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Postprint

This is the accepted version of a paper published in *International Journal of Physical Distribution & Logistics Management*. This paper has been peer-reviewed but does not include the final publisher proof-corrections or journal pagination.

Citation for the original published paper (version of record):

Jahre, M., Jensen, L-M. (2010)

Coordination in humanitarian logistics through clusters.

International Journal of Physical Distribution & Logistics Management, 40(8/9): 657-674

<http://dx.doi.org/10.1108/09600031011079319>

Access to the published version may require subscription.

N.B. When citing this work, cite the original published paper.

Permanent link to this version:

<http://urn.kb.se/resolve?urn=urn:nbn:se:hj:diva-13806>

COORDINATION IN HUMANITARIAN LOGISTICS THROUGH CLUSTERS

ABSTRACT

Purpose of this paper

In the field of humanitarianism, cluster thinking has been suggested as a solution to the lack of coordinated disaster response. Clusters for diverse functions, including sheltering, logistics and water and sanitation, can be viewed as an effort to achieve functional coordination. The purpose of this paper is to contribute to a greater understanding of the potential of cluster concepts using supply chain coordination and inter-cluster coordination. The focus is on the conceptual level rather than on specific means of coordination.

Design/methodology/approach

The cluster concept in humanitarian relief, along with some key empirical issues, is based on a case study. The concept is then compared to the literature on clusters and coordination in order to develop a theoretical framework with propositions on the tradeoffs between different types of coordination.

Findings

The results provide important reflections on one of the major trends in contemporary development of humanitarian logistics. This paper shows that there is a tradeoff between different types of coordination, with horizontal coordination inside cluster drawing attention away from important issues of the supply chain as well as the need to coordinate among the clusters.

Research limitations/implications

There is a need for more in-depth case studies of experiences with clusters in various operations. Various perspectives should be taken into account, including the field, responding agencies, beneficiaries, donors, military and commercial service providers, both during and between disasters.

Practical implications

The paper presents the tradeoffs between different types of coordination, in which basic aims such as standardisation through functional coordination, must be balanced with cross-functional and vertical coordination in order to more successfully serve the users' composite needs.

Value of the paper

The focus on possible trade-offs between different types of coordination is an important complement to the literature, which often assumes simultaneous high degrees of horizontal and vertical coordination.

Keywords: Disaster management, humanitarian logistics, cluster, horizontal coordination, vertical coordination.

Type of paper: Research paper

1. INTRODUCTION AND PURPOSE

The increasing number and complexity of disasters has made specialisation and coordination both important and challenging (Beamon, 2004; Oloruntuba, 2005; Schulz, 2008; van Wassenhove, 2006). Many organisations provide humanitarian aid, whether in immediate response to a disaster or in the months that follows. United Nations bodies, local and international non-governmental organisations (NGOs) and host governments, as well as donors, military and commercial service providers are all involved in one form or another. A number of the operative bodies tend to specialise in areas like camp management, medical care or water and sanitation (Jahre and Spens, 2007). They are largely independent, with many having their own funding and systems. When specialised and independent organisations combine, they can face a series of problems related to coordination, as evidenced during the Indian Ocean tsunami in 2004 and the Darfur crisis in 2004/2005. In both of these cases, coordination proved difficult in such large and complicated settings. Some provision of relief was overlapping, some populations were not well served and there were problems related to prioritising the pipeline (Adinolfi et al., 2005; OCHA, 2007). Such cases indicate the need for coordination in terms of both preparedness and response, such as contingency planning, needs assessment, appeals, transport management and last-mile distribution (Oloruntuba, 2005). An important question is when and how the key players should collaborate and how they should be coordinated (van Wassenhove, 2006).

One attempt to solve these problems is the cluster system, essentially a template for how coordination should be carried out in a number of areas. The cluster concept is defined functionally in terms of areas of activity – for example, water and sanitation, health, shelter, nutrition – which typically reflects the important and somewhat separate areas of relief work, often referred to as sectors (IASC, 2006). The purpose of this paper is to provide a theoretically-based evaluation and discussion of the cluster system. The ambition is conceptual in that we

discuss general types of coordination rather than specific coordination means. This is done in order to focus on the bigger picture rather than the detailed challenges in the cluster system. This gives a twofold opportunity for research. Firstly, it is useful to compare this system to the existing theories on coordination in order to arrive at propositions for how it will work in the humanitarian relief setting; this could provide direction for further research on clusters. Secondly, studying the cluster system and comparing its performance with theoretical predictions makes it possible to contribute to general coordination theory from this particular context. This is an especially salient point because the setting is characterised by some challenging coordination issues (Kovács and Spens, 2007; Oloruntoba, 2005; Thomas, 2003).

Section 2 describes the research design and methodology with a focus on the approach taken and the relevance of the empirical study. The cluster concept is briefly described in Section 3, followed by illustrations of its use with examples from the logistics cluster (essentially representing extracts from a larger case study). Section 4 reviews the relevant literature on clusters and coordination in order to provide a theoretical understanding of the cluster-thinking. The combination of the most salient aspects of the empirical descriptions and the theoretical frameworks enables the formulation of propositions in Section 5, followed by conclusions and suggestions for further research in Section 6.

