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SUPPLY CHAIN DESIGN AND COORDINATION IN HUMANITARIAN LOGISTICS THROUGH CLUSTERS

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ABSTRACT

Purpose of this paper

The cluster thinking in the humanitarian world has been suggested as a solution to the lack of coordinated disaster response in the past 10 years. Clusters on diverse functions including sheltering, logistics and water sanitation can be viewed as an effort of functional coordination, i.e. horizontal coordination within a functional area. The purpose of this paper is to contribute to more understanding of the cluster concept's potential effects for vertical, i.e. supply chain coordination as well as coordination between clusters.

Design/methodology/approach

The cluster concept and some main empirical issues are presented based on a set of interviews and secondary materials. Literature on clusters and coordination is used to develop a theoretical framework with propositions concerning what potentially negative effects and increased focus on horizontal coordination may have for a supply chain oriented approach.

Findings

Results provide important reflections concerning one of the major trends in today's development of humanitarian logistics. Coordination in one dimension may have negative impacts from other viewpoints.

Research limitations/implications

More in-depth case studies of experiences with clusters in various operations are needed. Care should be taken in applying various perspectives including the field, humanitarian organizations, beneficiaries, donors, private logistics service providers and during (response) as well as between disasters (preparedness).

Practical implications

Results provide important reflections concerning one of the major trends in today's development of humanitarian logistics.

What is original/value of paper

Focusing on the possible trade-offs between different types of coordination is an important complement to the literature which often assumes a high degree of both horizontal and vertical coordination. This is a general challenge which is well illustrated in the humanitarian context.

Keywords: Supply chain design, coordination, disaster management, humanitarian logistics, cluster.

INTRODUCTION AND PURPOSE

The heavily laden truck almost comes to a complete halt at the bottom of the gully, turns to the left to avoid a pothole then slowly works its way up the incline. The driver breathes a sigh of relief - the worst part of the journey is over. Half an hour later he pulls in to the improvised camp where a small crowd of people are waiting expectantly. A number of tents are up and he sees the flags of a well-known relief organization on some of them. It is quite obvious that the camp is far from complete, but the camp is not his responsibility. The delivery of a little over a thousand plastic jerry-cans is. Helped by some of the camp personnel and locals he opens the back of the truck and makes ready to start unloading. Everyone stops, and the driver is puzzled. After a couple of minutes the camp manager arrives. "What is wrong?" the driver asks. The camp manager shakes his head "Let me show you," he says and the driver follows to a large tent a little walk away from the rest. He pulls the flap to the side and the driver immediately realizes what is wrong, as he stands watching a pile of several thousand identical jerry-cans. "We're still waiting for clean water," the camp manager says.

This fictional background reflects some of the recurring problems that motivated the introduction of the cluster concept¹ developed for the purpose of coordinating relief efforts. The rising number (see fig.1) and increasing complexity of disasters call for more specialisation and coordination (van Wassenhove 2006).

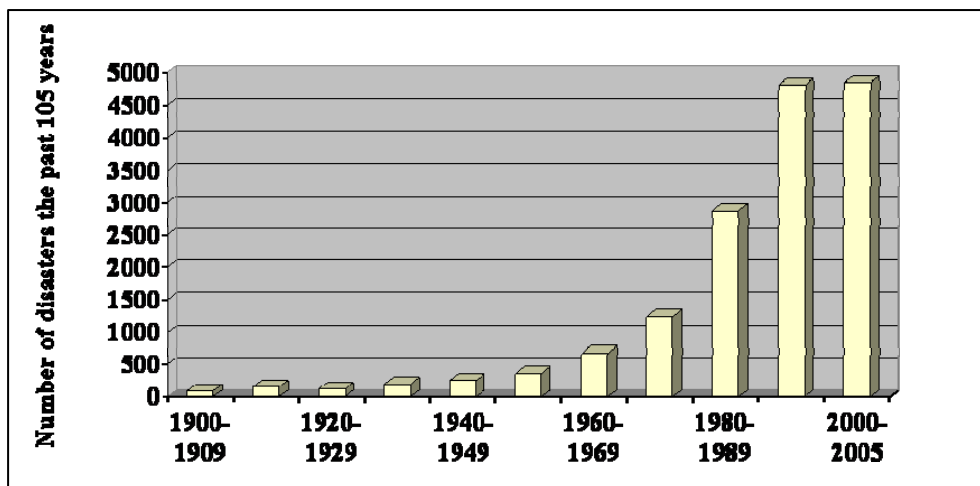


Figure 1: The number of disasters is increasing (Source: EM-DAT (www.em-dat.net/))

