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A guiding framework for designing humanitarian relief supply chains – A case study in Thailand

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ABSTRACT

Hundreds millions of people are affected by disasters each year. There is considerable evidence that the number of worldwide natural and man-made disasters is increasing, but there is still relatively little published work aimed at improving the understanding of the nature of logistics and supply chain management for humanitarian aid. Therefore, the aim of this paper is to identify elements of good practice in humanitarian relief supply chain, making use of published academic and practice-based literature and web sites associated with humanitarian aid. A guiding framework for designing supply chain system for humanitarian aid is developed. Then it is applied to a case study in Thailand to provide a guideline for the case study organisation to develop an effective humanitarian relief supply chain.

Keywords: Humanitarian supply chain, Relief supply chain, Thai Red Cross

1. INTRODUCTION

The term “disaster” is usually applied to a breakdown in the normal functioning of community that has a significant adverse impact on people, their works, and their environment which exceed the ability of the affected people to cope using only its own resources (United Nations, 1992). This situation may be result of a natural event or human activity (Roh et al., 2008). A disaster places exceptional demands on the supply chain, logistical and organisational skills of the affected country (PAHO and WHO, 2001). Logistics and supply chain management are required to support the organisation and implementation of response operations in order to ensure their timeliness and efficiency. Mobilising the staff, equipment and goods of humanitarian assistance organisations, the evacuation of the injured or the resettlement of those directly affected by disaster, requires a logistics and supply chain system to maximize effectiveness (PAHO and WHO, 2001).

Thai Red Cross (TRC) is a humanitarian organisation in Thailand under the support of the Thai government and the king of Thailand. It was found in 1893 and accepted as a member of the Federation of Red Cross and Red Crescent Societies in 1921. Relief and Public Health Bureau, a bureau under TRC, is responsible for providing assistance and relief to disaster victims and the underprivileged. It also offers community health service to the public. In recent years, logistics and supply chain management has received increased attention in humanitarian aid due to the perceived failures in aid delivery system following major crises (Fritz Institute, 2005). Same as to other humanitarian organisations, TRC would like to develop its logistics and supply chain strategy in order to enhance its operational capability of the supply chain in emergencies. However, the organisation still lacks of human resources and knowledge base to develop such strategies and, in turn, its operation may not be as effective and efficient as possible. Moreover, the academic

literature on humanitarian logistics and supply chain is scant and there is only a limited body of research on the topic (Beamon and Kotleba, 2006; Kovacs and Spens, 2007; Kovacs and Spens, 2009; Pettit and Beresford, 2009). There is therefore a need for research to conduct a literature review prior to developing a guiding framework for designing humanitarian supply chains. The research methodology commenced by reviewing related literature in the field of humanitarian logistics and supply chain, and principle concepts from business logistics and supply chain. The results from the review have then been analysed to form a framework. This framework has been applied in Thai Red Cross to provide guidelines to develop supply chain strategies to the case organisation.

This section presents the background of the research, its aim, the research approach, and followed by its scope. The remainder of the paper is organised as follows. Section 2 reviews the literature on humanitarian supply chain. Section 3 presents the proposed framework for designing humanitarian supply chain system. Section 4 presents the application of the framework in the case study. Finally, concluding remarks and future research directions are provided.

2. LITERATURE REVIEW

The purpose of this paper is to develop a guiding framework for designing humanitarian relief supply chain system. The intention of this section is to explore previous work in the area of disaster management and humanitarian relief supply chain, and to define the main elements in successful humanitarian relief supply chains. These objectives are achieved by addressing the following questions:

- Who are the main actors involved and responsibilities within humanitarian relief supply chains?

- What are the phases in the general process of disaster management?
- What are the supply chain strategies for humanitarian relief supply chains?
- What are the critical success factors of humanitarian relief supply chains?
- What are the performance metrics in humanitarian relief supply chains?

These questions will be answered through a review of the literature that has made a valuable contribution to knowledge in the field of humanitarian relief supply chain. The literature review is structured into five main sections.