2. RESEARCH APPROACH AND METHODOLOGY

The approach in this paper is phenomenological; that is, it is driven by particular problems in the coordination of humanitarian relief operations that existing theoretical frameworks have only studied to a limited degree. Such an approach has several implications. It is reasonable to treat this as a context of discovery, in which it is important to collect a rich information base for exploration (Glaser & Strauss, 1967). An explorative approach in which the theoretical

framework is not complete at the start naturally lends itself to a case approach. Notably, a “case study is not a methodological choice but a choice of what is to be studied” (Stake, 2000, p. 435). Furthermore, interest in the case itself can be motivation to carry out case study research (Stake, 2000). This is true in a broad sense in this instance because the focus on coordination in humanitarian relief has led to the creation of the cluster system, which therefore becomes a natural object of study as a critical case (Yin, 2009).

The empirical descriptions herein are based on a case study of the logistics cluster. The logistics cluster is relatively well developed, having been able to draw on the experiences of the UNJLC (United Nations Joint Logistics Centre), a previous mechanism for logistics coordination. The UNJLC was employed specifically to coordinate logistics issues in humanitarian relief operations and was institutionalised by the UN in 2002. It was gradually superseded by the cluster system from 2005 onwards. The logistics cluster supports other clusters, which makes it possible to observe coordination issues in several dimensions.

The study is interpretative in nature and based on a combination of semi-structured interviews, as well as UN and NGO documentation on the cluster system, including several evaluation reports. Since the purpose is to investigate some of the critical questions in humanitarian relief and tie these to existing theory on coordination, the goal of the paper is to create propositions rather than test theories.

The quality criteria in Lincoln and Guba (1985) based on trustworthiness are appropriate for an interpretative study such as this one (see also Haldórsson and Aastrup, 2003). The study makes a number of recommendations to achieve trustworthiness. Interviews were conducted with personnel in different positions. This allowed considerable overlap in the answers, which were then compared with official documentation and reports, creating triangulation of sources. Where possible, interviews were recorded and transcribed. Practitioners in the field also checked the resulting case document for feedback and consistency.

The study has several important limitations. Because the entire case cannot be presented, the paper offers only a reduced set of quotes and descriptions, the selection of which was, naturally, a matter of judgement on the part of the authors. By presenting information on only one cluster, it is clear that alternative approaches and success factors in the other clusters are not included. Most of the interviewees were directly involved in the UNJLC or cluster system; this can create a bias, especially considering that many NGOs do not fully subscribe to the cluster system. This bias is somewhat balanced, however, by the evaluation reports, some of which are quite critical and written by NGOs. Of equal or greater importance is that the cluster system itself is changing as experiences with it become available. In this sense, the concept presents a moving target and it is difficult to do it justice in any one description. Nonetheless, the basic problems that arise in coordination and the greater theme of coordination in humanitarian logistics, of which the cluster concept is an example, will remain the same. In terms of theory, these are the most important questions.

3. CLUSTERS AS A COORDINATION MECHANISM IN HUMANITARIAN RELIEF

The Asian tsunami in December of 2004 and the response to the Darfur crisis in 2004/2005 demonstrated problems providing sufficient coverage in large relief operations. The cluster concept involves organising humanitarian relief according to a number of sectors with a predefined leadership. Clusters were introduced to improve efficiency in the five following key areas (OCHA, 2007):

- 1) Sufficient global capacity to meet current and future emergencies
- 2) Predictable leadership at a global and local level
- 3) Strengthened partnerships between UN bodies, NGOs and local authorities

- 4) Accountability, both for the response and vis-à-vis beneficiaries
- 5) Strategic field level coordination and prioritisation.

The Inter-agency Standing Committee (IASC), the primary voluntary body for coordination of humanitarian efforts (IASC, 2008), accepted the use of the cluster concept in 2005. There are currently 11 clusters: Agriculture, camp coordination and management, early recovery, education, emergency shelter, emergency telecommunications, health, logistics, nutrition, protection, and water/sanitation and hygiene (WASH). Although clusters currently operate in 25 countries,¹ this does not mean that all clusters are active in all operations, as they can be mobilised individually. However, those clusters that are mobilised should cooperate in order to serve recipients better. Inter-cluster coordination has been a challenge, however. For the 2005 Pakistan Earthquake it was observed that “very rarely did the clusters cooperate” (Hollingworth, 2009).

3.1 Components of the cluster concept

The cluster concept is meant to apply to UN bodies, NGOs and INGOs (International NGOs). In principle, any humanitarian organisation can lead a cluster, as long as it has the capacity. Organisations working in the field can contribute to several of these sectors but there is considerable specialisation. In an emergency, many of the sectors are critical but the relative importance can vary depending on the nature of the emergency and additional features of the situation, such as the resources of the host government. In order to achieve the five goals listed above, three main aspects are seen as essential and are characteristic of the cluster system compared to previous coordination mechanisms. These three aspects, outlined below, come close to providing a formal definition of the concept, which adds some substance to the brief definition above.