Intra- and interorganizational coordination in humanitarian logistics is important but challenging (Beamon 2004, Oloruntuba 2005, van Wassenhove 2006, Schulz 2008) and can take place at different stages in the chain such as contingency planning, needs assessment, appeals, transport management or last-mile distribution (Oloruntuba 2005). The question is when and how the key players should collaborate and how they should be coordinated (van Wassenhove 2006). Coordination, collaboration and cooperation have been subjects of much

¹ The cluster concept has often been called the "UN cluster concept" because it was initially driven by the UN, but there is now a focus on avoiding the UN-centrism and involving NGOs and other bodies to a greater degree.

research in general. Also in supply chain management and logistics this issue has been afforded great attention. Beamon (2004) asks what general lessons can be applied to the humanitarian context. But we can also turn this around and ask whether there are experiences from the humanitarian world that can shed light over this question in general. In particular we are interested in whether some forms of coordination may weaken others, for example in terms of trade-offs between coordination along the supply chain and that between those at the same stage. This is the question of interest in this paper.

The cluster thinking has developed to cope with lack of coordinated disaster response. Clusters on diverse functions including sheltering, logistics and water sanitation can be viewed as an effort of functional coordination, i.e. horizontal coordination within a functional area. The purpose of this paper is to contribute to more understanding of the cluster concept's potential effects for vertical, i.e. supply chain coordination as well as coordination between clusters. After describing the research design in section two, the cluster concept with specific focus on the logistics cluster is presented in the third section. In section four, the empirical is confronted with literature on cluster and coordination to discuss the cluster-thinking from a theoretical point of view. Propositions for further research are suggested in section five.

RESEARCH DESIGN AND METHODOLOGY

The purpose of this paper is to contribute to more understanding of the cluster concept's potential effects for vertical, i.e. supply chain coordination as well as coordination between clusters. This is done in the context of a field where the empirical issues are substantial but theoretical development missing. The literature on coordination is extensive but the problems in the empirical setting quite specific, so that by using the empirical setting as the point of departure it is possible to achieve a better understanding of what elements of the coordination literature will be relevant here. An explorative approach to dealing with the field is therefore appropriate (Stake, 2000).

Here, we employ data collected for an explorative case study on the UNJLC and cluster concept in order to show some of the most important coordination issues that arise as a consequence of the cluster concept, both in terms of its conceptual structure, and as experienced in the field. Due to limitations of space we cannot present the case study here, but will rather present the structure of the cluster concept and some specific comments made by informants in order to show some main issues in the empirical section below. In order to give a context however, the data collection is briefly discussed below.

The empirical description is based on two main sources of data, one being public information and reports/evaluations of the cluster concept which gives a good general background on the concept and some of the initial experiences in using this. The other is a study of the UNJLC which was expanded to include a number of cluster issues. Starting with a site visit to the UNJLC Southern Sudan operation in Juba to gain some understanding of the operations of the UNJLC, more formal interviews were carried out at the UNJLC country Head Quarters in Khartoum covering both issues from the literature on coordination and emergent issues from the initial interviews carried out in Juba. Experiences and interviews from the site visit were written up as an initial description before visiting the UNJLC core unit in Rome. At this point it was apparent that the UNJLC could not be properly studied without reference to the evolving logistics cluster. Interviews in Rome were carried out both with UNJLC personnel and people in the logistics cluster core unit in Rome as well as other World Food Programme (WFP) personnel. Interviews were recorded and later transcribed in full, creating an extensive

log (list provided in the appendix). This was then combined with the general documentation available on the cluster concept to create a second description document specifically dealing with the cluster concept, the logistics cluster and the UNJLC as summarized in this paper². Corroboration of findings were sought both through talks with previous UNJLC personnel and third-party evaluation reports.

