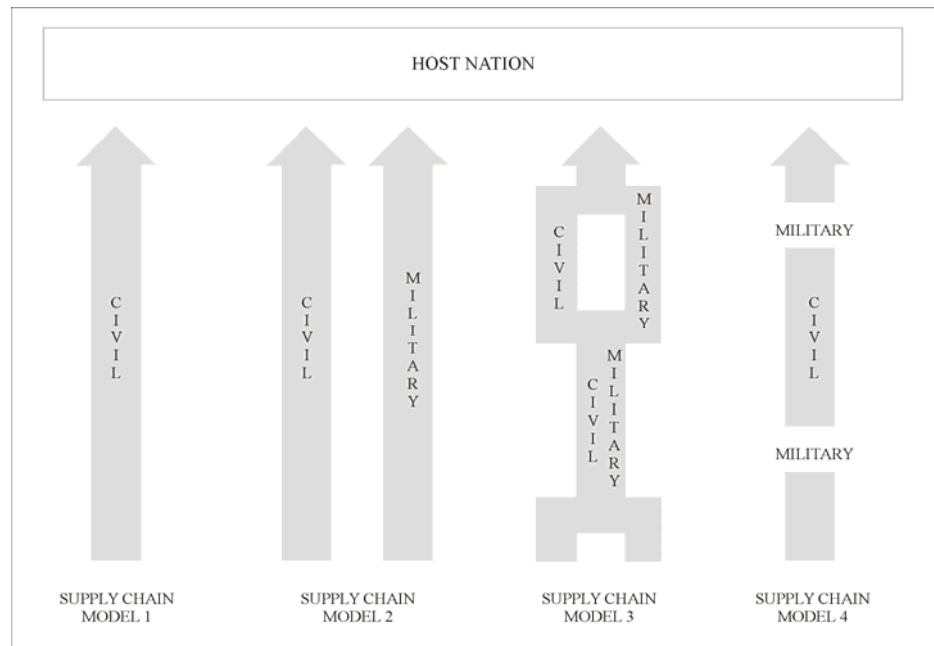


Figure 3: Supply chain models within the continuum of purely civilian and purely military organisations

The need for Coordination of Disaster Response Supply Chains

With respect to the design of supply chains, coordination can be considered the most important factor.⁷⁵ Therefore, potential types of coordination based on the identified supply chain models have to be discussed as to their adequacy within the context of disaster response. On the one hand, one type of coordination can be seen in the hierarchic leadership of supply chains. This type is usually characterised by the existence of a focal entity taking over the strategic leadership in the supply chain and determining its nature and scope. Hence, hierarchical

⁷⁵ See Busch/Dangelmaier (2004), p. 10.

coordination is based on the creation of a unilateral relationship of dependence.⁷⁶

On the other hand, another type of coordination can be seen in the heterarchic, or rather polycentric, leadership of supply chains. As there is no focal entity taking over coordination-related tasks, all parties are responsible for coordinating supply chains themselves. Therefore, heterarchic leadership requires intensive, cooperative and mutual coordination.⁷⁷ In order to select the appropriate type of coordination based on the identified supply chain models above, a further step needs to be taken. According to Fisher (1997), one has to classify the products provided by a supply chain according to their demand patterns. Products fall into two categories: They are either primarily functional or primarily innovative. Functional products satisfy basic needs that do not change much over time and have a stable, predictable demand and long life-cycles. Innovative products, however, are characterised by an unstable, unpredictable demand and a short life-cycle. Moreover, the great variety typical of innovative products additionally increases unpredictability.⁷⁸

Fisher's framework for identifying the supply chain type cannot fully be adapted. This results from the fact that there are specific characteristics of disaster response supply chains that differentiate them from traditional commercial supply chains.⁷⁹ However, some issues described within the framework are identical to the characteristics of disaster response supply chains. Thus, considering these particularities⁸⁰, the products provided by way of disaster response supply chains can be seen as similar to innovative products. Consequently, a responsive or flexible design should be required in terms of the supply chain models identified in the previous section in order to allow them to provide a quick response to unpredictable demand.⁸¹

⁷⁶ See Busch/Dangelmaier (2004), p. 10f.; Kraus (2005), p. 37.