Designated global lead: The cluster concept is defined at the global level and then mobilised for specific settings when they arise. Each global cluster is permanent and is led by one designated agency, although some of the clusters have an additional support agency. The cluster concept is not based on a consensus with all involved relief organisations, so their response to the situation can vary considerably. The IASC determines which clusters to mobilise during any particular operation.

Central and local capacity building: The global cluster lead has a particular responsibility for ensuring both central and local capacity building. This could refer to a variety of tasks, such as building rosters² of qualified personnel for mobilisation, creating stockpiles of essential relief items (even on behalf of other agencies), training personnel or participating in mitigation efforts for future disasters in exposed areas.

Provider of last resort: The concept of a provider of last resort is an important part of the cluster thinking. It states that if no other organisation can provide a needed service, the cluster lead should take on the task of delivering it. This is a large responsibility, considering the scale of some humanitarian relief efforts. It has been argued that this places the lead in a position of unbounded commitments without the capacity to meet them. The responsibility has been clarified by the IASC:

It represents a commitment of cluster leads to do their utmost to ensure an adequate and appropriate response. It is necessarily circumscribed by some basic preconditions that affect any framework for humanitarian action, namely unimpeded access, security, and availability of funding. (IASC, 2006, p. 10)

Evaluations of cluster interventions to date reveal that the problems related to a lack of inter-cluster coordination have received a great deal of attention. It has been noted that "... there was a general feeling among NGOs that clusters were overly compartmentalized and there was no need for so many" (ActionAid, 2007, p. 5). The initial evaluation of the cluster system after two

years stated that, “A more fundamental barrier to addressing cross-cutting issues stems from weak inter-cluster coordination, including inadequate information management and analysis” (Stoddard et al., 2007, p. 40). In relation to the 2007 Mozambique floods, it was concluded that “The cluster approach encourages a closer focus on the sectors covered by the cluster – this may be at the cost of cross-cutting themes” (Cosgrave et al., 2007, p. 33).

3.2 The Logistics Cluster illustrating coordination challenges

The logistics cluster is responsible for preparedness (including stockpiling) and emergency response with regards to logistics coordination. The global lead for the cluster is the World Food Programme (WFP). As a service cluster, logistics must not only determine the needs of organisations that concentrate on logistics but must also serve the other clusters in their logistics.

As discussed in the method section, the purpose of the empirical presentation in this paper is to highlight some of the most important issues in the coordination of humanitarian relief. The cluster concept has been described in general terms, showing its present main structure and purpose. The focus of this final empirical section is on specific examples of logistics cluster tasks. The examples discussed here are referred to as use of direct authority, supply chain management, and information management and exchange.

In a number of interventions, the logistics cluster has been given the task of controlling a critical function through *direct authority*. During the first stages of an emergency, air transport is often the only viable option, which puts strong pressure on capacity. In several interventions, the cluster has taken on the task of air traffic control for a limited period in order to overcome problems in local capacity that is either insufficient for the sheer volume handled or damaged due to the disaster. This can lead to some operational responsibility for air traffic control but,

most importantly in terms of logistics, is the ability to prioritise cargo so that essential items reach recipients as soon as possible and that all clusters have access to transport.

The WFP is a large organisation and has many ongoing operations in various countries. It is an open question as to how other UN bodies and actors perceive the decisions that the WFP makes. It is important to dispel the notion that the local cluster lead in charge of air traffic control, for example, will assign priority to its own cargo, to the detriment of others. It does appear that the exercise of authority or pure direction for coordination is acceptable to parties for some tasks, such as air traffic control or cargo prioritisation for a common humanitarian transport service. However, these are relatively limited and many of them are acceptable because it is obvious that they must be managed by a single party in order to be effective. In contrast, the success of the overall cluster seems to depend, at least in part, on finding an acceptable and more participatory style of leadership (Cosgrave et al., 2007).

It is possible for the logistics cluster to take on the responsibility for running an entire supply chain. The best example of a coordination body taking on such a *supply chain management* responsibility actually started through the UNJLC in Sudan. Because the UNJLC is now part of the cluster and the cluster can take on the same type of responsibility, it is still UNJLC that is employed in Sudan being responsible for managing the non-food item (NFI) pipeline system. There is one common pipeline for Darfur, one for the rest of Sudan and efforts have been made to implement the same in South Sudan (although, at the time of data collection, this was not complete). As many as 12 different pipelines were operating in South Sudan at one stage, compared to the single common pipeline implemented for Darfur (Senior Logistics Officer, UNJLC Core). There has been considerable acceptance of the common pipeline system, based on three basic principles. Firstly, the common pipeline filled a vacuum, given that there was a distinct lack of capacity and limited systems in place for handling the flow of NFIs. Secondly, organisations are not forced to participate but do so through a system of requests when they

want to. Thirdly, because the system has considerable funding, the common pipeline provides ‘free’ items to NGOs at the camps if their requests are approved.