2.1 The humanitarian supply chain

Supply chain links the sources of supply (suppliers) to the owners of demand (end customers). The ultimate goal of any supply chain is to deliver the right supplies in the right quantities to the right locations at the right time. Supply chains comprise all activities and processes associated with the flow and transformation of goods from the raw material stage through the end user (Beamon and Balcik, 2008). Similar to commercial supply chain, supplies flow through the relief chain from the donation to the consumers. There is no single form of humanitarian supply chain, although a typical supply chain could follow the sequence in Figure 1. Government and NGOs are the primary parties involved (Ergun et al., 2009). Governments hold the main power with the control they have over political and economical conditions and directly affect to supply chain processes with their decisions. Donors, public and private organisations are the other significant players in the humanitarian supply chains. Donors have become particularly influential in prompting humanitarian organisation to think in terms of greater donor accountability and transparency of the whole supply chain (Wassenhove, 2006). Two-way arrow in the figure represents two-way communications in information, product and fund flows among the parties in the humanitarian chain.

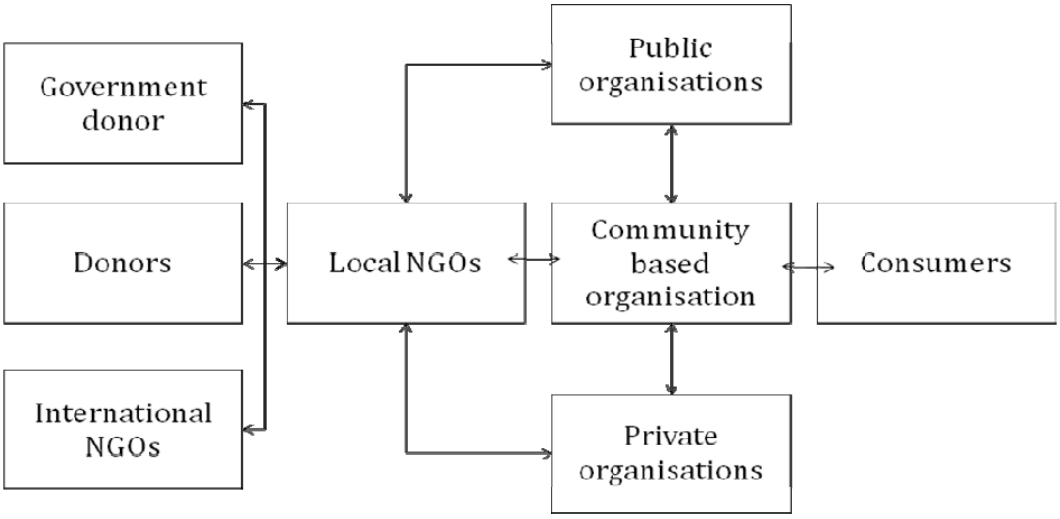

Figure 1: A typical humanitarian supply chain

Even though the structure of humanitarian chains is similar to most business supply chains, the humanitarian supply chain is often unstable (Oloruntoba and Gray, 2006). As a result, coordination and management of disaster supply chains are increasingly needed and must be put in place in the humanitarian supply chains. Goals, revenue sources, and performance metrics of humanitarian and regular supply chains differ notably. Unlike the humanitarian supply chains, which do not have any profit targets and rely heavily on volunteers and donors, in regular supply chains, stakeholders are the "owners" of the chain. The source of revenue for humanitarian supply chain is government funding, charitable donations from individuals and corporation, and in-kind donations. The goal of humanitarian supply chain is to be able to respond to multiple interventions, as quickly as possible and within a short time frame (Wassenhove, 2006). In addition, performance measurement in the nonprofit sector include the intangibility of the services offered, immeasurability of the missions, unknowable outcomes, and the variety, interests and standards of stakeholders (Beamon and Balcik, 2008).

2.2 Disaster relief phases

Disaster management is often described as a process with several phases (Nisha de Silva, 2001). The minimal distinction is between preparation and post-event phases (Long, 1997). On a more detailed level, The National Governors Association's (1979) suggests a four-stage process model of disaster relief that include preparedness, response, recovery and mitigation as the details below.

- Preparedness: During the preparedness phase, governments, organizations, and individuals develop plans to save lives, minimise disaster damage, and enhance disaster response operations.
- Mitigation: Activities that either prevent the occurrence of an emergency or reduce the community's vulnerability in ways that minimize the adverse impact of a disaster or other emergency are examples of mitigation.
- Response: The focus in the response phase is on meeting the basic needs of the people until more permanent and sustainable solutions can be found.
- Recovery: Recovery activities aim at restoring the affected people lives and the infrastructure that supports them.