CLUSTER THINKING IN THE HUMANITARIAN REFORM

The Asian Tsunami in December 2004 and not least the response to the Darfur crisis in 2004-2005 demonstrated problems in achieving sufficient coverage in large relief operations. The cluster concept was developed to improve efficiency in 5 key areas (Cluster Appeal 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.

From the Inter-agency Standing Committee (IASC) accepted the use of the cluster concept in 2005, it has been introduced in a number of ongoing humanitarian aid operations. It is currently in use in 12 countries³, but according to the concept clusters can be mobilised individually so this does not mean that all clusters are active in all these operations. However, those clusters that are mobilised are intended to cooperate in order to serve recipients better. Inter-cluster coordination has however been a challenge. For the 2005 Pakistan Earthquake it was said that: "very rarely did the clusters cooperate."⁴

Components of the cluster concept

The cluster concept is meant to apply to UN bodies, NGOs (Non-Governmental Organizations) and INGOs (International NGOs). In principle any humanitarian organization with the capacity can lead a cluster. The cluster concept is defined functionally in terms of areas of activity, e.g. water and sanitation, health, nutrition and so on - typically reflecting important and somewhat separate areas of relief work. In the humanitarian system these have often been called sectors. Organizations 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.

Designated global lead: The cluster concept is top-down in nature, i.e. it is defined at the global level and should then be applied to specific settings when they arise. Each global

² A more extensive teaching case has been created and is the basis for the brief description in this paper. The empirical material as presented here is used to focus the most important issues in terms of coordination.

³ Major operations as of 230109. For a current list of clusters and operations see <http://www.humanitarianreform.org/humanitarianreform/>

⁴ Larry Hollingworth, former Humanitarian Coordinator for the UN during the Pakistan Earthquake. Keynote Speech 25th March 2009, 2nd CCHLI Conference.

cluster is permanent and is lead 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 organizations so that their response to it can vary considerably. The IASC determines which clusters to mobilise in 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 may mean a variety of tasks such as building rosters⁵ of qualified personnel for mobilisation, creating stockpiles of essential relief items, training of 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 new with the cluster thinking. It states that if no other organization can provide a needed service the cluster lead should take on the task of delivering it. This is big responsibility considering the scale of some humanitarian relief efforts. It is argued that it places the sector lead in a position of unbounded commitments without the capacity to match this and 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)

The Logistics Cluster

The logistics cluster is responsible for preparation (including stockpiling) and emergency response with regards to logistics coordination. The global lead for the cluster is WFP, which is considered an advantage by some because of the “weight” of the organisation (Interview, Chief Freight Analysis, WFP). As a service cluster which is cross-cutting in nature, logistics must determine needs not only for other organizations concentrating on logistics but also serve the other clusters in their logistics. The main focus of the cluster is on logistics information and coordination and not on carrying out logistics operations itself, although this can also be the case. Especially when some critical coordination functions such as air traffic control require specialized skills and involve a high degree of operational control, this can be undertaken by the cluster.

In describing the logistics cluster it is important to point out that it has benefitted from the fact that logistics has been considered a Common Service for some time, and from previous work in logistics coordination. The UNJLC was the previous mechanism used for logistics coordination and was still in place when the cluster concept was launched. UNJLC was first mobilised during the East Zaire or great lakes crisis in 1997 and had a significant impact in the Mozambique floods in 2000. Institutionalised in 2002, it was established by and received its mandate from IASC. The background for the UNJLC was the need to coordinate logistics activities between a number of agencies such as UNHCR, WFP and UNICEF⁶, in particular in the early stages of a crisis response. Previously, such coordination had taken place on an ad-hoc basis. This had worked well in some cases and less so in others, making it important to find a way to ensure more consistent success in logistics coordination.

In this sense, we see several transitions within logistics coordination. Firstly from the largely ad-hoc coordination before the UNJLC, then an experimental use of the UNJLC in several

⁵ Lists that name potential personnel with specified competencies, e.g. logistics, IT, etc.