The NFI pipeline is an example of gap-filling because other bodies in the area did not have the capacity to take on the responsibility. In this respect, the cluster would handle the same challenge through an appeal to the provider of last resort mechanism. The UNJLC in Sudan covers many supply chain management tasks, such as information management, handling and approving orders, stock management and matching overall supply and demand. The UNJLC believes that this merging of pipelines creates substantial efficiency due to scale, represented, for example, through a low purchase price for the NFIs provided (Head of Rest of Sudan Office, Khartoum). The conditions were particularly favourable for the introduction of the system, however, and especially the funding. This makes participation advantageous to NGOs, which is considered important for making the system work (Pipeline Manager, UNJLC Khartoum). It does, however, show the possibility of merging the potential pipelines of a large number of organisations.

Information management and exchange is a core activity for the cluster. The range of information covered is potentially quite wide but it focuses on transport routes, infrastructure status and the availability of transport resources. Such information is often quite obvious to those in the field but difficult to obtain for those who are not. Such information is usually disseminated through a central webpage³ and a series of local meetings. There are a number of special areas in which the cluster can provide special services that are useful to many participants in local interventions. One of these is geographical information systems (GIS), which essentially are mapping services that specialise in logistics information. However, in order to obtain information from NGOs and other bodies, it is often necessary to possess information or resources in order to “bring people to the table” (Head of Office Southern Sudan, OCHA).

A final task tied to the information management issue is that of developing standards, information materials and training for logistics. Although the correct use of standards is relevant for professionals operating within the logistics cluster, it is equally important to disseminate at least a basic understanding of logistics needs and logistics information to other clusters. Some of these cluster personnel will be in a position to provide valuable logistics data as a by-product of their regular activities (for example, presence in a particular area will allow them to comment on the status of the roads there). However, such information is often based on judgement and experience, which makes it much harder in practice to obtain good data from such sources. Indeed, obtaining good data is one of the main tasks of the logistics cluster.

Logistics information, such as the quality of roads, warehousing, airports etc., is often considered to be relatively simple. However, experience suggests a general problem with such data in humanitarian logistics, especially when it is gathered by third parties.⁴ The basic quality of data is of variable quality: "... People can't understand why you can't use it; they think we're being stubborn about data quality ... we simply can't use it" (GIS Specialist, Rome). It is often impossible to use data that is not of sufficiently high quality: "... It's so simple [i.e. basic, that] people don't apply it" (Consultant Information Management, UNJLC Core).

The information management and exchange function clearly shows the challenges involved in obtaining and disseminating basic information in a crisis. The value of logistics information is particularly high early in a crisis due to the disruption in regular infrastructure, such as knowing which roads and means of transport are still operational. This information is often held by operative units in the area, which forces the logistics cluster to depend on others for information, then put it together and disseminate it back to them again. The added difficulty for the logistics cluster is that non-logistics specialists hold much of the valuable potentially available information.

3.3 Summarising coordination aspects of the case

The empirical part of this article is twofold. One part is the cluster concept, including the reasoning behind the concept. The second part is an actual example of a particular cluster, including some of the most important activities and challenges it faces. There are four key observations about the cluster concept, which tie in to the theoretical review in the next section: (1) There are challenges in defining standards for basic logistics information as well as logistics operating procedures, (2) Information management is crucially related to participation from members of all clusters, (3) The global cluster leads are working on building spare capacity and buffer stocks, and (4) Examples of supply chain control include the cluster/UNJLC NFI pipeline in Sudan, cargo prioritisation and air traffic control. However, there is limited coordination among the clusters.

4. COORDINATION IN SELECTED LITERATURE – A REVIEW

This review is based on selected literature on different types of coordination relevant to the topic of clusters. Whereas the term *coordination* is used here in accordance with the empirical context, the concepts of cooperation, collaboration, coordination and integration are used interchangeably, both outside the humanitarian context (Fabbe-Costes and Jahre, 2006; 2008) and within it (Kovacs and Spens, 2007; Schulz, 2008; van Wassenhove, 2006). An extensive review to clarify the concept is beyond this paper and is a subject for future research.

Porter (1998) defined the term ‘cluster’ as “geographic concentrations of interconnected companies and institutions in a particular field” (p. 78), which “allows each member to benefit as if it had greater scale or as if it had joined with others without sacrificing its flexibility” (p. 81). In line with this, Patti (2006) assumed that clusters include upstream and downstream customers and often “extend horizontally to makers of similar and complementary products that

require the same basic skills, raw materials, and specialized equipment” (p. 266). Clusters benefit from competition and cooperation through increased productivity because they provide better access to employees, suppliers, public institutions and specialised information, increased availability of complementary products and services, and better motivation and measurement (Patti, 2006, p. 267).

Reichhart and Holweg (2008) discussed the forms and functions of what they termed “co-located supplier clusters”. They also developed a matrix for classification, comprised of the two following dimensions: (A) Spatial integration and infrastructure constitute supplier location in relation to customers and the existence of dedicated infrastructure, and (B) Local value added. In line with much of the logistics literature, the most common empirical setting constitutes manufacturing in the automotive sector. Maskell et al. (2006), however, reported from a very different context. They saw trade fairs, conventions and professional gatherings as temporary clusters, which they defined as “inter-firm organization characterised by knowledge-exchanging mechanisms”. These are distinct from projects and stable inter-firm networks and similar to permanent clusters (in Porter-terms) but short-lived and intensified.