These four phases are accepted as a disaster process in the debate on disaster management. It is relevant to point out that the phases are mutually inclusive and multidimensional, because they are strongly interconnected (Lettieri et al, 2009). In similar way, Ludema and Roos (2000) characterise disaster relief operations as consisting of emergency, elementary, rehabilitation, and development relief. Moe and Pathranarakul (2006) present disaster management in five generic phases: prediction, warning, emergency relief, rehabilitation and reconstruction. Even though they categorise into five phases, there are four essential activities conducted in the project life-cycle: mitigation, preparedness, response and recovery. Wassenhove (2006) proposes four phases in disaster management: mitigation,

preparedness, response and rehabilitation. However, Kovacs and Spens (2007) discuss three phases of disaster relief operations, the times before a disaster strikes (the preparation phase), instantly after a disaster (the immediate response phase) and in the consequences of a disaster (the reconstruction phase). They also propose management perspectives to each phase as respectively: strategic planning for the preparation phase, short-term project management for the response phase, and long-term project management for the reconstruction phase. Similarly, Jahre et al. (2009) classify humanitarian logistics management into three phases: preparedness, response and recovery phases.

From the literature, the phases of disaster relief can be seen in terms of a cycle in three different temporal phases: pre-disaster, disaster and post-disaster (Lettieri et al., 2009). Further details can be added to these phases such as mitigation, warning, or rehabilitation. Therefore, in the purpose of humanitarian aid supply chain management in this paper, the three phases, preparation, response and reconstruction will be used to refer the period that goes before the occurrence of a disaster, the aftermath of the disaster and the return to a normal condition consecutively (Bertrand and Lajtha, 2002; Hensgen et al., 2003) Different resources and skills needed for each phases of disaster relief will be discussed further.

2.3 Supply chain strategy

A major challenge to humanitarian supply chain is the balance between the ability to quickly respond to a given crisis and the need to be cost efficient both when reacting to a crisis and in between crises (Jahre et al., 2009). The concepts of “lean” and “agility” are often referred to manufacturing and business supply chains to optimise performance and improve competitive position. The following definitions relate the agile and lean

paradigms to business supply chain strategies and were developed to emphasise the distinguishing features of each (Naylor et al., 1999).

- Agility means using market knowledge and a virtual corporation to exploit profitable opportunities in a volatile marketplace with the customer drivers in availability.
- Leanness means developing a value stream to eliminate all waste, including time, and to ensure a level schedule.

Leanness and agility can sometimes be combined with the strategic use of a decoupling point, thereby capitalising on the benefits of both paradigms. The supply chain can adopt a lean approach upstream, enabling to drive down costs upstream while simultaneously still ensuring that downstream of the de-coupling point there is an agile response capable of delivering to an unpredictable demand (Jones et al., 2000).

Humanitarian supply chains are clearly unstable, unpredictable, and requiring flexibility to respond the affected people as quickly as possible in the response phase and therefore insights are to be gained from this phase as agile supply chain. Oloruntoba and Gray (2006) propose their study on an agile supply chain for humanitarian aid. They explain that the humanitarian supply chain at the level of the international donor in developed countries should be lean for upstream activities such as needs assessment, mobilisation of sufficient financing, people, skills and goods, procurement, transportation sourcing, disaster preparation and planning. For downstream, the supply chain should be agile in activities such as recipient specific deliveries, site selection planning and decision making and sensitive needs assessment. However, they also argue that upstream activities in the humanitarian supply chain are usually lauded for their agility such as attraction of donors.

Literature suggests a combination of lean and agile approaches for optimal supply chain management. Jones et al. (2000) argue that agility will be used downstream and leanness upstream from the decoupling point in the supply chain. Thus, leagile enables cost effectiveness of the upstream chain and high service levels in a volatile marketplace. However in the context of humanitarian aid supply chains, lean and agile concepts should be applied according to the disaster relief phases. In the preparedness and reconstructing phases, lean concepts will reduce non-value added operations and improve the value added to the operations in these phases, while the response phase should develop the agile operation where minimal lead times are required to be able to service volatile consumer demand with high levels of availability.

2.4 Critical success factor

The critical success factors are the limited number of areas in which results ensure successful competitive performance (Alazmi and Zairi, 2003). Critical success factors in the disaster management have been addressed by authors in the research field. For example, Moe and Pathranarakul (2006) suggest 10 critical success factors that must be carefully taken into considerations in managing disasters (shown in Table1). They further explain that these success factors are the circumstances, facts, or influences that are inputs into management systems and can directly or indirectly affect the outcomes of a disaster management project. In the same year, Wassenhove (2006) proposes five key elements in the preparedness phase that have to be in place to produce effective results. These in turn lead to effective disaster management. They are human resources, knowledge management, operations and process management, financial resources and the community. Later, Perry (2007) studies the natural disaster management planning concerning the 2004 tsunami disaster. The main findings are four important factors for preparedness activity in vulnerable region (shown in Table 1).