⁶ United Nations High Commissioner for Refugees, World Food Programme, United Nations Children's Fund

relief operations, which proved broadly successful, followed by the institutionalisation of the UNJLC. Finally, we see an overlap between the two concepts, with the UNJLC core unit absorbed by the Logistics Cluster formally in January 2009. However, it has been commented that many of the tasks carried out are essentially the same, although these are now carried out by the cluster (Interview, UNJLC Consultant, Rome).

Responsibility for collecting and disseminating information: The cluster is responsible for logistics information, both in its collection and dissemination. This implies a potentially wide range of information, but focused on transport routes, infrastructure status, and the availability of transport resources. This type of information is often quite obvious to those in the field but very hard to obtain for those who are not. Usually such information is spread through a central webpage (<http://www.logcluster.org/>) as well as through a series of meetings locally. There are a number of special areas where the cluster can provide special services that are useful to many participants in local interventions. One of these is geographical information systems (GIS), essentially a mapping service specialising 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” to start with (Interview, Head of Office Southern Sudan, OCHA).

Responsibility for coordinating use of logistics resources: During the first stages of an emergency air transport is often the only viable option, creating strong pressure on capacity. In several interventions the UNJLC and now the cluster has taken on the task of air traffic control for a limited period, in order both to overcome problems in local capacity which either is insufficient for the sheer volume handled, or damaged because of the disaster. This can mean some operational responsibility for air traffic control, but most important in terms of logistics is the ability to prioritise cargo so that essential items reach recipients as soon as possible. With WFP which is a large organization and with many ongoing operations in charge, it is an open question how other UN bodies and actors will perceive the decisions made. Clearly 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.

Responsibility for training logistics personnel: The core cell of the logistics cluster carries out training sessions for potential field logisticians which creates a roster and increases the overall capacity in terms of qualified personnel for relief operations.

Extending responsibilities: The tasks taken on by the logistics cluster are not exhaustive in that new tasks may be added as needs arise. The logistics cluster has not taken on the provider of last resort task, although the WFP with its large food distribution operation may be better placed for this than many other sectors leads. In a move unique to Sudan however the UNJLC has been given the sector lead for the distribution of Non-food items. This is somewhat unusual in that the cluster concept is not in place in Sudan, but it remains a good example of controlling the entire pipeline from purchase to delivery. The NFI pipeline clearly achieves some significant savings. For example, in Southern Sudan there was at one stage 12 different pipelines operating, compared to the single pipeline for Darfur when the common pipeline was implemented (Interview, Senior Logistics Officer UNJLC Core).

CLUSTER COORDINATION IN VIEW OF SELECTED LITERATURE

Starting with the cluster concept, this review is based on selected literature on different types of coordination for the purpose of theoretical categorisation and description of clusters. Whereas the concept coordination is used here in accordance with the empirical context,

cooperation, collaboration, coordination and integration are used interchangeably both within and outside the humanitarian context (Schulz 2008, Kovacs and Spens 2007, Fabbe-Costes and Jahre 2006, van Wassenhove 2006)⁷.

Types of coordination – a literature review

The term ‘cluster’ was defined by Porter (1998) 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) assumes that clusters include upstream and downstream customers, but 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 specialized information, increased availability of complementary products and services and better motivation and measurement (p.267).

Reichhart and Holweg (2008) discuss forms and functions of what they term ‘co-located supplier clusters’ and develop a two-dimensional matrix for classification: A) Spatial integration and infrastructure constitute supplier location in relation to customers and existence of dedicated infrastructure and B) Local value added. Whereas the empirical setting, in line with much logistics literature, is manufacturing particular the automotive sector, Maskell et al. (2006) report from a very different context. They see trade fairs, conventions and professional gatherings as temporary clusters defined as ‘inter-firm organization characterised by knowledge-exchanging mechanisms’ different from projects and stable inter-firms networks and similar to permanent clusters (in Porter-terms), but short-lived and intensified.

Coordination⁸ as a concept has longer traditions within a number of disciplines including organization, strategy, marketing and logistics. It is often suggested as something in between market and hierarchy, representing what the literature often call a hybrid form (Williamson 1991). Different typologies have been suggested, for the most relating to vertical and horizontal coordination as in figure 2 below. By horizontal cooperation is meant ‘concerted practices between companies operating at the same level(s) in the market.’ (EU 2001). It concerns collaboration with competitors, internally and with non-competitors, e.g. sharing manufacturing capacity (Barratt 2004, p.32) and is also 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).