The topic of clusters is one key element of this paper; the second is the issue of coordination. The concept of coordination has a long tradition within a number of disciplines, including organisation, strategy, marketing and logistics. Coordination is often described as being somewhere between market and hierarchy, representing what the literature often calls a hybrid form (Williamson, 1991). Different typologies have been suggested, mostly in relation to vertical and horizontal coordination, as in Figure 1, below. The European Union defines horizontal cooperation as “concerted practices between companies operating at the same level(s) in the market” (Cruijssen et al., 2007). Horizontal coordination involves internal collaboration and collaboration with competitors and non-competitors (for example, sharing manufacturing capacity) (Barratt, 2004, p. 32). Coordination has also been defined as, “When

two or more unrelated or competing organizations cooperate to share their private information or resources such as joint distribution centers” (Simatupang and Sridharan, 2002, p. 19).

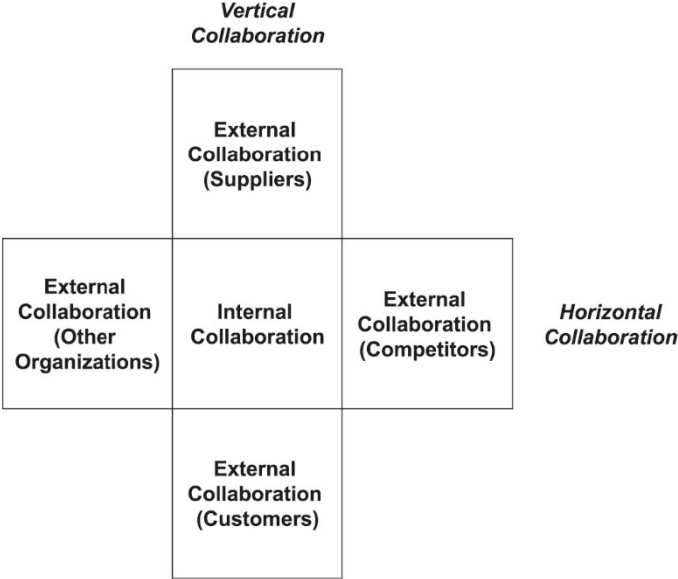


Figure 1: Horizontal and vertical cooperation (Source: Barratt, 2004)

Vertical coordination is a common topic in the literature (Schulz, 2008) and has been defined as “...when two or more organizations, such as the manufacturer, the distributor, the carrier and the retailer, share their responsibilities, resources and performance information to serve relatively similar end customers” (Simatupang and Sridharan, 2002). It takes place across tiers in the supply chain so that “the enterprise can improve performance” (Simchi-Levi et al., 2004, p. 41) and customer demands are fulfilled (Christopher, 1998). The review identified two groups of typologies. The first concerns the levels at which coordination takes place; for example, Xu and Beamon (2006) defined it as the *strategic* response to the challenges that arise from organisations in a chain that are dependent on the performance of each other, whereas Barratt (2004) suggested that coordination also takes place at *tactical* and *operational* levels. The other typology constitutes what has been termed ‘dimensions’, the most common of which

is the three *flows of information, material and financial* (e.g., Romano, 2003, Surana et al., 2005, Simatupang and Sridharan, 2005). It has been suggested that, in order to develop and manage innovative supply chain processes that enable smooth flows, chain members must collectively define:

A collaborative performance system with specific performance metrics, information sharing on planning, costs and performance, decision synchronisation for inventory, replenishment etc, and finally incentive alignment based on overall performance. (Simatupang and Sridharan, 2005, p. 258)

Giannoccaro and Pontrandolfo (2003) claimed that activity flows have received more attention than coordination (i.e., governance) of actors. Accordingly, some studies have suggested including supply chain relationships as a fourth dimension, in addition to the three flows (e.g., Power, 2005; Samaranayake, 2005). The industrial network approach, which is used increasingly in logistics and supply chain management studies (e.g., Håkansson and Persson, 2004, Bygballe, 2006, Jahre et al., 2006, Awaleh, 2008), placed the relationships in the centre, suggesting they are based on how business units are connected through three layers. Firstly, *actor bonds* connect actors and influence how actors perceive each other and form their identities in relation to each other. Secondly, *activity links* are the technical, administrative, commercial and other activities of a company that can be connected in different ways to those of another company. Thirdly, *resource ties* connect various resource elements of companies and result from how the relationship has developed. Finally, based on extensive literature reviews of supply chain and logistics integration, Fabbe-Costes and Jahre (2006; 2008) suggested a multi-dimensional concept constituting (1) the three *flows*, (2) *processes and activities*, (3) *technologies and systems* and (4) *actors*.

From the review, one can conclude that, whereas the theoretical cluster concept includes both horizontal and vertical coordination, logistics coordination focuses on vertical (supply chain) aspects. In particular, the literature concerns two major aspects, as shown in Table 1, below.