In the realm of humanitarian relief supply chains, there are still limited numbers of researchers exposing the role of critical success factors in the relief supply chain. In 2007, Kovacs and Spens (2007) propose the important elements in each disaster relief phase to the success of humanitarian supply chains. They are collaboration and coordination in the preparation phase; supply, fulfil and demand management in the response phase; and coordination and collaboration in the reconstruction phase. Later, Pettit and Beresford (2009) study critical success factors in a commercial context and set out 10 critical success factors for humanitarian aid supply chain management (shown in Table 1). Although the circumstances in which humanitarian aid supply chains operate are different, the basic activities within those chains are not fundamentally different to commercial supply chains. Their work initiated the applicability of supply chain success factors to humanitarian aid sector. However these success factors have not been validated in their study.

Table 1: Critical Success Factors

Authors	**Critical success factor**
Disaster management:	
Moe and Pathranarakul (2006)	Effective institutional arrangement Coordination and collaboration Supportive laws and regulations Effective information management system Competencies of managers and team members Effective consultation with key stakeholders and target beneficiaries Effective communication mechanism Clearly defined goals and commitments by key stakeholders Effective logistics management Sufficient mobilization and disbursement of resources
Wassenhove (2006)	Preparedness: Human resources, knowledge management, operations and process management, financial resources, the community
Perry (2007)	Preparedness activity in vulnerable region Involvement of the local people Collaborative information sharing between participating parties Early involvement of logisticians

Authors	Critical success factor
Humanitarian aid supply chain:	
Kovacs and Spens (2007)	Preparation: coordination and collaboration Immediate response: demand management, supply management and fulfilment Reconstruction: coordination and collaboration
Pettit and Beresford (2009)	Strategic planning: long-term decision making, planning, management Resource management: inventory management Transport planning: transport availability and constraints Capacity planning: storage, processing and transport capacity Information management: strategic information management and enterprise resource planning Technology utilisation: implementation of new technology Human resource management: participative management Continuous improvement: benchmarking, key performance indicators Supplier relations: collaboration Supply chain strategy: Just-in-time, agility and lean supply

2.5 Performance measurement in humanitarian relief chains

Performance measurement and its application continue to grow and encompass both quantitative and qualitative measurements and approaches (Hervani and Helms, 2005). The variety and level of performance measures depends greatly on the goal of the organisation or the individual unit's characteristics. Supply chain models have predominantly utilised two difference performance measures: cost and a combination of cost and customer responsiveness (Beamon, 1999). From these measures, the performance measurement in supply chain has been expanded into several measurements. For example, Beamon (1999) suggest a supply chain measurement system must place emphasis on three separate types of performance measures: resource measures, output measures, and flexibility measures. Holmberg (2000) propose to use costs, lead time and inventory levels to measure in supply chain collaborative activities. Keebler and Plank (2009) categorise the logistics performance measurement into effectiveness measures involving trading partner, effectiveness measures internal focus, efficiency measures, productivity and utilisation. Thakkar et al. (2009) summarise that a number of experts and practitioners from supply

chain strategy use the following metrics which incorporate all the dimensions of supply chain performance: total supply chain cost, service level, asset management, customer accommodation, cash-to-cash cycle time and benchmarking. Chia et al. (2009) propose to use the four perspectives of the Balanced Scorecard for supply chain entities' measurement which are: financial, customer, internal business processes, the organisation's learning and growth perspectives.

The literature shows that the body of existing research on performance measurement in general and on logistics and supply chain management in particular is extensive (Schulz and Heigh, 2009). Only in recent years has research on performance measurement in the context of humanitarian logistics begun (Beamon and Balcik, 2008). Schulz and Heigh (2009) suggest and test key performance indicators to guide and monitor the continuous performance improvement of International Federation of Red Cross and Red Crescent Societies logistics unit on a daily basis. The indicators are assigned to the four perspectives: customer service, financial control, process adherence and innovation and learning. Later, Beamon and Balcik (2008) adopted Beamon's (1999) three-part performance measurement framework to humanitarian relief chains. Their performance measurement consist of resource metrics (e.g. total cost, overhead cost, distribution cost, inventory investment, inventory obsolescence, order/setup costs), output metrics (e.g. total amount of disaster supplies, target fill rate achievement, number of stock-outs) and flexibility metrics (minimum response time, mix of different types of supplies that the relief chain can provide in a specified time period).