⁷ An extensive review to clarify the concept is beyond this paper and is left for future research.

⁸ Late Latin co- + ordination-, ordinatio arrangement, from ordinare to arrange: the harmonious functioning of parts for effective results (Encyclopedia Britannica Online)

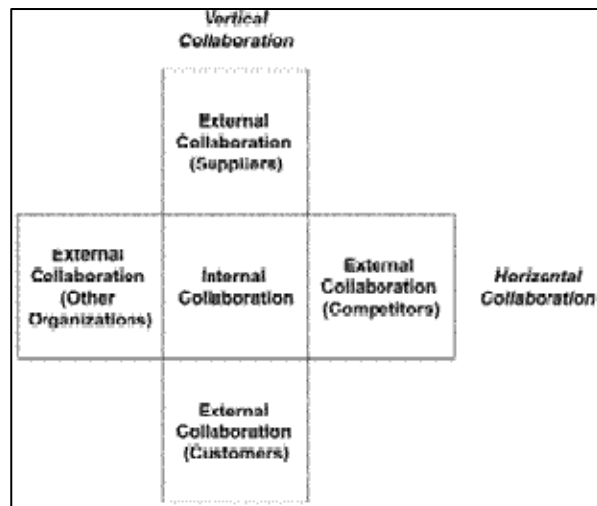


Figure 2: Horizontal and vertical cooperation (Source: Barratt 2004)

Numerous studies on vertical coordination have been reported (Schulz 2008). Taking 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), vertical coordination is 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). Two groups of typologies have been identified in the review. One concerns the levels at which coordination takes place, e.g. Xu and Beamon (2006) who define it as the *strategic* response to the challenges that arise from organizations in a chain being dependent on the performance of each other, whereas Barratt (2004) suggests coordination taking place also at *tactical* and *operational* levels. The other constitute what has been termed dimensions, within which the most common is the three *flows of information, material and financial* (e.g. Romano 2003, Surana et al. 2005, Simatupang and Sridharan 2005). It is suggested that in order to develop and manage innovative supply chain processes that enable smooth flows, chain members must collectively define (Simatupang and Sridharan 2005, p.258):

- *A collaborative performance system* that specifies performance metrics and targets across the supply chain to agree on measures for customer service, quality, price, cost and responsiveness – all for the purpose of enhancing each member’s profit, return-on-investment and cash-flow.
- *Information sharing* about planning, process, control and performance including acquisition, processing, storage and use of data on demand, inventory, order status, cost and performance, etc.
- *Decision synchronisation* that enables the members to make joint decisions that influence supply chain direction and performance such as sales and order forecast, inventory, replenishment, etc.
- *Incentive alignment* based on overall performance to induce productive behaviour and improvement by calculating costs, risk and benefits and formulating according incentive schemes.

Giannoccaro and Pontrandolfo (2003) claim that more attention has been given to flows than actors (i.e. governance) and studies have suggested including a fourth dimension in addition to the three flows, i.e. supply chain relationships (e.g. Power 2005 and Samaranayake 2005). Based on extensive literature reviews of supply chain and logistics integration, Fabbe-Costes and Jahre (2006, 2008) suggest a multi-dimensional concept constituting *flows* (physical, information, financial), *processes and activities*, *technologies and systems* and *actors*. The industrial network approach, increasingly used in logistics and supply chain management studies (e.g. Håkansson and Persson 2004, Bygballe 2006, Awaleh 2008, Jahre et al. 2006) put the relationships in the centre, suggesting they are based on how business units are connected through three layers: (1) *Actor bonds* connect actors and influence how actors perceive each other and form their identities in relation to each other; (2) *Activity links* regard technical, administrative, commercial and other activities of a company that can be connected in different ways to those of another company; and (3) *Resource ties* connect various resource elements of companies and result from how the relationship has developed.