< Insert Table 1 >

Table 1: Coordination aspects in selected literature

5. DISCUSSION: PROPOSITIONS AND CONCEPTUAL FRAMEWORK

The empirical section has shown that the main focus of the cluster system to date has been to improve coordination between organisations that are experts in the same functional areas of disaster response. This can be classified as horizontal coordination, as defined in the literature. So far, the clusters have focused less on vertical coordination, although there have been moves to create stockpiles at a global level. Coordination largely takes place between the providers of services at the same stage in the supply chain; for example, between providers of water and sanitation solutions.

Dimension/Type of coordination	Horizontal	Vertical
<i>What</i> to coordinate	Actors, Activities, Resources at strategic, tactical and operational levels in information, money and material flows for companies at the <i>same</i> stage in the supply chain. Focus on the companies and their specific tasks.	Actors, Activities, Resources at strategic, tactical and operational levels in information, money and material flows for companies at companies at <i>different</i> stages in the supply chain. Focus on the customer and synchronisation.
<i>Why</i> coordinate	To achieve economies of scale and to reduce costs for the individual company To have access to more physical resources, information and competence	To reduce overall supply chain costs but can increase costs for some actors. To improves customer service through smoother flows

According to the theory on coordination, and as shown in Table 1 above, one advantage of horizontal coordination is that it can achieve advantages of scale and individual clusters would be expected to achieve some aspects of this. However, one particular challenge for the cluster system is that effective coordination across different clusters can be crucial to serving the beneficiary. For example, good camp management requires water and sanitation solutions and clean water must be accompanied by storage tanks, and vice-versa, in order to be useful. Ideally, clusters operating in concert in a manner that is appropriate to a particular relief effort should serve all the needs of the beneficiaries. Empirical evidence from the 2005 Pakistan Earthquake for example, suggests that such coordination was not achieved. The argument is not primarily one of efficiency but of the clusters working together to provide a timely package of services that is appropriate to a recipient population. This leads to Proposition 1:

Coordination within clusters may impede coordination across clusters, leading to excessive functional focus and reduced focus on total beneficiary needs.

This proposition speaks to the relatively non-controversial issue in the literature that if the functional focus in an organisation becomes too strong, this can lead to a loss of focus on the overall goals of the organisation. In this particular setting, this can mean that, although a geographical area is efficiently covered in terms of each functional area, matching functional areas are not coordinated. This coordination can apply to information standards that apply to all clusters, such as basic logistics information in terms of road status discussed in the empirical section. It can also apply to cross-cutting themes such as HIV/AIDS, for which the efforts of several clusters are essential (Cosgrave et. al., 2007).

The other major issue that Table 1 summarised is vertical coordination. The main effect of vertical coordination in the literature is to synchronise different levels of a supply chain for overall efficiency and to improve customer service by making all participants focus on the final customers' needs. In the cluster concept, the cluster leads create global standards and work with other agencies to secure capacity such as human resources. There are also some examples of pipeline management, such as the logistics cluster handling air traffic control and cargo prioritisation. However, there are two main challenges, which can be seen as two sides of the same coin, in terms of vertical coordination with the cluster system as it stands. Firstly, the strategic or upstream level in ongoing operations could be enhanced and, secondly, it is difficult to make the system recipient-driven.

The cluster system is defined at a global coordination level and a local level in response to a particular crisis. However, this does not mean that the two are connected in terms of a coordinated supply chain, but rather that some standards and global resources are defined by the permanent cluster lead and the local cluster lead is responsible for a particular response.

There is considerable evidence that bridging the supply chain from the global level to the local level is a challenge, especially where there is a lack of coordination among clusters (Adinolfi et al., 2005; Stoddard et al., 2007).

Furthermore, the needs in the field are best determined by the organisations that are actually in the field or close to the recipient. Supply chain management thinking would then define the requirements and design the supply chain to support it. However, the fact that the cluster system only controls parts of the supply chain into a disaster area, for example through a common humanitarian service (Stoddard et al., 2007), makes it difficult to manage this supply chain. There are many organisations involved, each of which may define different needs and bring different sources of funding. As a result, it becomes difficult to synchronise the humanitarian supply chain. In the empirical description, the 12 different supply chains for NFI goods, with different organisations using different routes, is an extreme example of this type of challenge. One should also consider the common issue of congestion in the first phases of humanitarian relief (Elzinga and Folmer, 2005), which illustrates the difficulty of managing this pipeline. The NFI pipeline in Sudan is an example of how pipeline management can work when there is common funding. On this basis, this paper argues that the challenge is to create a strategic level for managing a global pipeline for disaster relief, which will be enhanced by merging pipelines where several exist. Hence, in spite of some evidence of global capacity-building and stockpiling of emergency goods, proposition 2 suggests that:

Effective vertical coordination depends on successfully merging the pipelines of many of the organisations in an operation, and on creating a strategic level for carrying out coordination between disasters; that is, preparing for a coordinated approach in operations.