3. A FRAMEWORK FOR HUMANITARIAN RELIEF SUPPLY CHAINS

By synthesising the key elements of the humanitarian relief supply chains, a framework for humanitarian relief supply chains is proposed (see Figure 2). The framework in Figure 2 combines the key elements in delivering humanitarian aid on relief operations with the three different phases of the operations (before, during and after disaster). Each phase has different activities, actors, approaches, supply chain strategies, elements and key performance measurement to operate. The first phase, preparation, consists of two main activities which are mitigation and preparedness. Mitigation includes activities that prevents an emergency, reduces the chance of an emergency happening or lessens the damaging effects of unavoidable emergencies. Preparedness includes activities of planning how to respond in case of a disaster. The second phase, response, is an action taken immediately before, during and just after a disaster or major emergency. The goal of the responder is to save lives, minimise property damage and enhance the beginning of recovery from the incident. The last phase, reconstructing phase, includes recovery activities that returns infrastructural systems to minimum operating standards and guides long-term efforts designed to return life to normal or improved levels after a disaster. As a result, in each phase, the approaches are different. The first phase deals with strategic planning addressing long-term decision making. Strategic planning identifies assets and resource and assesses the strengths and weaknesses of possible scenarios. A long-term approach is adopted which allows an organisation to be prepared for what must be done when an emergency occur (Long, 1997). Strategic planning should include organisation strategy, location of distribution centres (e.g. centralised or localised), outsourcing of non-core activities, acquiring donation, deployment of resources and the effective use of the organisations skills (Pettit and Beresford, 2009). The recommend of supply chain strategy

in this phase is lean strategy through eliminating obvious wastes. The lean thinking paradigm suggests that any activity that does not add value as perceived by the end consumer is waste, and through the removal of waste, value can be added and a superior offer provided. This is a simple yet powerful idea that is applicable across all industry sectors and places a strong emphasis on supply chain actors to develop efficient yet effective solutions to the supply of goods and services. Waste reduction will also lead to time compression; the reduction of cycle time in the supply chain from time of order to time of delivery (Pettit and Beresford, 2009).

The key elements in this phase in the proposed framework are collaboration, coordination, resource planning and knowledge management. There is evidence of a frequent lack of planning in humanitarian supply chains, resulting in inefficiencies, and a lack of inter-organisational collaboration for information systems (Oloruntoba and Gray, 2006). Emergency humanitarian operations frequently require the involvement of several public and private organisations especially local organisations. It is necessary to have coordination mechanism to put in place during the preparation phase to allow the organisations to integrate information in order to plan resource supply and capacity planning. The humanitarian supply chains should adopt knowledge management which comprises a range of strategic and practices to identify, create, represent, distribute, and enable adoption of insights and experiences. Such insights and experiences comprise humanitarian aid knowledge, either embodied in individuals or embedded in organisational processes or practice. The main performance measurement category in this phase is resource. Resource performance metrics indicate the level of efficiency in the relief chain and cost is the predominant resource metric in traditional commercial supply chains

(Beamon and Balcik, 2008). The main performance measurement is therefore cost during the preparation.

	Phase	Activities	Approach	Supply chain strategy	Key elements	Key performance measurement
Before	Preparation	Mitigation Preparedness	Strategic planning	Lean	• Collaboration • Coordination • Resource planning • Knowledge management	Resource
During	Response	Response	Short term project management	Agile	• Information management • Demand management • Supply management • Fulfillment management	Resource Output Flexibility
After	Reconstruction	Recovery	Long term project management and completing	Lean	• Collaboration • Coordination • Resource planning • Knowledge management • Continuous improvement	Resource Output Flexibility