⁷⁷ See Busch/Dangelmaier (2004), p. 11; Kraus (2005), p. 38.

⁷⁸ See Fisher (1997), p. 106.

⁷⁹ See Beamon (2004), p. 77.

⁸⁰ See pp. 4f.

⁸¹ See Fisher (1997), pp. 107f. ; Schulz (2009), pp. 69f.

To resume the discussion of the advised coordination mechanism related to the supply chain models identified, the benefit of hierarchic coordination over a heterarchic one can be assumed on the basis of the following elements:

- Flexible design is needed for disaster response supply chains because of underlying unpredictability. As a result, hierarchic structures can be considered more adequate.⁸²
- The time needed for establishing a disaster response supply chain is highly significant, as this often means the difference between life and death for the disaster-affected population.⁸³ In general, the establishment of a supply chain is based on a decision-making process. Due to simplified processes used to gather, distribute, and process information, hierarchic structures allow for a quicker pass-through.⁸⁴
- In theory as well as in practice, the approval or predominance of hierarchic over heterarchic structures becomes apparent in disaster response supply chains.⁸⁵

In general, the application of hierarchic coordination may be considered uncritical as regards supply chain models 1 and 2. Both, the purely civilian and the purely military supply chains possess central coordination mechanisms.⁸⁶ Despite their benefits, the adequacy and acceptance of hierarchic structures applied in the supply chain models 3 and 4 have to be verified in detail. According to Byman et al. (2008)

⁸² See Frost (2005), p. 311.

⁸³ See Beamon (2008), p. 11.

⁸⁴ See Laux/Liermann (2005), p. 98.

⁸⁵ See Tufinkgi (2006), p. 185; Auswärtiges Amt (2009), p. 6. According to Byman et al. (2008) the most influential actors take over the leadership in order to coordinate disaster response. Thereby, the actors may be characterised as host-nation leader, United Nations leader, alliance or coalition leader and may vary from one operation to another. See Byman et al. (2008), p. 81.

⁸⁶ See Schulz (2009), p. 40. Referring to this, it should be noted that the central role of the United Nations becomes manifest within General Assembly Resolution 46/182. See OCHA (1991), §12. Despite this, military organisations are basically characterised by their hierarchic structures. See Byman et al. (2008), p. 102.

civil-military supply chains often lack official structures essential to coordinating activities.⁸⁷ Moreover, civilian organisations are often skeptical about coordinating with military organisations and, therefore, postulate a “humanitarian space”. In addition to the named issues, the organisations typically involved in disaster response have characteristics that probably hinder civil-military coordination and make them difficult partners.⁸⁸

Conclusion

Due to the great variety of disasters highlighted in this article and the different impacts resulting from them, great demands are placed on establishing disaster response supply chains. Furthermore, the configuration of a generic disaster response supply chain that allows for a quick and effective response will not prove successful because of the great variation in its predominating criteria. As a result, the main objective pursued in this article was to identify various supply chain models of disaster response that are basically applicable within the continuum of purely civilian and purely military supply chains. Four supply chain models differing as to the actors involved as well as to the nature of their coordination have been developed. Due to the increasing intensity of the impact resulting from disasters, the following conclusion can be drawn: increasingly, coordination between different actors can be considered unavoidable rather than only necessary.⁸⁹ Therefore, quick and effective disaster response will hardly be managed by exclusively civilian or military supply chains in the future. Although the suitability of hierarchic structures over heterarchic ones has been highlighted, the differing cultures, motivation and mandates between civilian and military organisations make civil-military coordination difficult. Thus, the emergence of mutual concurrence and other types of problems that hierarchic coordination might not be able to eliminate have to be faced. In order to come to an end, the appropriateness as well as the acceptance

⁸⁷ See Byman et al. (2008), p. 99.

⁸⁸ See Byman et al. (2008), p. 99.

⁸⁹ See Kolerus (2007).

of hierarchic coordination within civil-military supply chains has to be verified in detail⁹⁰ and should, therefore, reflect the focus of future research activities.

⁹⁰ See Kolerus (2007).

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