These two relatively broad propositions can be complemented with a simple matrix that emphasises the most salient characteristics from the theoretical framework and empirical

points. Several important issues when dealing with coordination have been discussed, including the question of *what* to coordinate. It is essential to coordinate flows that are of a physical, informational and financial nature. Coordinating processes and activities, actors and technologies and systems are all ways of achieving efficiency. This covers what types of issues can be coordinated, in a broad and general sense, and those that can be carried out vertically and/or horizontally. Finally, the coordination can be carried out at an operational, tactical or strategic level. Combining the two dimensions of coordination with findings from the empirical setting provides a useful summary matrix (see Figure 2) for different types of coordination and coordination observed in a particular situation. This should be seen as a way of illustrating what different types of coordination would involve for the cluster system at the different levels. The highlighted area shows the focus of coordination efforts so far.

		Type of coordination			Level of coordination
		Horizontal		Vertical	
		Within cluster	Among clusters		
Operational	Organisations in a cluster cooperate in an operation	Cooperation among different clusters in an operation	Pipeline for an operation is coordinated among participants		
Tactical	Organisations in a cluster cooperate at the regional level	Clusters cooperate at the regional level for storage, capacity	Storage and distribution from a regional level		
Strategic	Global capacity building, standards for a cluster	Global assessments, inter-cluster standards	Purchasing, global stockpiles and pipelines to affected regions		

Figure 2: Coordination matrix

Ideally, the cluster concept should be relevant for all the blocks in the figure. There is, however, a danger that coordination will be focused on horizontal within-cluster coordination, and

primarily at the operational level with some efforts at the strategic level through the global cluster leads. This is useful in itself but only yields some of the potential of coordination.

6. CONCLUDING REMARKS AND FURTHER RESEARCH

This paper considers the tradeoffs and challenges involved in achieving several types of coordination in the cluster system. An overly strong focus on the coordination of specialised actors can have a negative impact on the ability to develop efficient and effective supply chains that cover all the basic needs of a beneficiary during a disaster. It is necessary to coordinate among the clusters, in addition to the present coordination within the clusters. It is possible to make some general comments on the study and further research. Although the focus is on tradeoffs, there are ways of combining vertical and horizontal coordination. In addition, there may be coordinators other than the cluster system, which have not been discussed here. This section discusses these three issues and ends with some practical implications from the study.

Evaluations of cluster experiences to date show that horizontal coordination has received the most attention. At the same time, there are clear challenges in terms of making all the clusters work together in order to serve the final recipients. Expanding on the fairly straightforward dichotomy between horizontal and vertical coordination can also lead to an increased understanding of practice. Recent research by Schultz (2008) described cooperation in the humanitarian logistics context as a multi-dimensional construct constituting structure, extent and intensity. Although Schultz studied horizontal coordination, her model can be used for further studies, including vertical coordination and possible combinations.

This paper has focused on vertical and horizontal coordination as a concept and, consequently, the actual means of coordination have not been discussed in any detail. Further research requires more in-depth studies of what coordination means are used in humanitarian logistics contexts.

For example, is it cost-effective for one person to visit all the cluster meetings in order to assemble a full picture of the situation, and what are the practical difficulties tied to writing, translating and disseminating useful minutes from the meetings? These issues can be tied to more general coordination means in the literature. Hence, a greater understanding of how the coordination could/should take place suggests using the literature from organisation theory (e.g., Brunsson and Jacobsson, 2004; Grandoori and Soda, 1995; Thompson, 1967), the industrial network approach (e.g., Håkansson and Snehota, 1995), and/or logistics and supply chain management (e.g., Fabbe-Costes et al., 2006; Holweg and Pil, 2008; Mason and Lalwani, 2008; Romano 2003).

Simatupang and Sridharan (2002) suggested the concept of lateral collaboration as a more flexible form by combining and sharing capabilities in both vertical and horizontal manners. The humanitarian context is characterised by the large number of organizations involved in most relief operations. Although the supply chain concept can contribute significantly in this setting, it seems promising to consider networks as a venue for future research; this can say more about the interactions of multiple firms where boundaries between horizontal and vertical coordination become unclear. This is in line with Hertz (2001; 2006) and Fredriksson and Gadde (2005), who argued that “Efficiency ... needs to be considered in a network context, because the performance in one particular supply chain depends on how it is combined with other supply chains” (p. 703). This view is complicated by the fact that any particular NGO may specialise in several functional areas and, as a result, be spread out across several clusters.

Finally, when it comes to coordination, the role of the coordinator is always of interest – both in terms of who takes on the role and the contents of the role itself. Recent studies have developed concepts such as ‘Maestros’ (Bitran et al., 2007). Other studies have addressed the role of a logistics service provider in integrated supply chains (Fabbe-Costes et al., 2009) as well as the different possible roles for intermediaries (Jensen, 2009). Expanding on such roles

in this context can provide interesting insights into the theory, as well as how the coordinator in practice contributes to efficiency in the supply chain.

The practical implications of this paper apply to two areas. One is the cluster concept itself and the second is coordination in humanitarian logistics in general. In terms of the cluster concept, it seems clear that limited resources for coordination have caused important tradeoffs. Within-cluster coordination has been the most successful to date, but an emphasis on this makes it more difficult to also achieve between-cluster and supply chain or vertical coordination. There is a challenge then in terms of spending more coordination resources on the latter two types of coordination without overly weakening the first, intra-cluster coordination. The more general point for practice is that different types of coordination achieve different aims. Although functional coordination achieves basic standards and geographical coverage within a functional area, adequately serving an end user also requires cross-functional and vertical coordination. As a final note further cluster evaluations will be carried out in 2010 and it will be important to incorporate the findings from these in future studies.