Summarising from this review, we see that:

- Clusters include both horizontal and vertical coordination. In line with mainstream, logistics literature view geographical proximity as important.
- Little is written on horizontal coordination in logistics. Focus seems to be on how logistics service providers can increase their own performance by cooperating, but with little attention to customer demands.
- Vertical coordination is to give better customer service and reduce costs for all. The literature suggests this can take place at different levels and along a number of dimensions/layers. Of great importance is to share performance systems and information and synchronise activities and incentives for the purpose of smoothing flows.

POTENTIAL TRADE-OFFS – PROPOSITIONS AND MATRIX

From the case we see that the clusters have been developed to take care of coordination between organizations that are experts in the same functional areas of disaster response. Hence, we can classify it as horizontal coordination as defined in the literature. With relation to vertical coordination, however, we see that the clusters do not focus on this. Partly, it seems that the coordination takes place only between the providers of the services at the same stage in the chain, e.g. between those offering water and sanitation (watsan) solutions, and not upstream to these organizations' suppliers of equipment and services. Further, with regards to fulfilling end-customer demands as discussed in the literature, we would suggest that coordination would have to be undertaken across the different clusters for the fulfilment of all basic needs of a beneficiary such as such as shelter, watsan and health. Hence, the clusters do not take care of the supply chain coordination, which is in contrast with the *literature* on clusters including both types - vertical and horizontal. On the basis of this we formulate two propositions.

Proposition 1: Coordination within clusters may impede coordination across clusters leading to excessive functional focus and reduced focus on beneficiary needs.

This proposition speaks to the relatively uncontroversial issue in the literature that if the functional focus in an organization becomes too strong, then this can lead to a loss of focus on

the overall goals of the organization. In the particular setting here, this can mean that although a geographical area is well covered in terms of each functional area, there is lack of coordination in terms of timing and loss of efficiency because each functional area operates independently. Note that we are here taking the present clusters as given – a reorganization of the tasks taken on by individual clusters might lead to different results but is not seen as an option currently.

The second major issue is vertical coordination. Coordination should be handled through the cluster leads in order to create an overall understanding of needs, i.e. demand, within the specific area in order to match with activities, i.e. supply. However, there is a danger that this important horizontal coordination in a disaster area comes at the cost of vertical coordination. One aspect of this is that there may not be significant cluster-level vertical coordination at all. That is, the cluster assigns geographical areas for organizations to work in, and the organizations each have their own internally managed pipelines. This may make it impossible to achieve advantages of scale, and can lead to considerable congestion in the overall pipeline to a country as has been seen in many relief operations.

The second aspect is that even where a common pipeline exists within a disaster area, only some of the advantages of vertical coordination are achieved. The needs in the field are best determined by those organizations in the field, but there is also a strategic level involving issues such as purchasing, stockpiling and efficiency in transport to the disaster area. This means that vertical coordination not only applies in the disaster area but for the entire supply chain. This leads us to our second proposition.

Proposition 2: Effective vertical coordination depends on successfully merging the pipelines of many of the organizations in a disaster operation, and on creating a strategic level for carrying out coordination.

There is some evidence of this strategic level in global capacity building and stockpiling of emergency goods, so here we do see some steps being taken. It is however not clear at this stage to which extent these steps reflect the global lead building its own capacity and to what extent it reflects efforts at strategic coordination.

These two relatively broad propositions can be complemented with a simple matrix which emphasises the most salient characteristics from the theoretical framework and empirical points here. The discussion has shown several important issues when dealing with coordination. The question of what to coordinate has been answered in several ways. It is essential to coordinate flows which are of a physical, informational and financial character. Coordination of processes and activities, actors and technologies and systems are all ways of achieving efficiency. This covers what types of issues to coordinate in a broad sense. Crucially, this type of coordination can be carried out in a vertical or a horizontal sense. Finally, the coordination can be carried out at an operational, tactical or strategic level. Combining the two dimensions of coordination gives us a useful matrix for arranging both different types of coordination and coordination observed in a particular situation. Figure 3 below shows the matrix:

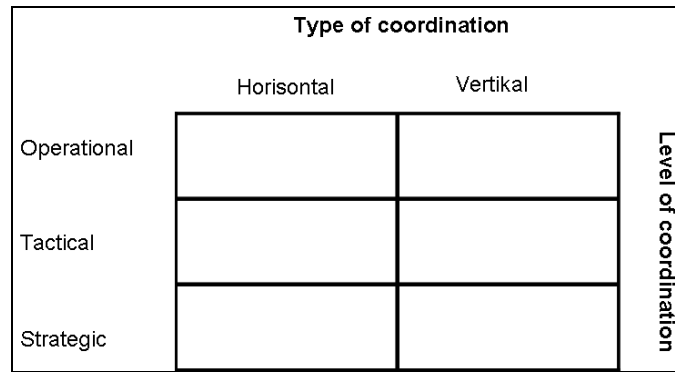


Figure 3: Coordination matrix

Ideally, the cluster concept should have relevance for all the blocks in the figure. There is however a danger that coordination will be restricted to horizontal coordination at the operational level only. This in itself is useful, but only yields some of the possible benefits in the cluster concept itself.

CONCLUDING REMARKS AND FURTHER RESEARCH

It is concluded that too strong a focus on the coordination of specialized humanitarian organizations may impact negatively on the ability to develop efficient and effective supply chains covering all basic needs of the beneficiary in a disaster. Hence, coordination of the clusters is needed in addition to the present coordination within the clusters. As such the results provide important reflections concerning one of the major trends in today's development of humanitarian logistics. Coordination in one dimension may have negative impacts from other viewpoints. Combining coordination literature with that of clusters contributes to more understanding of possible trade-offs between different types of coordination. This is a general challenge but is well illustrated in the humanitarian context. With basis in the empirical issues raised combined with the literature, propositions concerning this have been suggested and a tentative framework for further studies has been developed.

However, more in-depth studies of the experiences with different types of clusters in various operations are needed. The present empirical description is limited since it studied the Logistics Cluster during a transitional period, and will be strengthened by further studies of an operational cluster in the field once the concept is fully implemented. Care should be taken in viewing this from various perspectives including the field, the humanitarian organizations as well as beneficiaries, donors, private logistics service providers and during (response) as well as between disasters (preparedness).

Recent research by Schultz (2008) describes cooperation in the humanitarian logistics context as a multi-dimensional construct constituting structure, extent and intensity. Whereas she studies horizontal coordination, her model can be used for further studies including vertical coordination and possible combinations.

Building on Simatupang and Sridharan (2002), Mason et al. (2007) discuss combining vertical and horizontal collaboration as do Jain and Dubey (2005). Simatupang and Sridharan (2002) suggest 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 a 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 because 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). Fredriksson and Gadde (2005, p.703) suggest 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'.

This paper has not dealt with actual coordination mechanisms in any detail. Further research requires more in-depth studies of what coordination means are used in the humanitarian logistics context, both in the clusters, in the different organizations and in different operations. For example, what is the cost of one person visiting all the cluster meetings to pull together the information, and what are the practical difficulties tied to writing, translating and disseminating useful minutes from the meetings? These issues can usefully be tied to more general coordination mechanisms in the literature. Hence, a literature review on coordination mechanisms is an important area and could be based on literature from organization theory (e.g. Thompson 1967, Brunsson and Jacobsson 2004, Grandoori 1997, Grandoori and Soda 1995), the industrial network approach (e.g. Håkansson and Snehota 1995, logistics and supply chain management (e.g. Romano 2003, Holweg and Pil 2008, Fabbe-Costes et al. 2007, Mason and Lalwani 2008).

A third area of interest is studies of how the temporary and permanent supply chains and networks are designed and whether the development of cluster thinking has some consequences for this. Examples include the number, location and capacities of facilities and how they serve specific markets, e.g. warehouses for prepositioning of goods with matching supplier selection and relationship development (Meixell and Gargeya 2005). Meixell and Gargeya consider international supply chains and how these are typically characterised by long supply lines, differences in local cultures, challenges in infrastructure and economic and political instability to name a few. The same features are highly relevant in describing humanitarian supply chains. This makes it relevant to study these with a view to contributing to the literature on commercial global supply chains.

Finally, when it comes to coordination, the role of the coordinator is always of interest – both who may take on such a role and the contents of the role. Recent studies develop concepts such as 'Maestros' (Bitran et al. 2007) and there are also studies concerning the role of a logistics service provider in integrated supply chains (Fabbe-Costes et al. 2009).

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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