ACKNOWLEDGEMENTS

We would like to thank Arnt Breivik, former head of the UNJLC as well as a number of interviewees for providing important insights. The SAMRISK programme of the Norwegian Research Council has funded the research. Further thanks to the 2nd CCHLI Conference where a first draft of the paper was presented, and finally our heartfelt thanks to two anonymous reviewers who provided us with exceptionally thorough and constructive feedback.

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Jahre, Marianne, Female, Professor, Lund University, Department of Industrial Management and Logistics, S-22100 Lund. e-mail:marianne.jahre@tlog.lth.se, Phone: +46 2229153, Fax: +46 2224615, Brief presentation (biography): Marianne Jahre is Professor at the Department of Industrial Management and Logistics at Lund University. She also works in the Department of Strategy and Logistics at BI Norwegian School of Management. She received her PhD in logistics in 1995 at Chalmers University of Technology and is now docent there and visiting professor at Université de la Méditerranée in France. Her current research interests include disaster relief logistics, design and development of logistics networks, supply chain integration and the role of service providers. She has extensive experience in heading externally funded research projects and has supervised many phd.students. She has co-edited and co-authored several books and published articles in *International Journal of Physical Distribution & Logistics Management*, *International Journal of Logistics: Research and Applications* and *International Journal of Logistics Management*. She won the Outstanding Paper Award at the Literati Network

Awards for Excellence 2009 from Emerald. She is an international delegate to the Norwegian Red Cross and was during the fall of 2009 undertaking a project on health supply chains in Uganda for Unicef.

Jensen, Leif-Magnus, Male, Assistant Professor, BI Norwegian School of Management, Department of Strategy and Logistics, Nydalsveien 37, NO-0442 Oslo – Norway, E-mail: leif-magnus.jensen@bi.no, Tel: +47 46 41 04 76, Fax: +47 46 41 04 51, Brief presentation (biography): Leif-Magnus Jensen is assistant professor at the Department of Strategy and Logistics at BI Norwegian School of Management. He recently received his PhD from the Norwegian School of Management on the topic of intermediaries in distribution, focusing on car distribution. His main research interests are related to variety and coordination in distribution systems with particular focus on the role of intermediaries. He is currently working on the Norwegian Humlog-NET project focusing on issues related to coordination in humanitarian logistics.

APPENDIX: LIST OF INTERVIEWS

Rome		
Leader, Geographic Information Systems	UNJLC, Core	27 March 2008
Logistician, Joint Supply Tracking	UNJLC, Core	31 March 2008
Consultant, Information Management	UNJLC, Core	27 March 2008
Logistics Officer	Logistics Cluster Core Group	1 April 2008
Chief Freight Analysis & Support Service	WFP Rome	28 March 2008
Customs Specialist, Customs Information Group	UNJLC, Core	1 April 2008
Customs Administrator, Customs Information Group	UNJLC, Core	1 April 2008
Chief Aviation Unit, ODTA (WFP Aviation)	WFP	31 March 2008
Logistics Officer, Head of Training ODTF (WFP Freight Analysis and Support Service)	WFP	28 March 2008
Acting Chief, UNJLC	UNJLC, Core	27 March 2008
Senior Logistics Officer	UNJLC, Core	27 March 2008
Logistics Officer, Special Projects, ODTL (WFP Logistics Service)	WFP	1 April 2008
Logistics Officer, WFP Fleet	WFP	1 April 2008
Sudan		
Senior Logistics Officer	UNJLC, Juba	25 October 2007
Head of UNJLC Juba	UNJLC, Juba	25 October 2007
Logistics Officer, Head of NFI pipeline, Emergency Shelter	UNJLC, Juba	26 October 2007
Head of GIS unit	UNJLC, Juba	25 October 2007
Logistician, GIS unit	UNJLC, Juba	26 October 2007
Information Officer	UNJLC, Juba	24 October 2007
Country head, UNJLC	UNJLC, Khartoum	28 October 2007
Head of Rest of Sudan Office	UNJLC, Khartoum	29 October 2007
Pipeline Manager	UNJLC, Khartoum	29 October 2007
Deputy Head, UNJLC Sudan	UNJLC, Khartoum	28 October 2007
Field Logistics Officer Darfur	UNJLC, Darfur	27 October 2007
Head of Office, Southern Sudan	OCHA	26 October 2007
Air Transport Officer	UNHAS, Juba	24 October 2007

¹ <http://www.humanitarianreform.org/Default.aspx?tabid=310>

² Lists that name potential personnel with specified competencies, e.g., logistics, IT, etc.

³ <http://www.logcluster.org/>

⁴ Because there is limited general survey capacity, much of the data must be gathered from organisations in the field. If this is done successfully, it is an advantage because it is the only realistic way to cover all the areas needed. However, it also means that data-gathering is an additional task for organisations and individuals who are already very busy.