Figure 2: A framework for humanitarian relief supply chains

In response phase, short-term project management focusing on demand, supply, fulfilment and information management should be employed in the part of disaster relief. The demand supply and fulfilment management are concerned with balancing the affected people's requirements with the capabilities of the supply chain. This includes forecasting demand, defining customer requirements, synchronising it with the supply and distribution capabilities, designing the logistics network and fulfilling the needs (Kovacs and Spens, 2008). The information management is concerned with the information management for supply chain planning, collaboration, delivery and supplies tracing and tracking. The

supply chain strategy for this phase is agile supply chain. The aim is to be able to respond rapidly to changes in customer demand levels and requirements (Booth, 1996). It embraces the organisation as whole including information systems, logistics processes and, most importantly, mindsets (Christopher and Towill, 2001). The key is flexibility in being able to respond to changes when disasters occur. This requires excess capacity to be available in order to meet the changing requirements while minimising the amount of inventory within the supply chain. An agile supply chain is, therefore, less cost effective than a lean one but has improved customer service levels, able to meet the demands of consumers as they change. The key performance metrics in this phase include all three categories: resource, flexibility and output to measure level of efficiency, effectiveness and ability to respond to a changing environment. Breaking down each performance measurement categories, the metric can comprise of total amount of disaster supplies, target fill rate achievement, total cost of distribution, response time, number of individual units of Tier 1 supplies that an organisation can provide in time, responsive flexibility, etc.

The last phase, reconstruction phase, deals with the recovery activities which require long term project management. The strategy adopted in this phase is lean strategy as the demand is known, and therefore waste reduction is the main focus in the phase. The key elements for this phase are similar to the preparation phase except the addition of continuous improvement. Continuous improvement is an ongoing effort to improve services or processes. In this context, performance metrics which include flexibility, resource and output can be used to manage and improve performance, tracking key factors in supply chain performance. When the cycle of disaster management completes, all key performance metrics must be analysed to seek opportunities for further improvement.

3.1 CASE STUDY

This section presents the framework application to Thai Red Cross. The aim is to provide a guideline for the case study organisation to develop an effective humanitarian relief supply chain.

The Relief and Community Health Bureau, Thai Red Cross has provided assistance and relief to disaster victims and the underprivileged and offers community health service to the public since 1920. Disaster relief services are provided in compliance with humanitarian principles to disaster victims. Before a disaster occurs, preparation is made in terms of procedural plans, manuals, staff, vehicles, communications, medicine, medical supplies, and other basic necessities. While a disaster occurs, relief units are put into operation as appropriate, and medicine, medical supplies, and other basic necessities are transported to Red Cross Chapters and Red Cross Help Stations, which serve as centres for disaster relief for victims in each region. After a disaster occurs, assistance is given to individuals and families affected by disaster to enable them to resume their normal daily activities independently. However, with increasing numbers of natural and man-made disasters, the organisation faced challenges due to the limited number of available experienced and trained logisticians and a lack of up-to-date technology systems. At the same time, the current operational procedures, networks and coordination structure were still in the informal form and the use of key performance indicators was very limited, mainly time to delivery. Furthermore, the organisation lacked of using the lesson learned from previous disasters for its performance improvement. Such these challenges, the organisation wanted to develop strategies to deal with logistics and supply chain issues in order to improve its performance and meet the needs of affected people.

The author utilised the framework presented here to present the guidelines for supply chain improvement for the case organisation. The disaster relief services of the case organisation were divided into three phases aligning with the phases in the framework which made the case organisation easy to understand what are required for its supply chain improvement. The framework facilitated analysis in approach, supply chain strategy, key elements and performance measurements related to each phase. However, human resources in the case organisation had limited knowledge about logistics and supply chain system as a result to use the framework the basic supply chain management training is required. Lean and agile concepts and key performance measurements in the realm of supply chain management including practices in supply chain management must be included in the training so an organisation can immediately understand and adopt the concepts to implement in its supply chain. Regarding to the case application, the framework is shown as a very useful tool to provide the broad key features. Nevertheless, the framework does not intend to fit with a particular relief organisation or operation. Each system is different with varied goals, objectives, and operating environments. Rather, this framework is provided as a means of guiding and organising humanitarian supply chains for relief organisations.

4. CONCLUSIONS

Managing humanitarian relief chain is critical, in terms of securing donor funding and improving the relief mission. The aims of this paper were to identify elements of good practice in humanitarian relief supply chain and to develop a guiding framework for designing supply chain system for humanitarian aid. The proposed framework can be used as a basis to improve supply chain system in the relief sector. For future work it is necessary to further evaluate the framework with more case studies. This would provide a better understanding of the framework and may lead to further refinement. Future work

could also focus on the implementation of the framework guidelines. This could explore how to apply conventional supply chain management practices in the relief sector.

REFERENCES

Alazmi, M. & Zairi, M. 2003, "Knowledge management critical success factors", *Total Quality Management*, vol. 14, no. 2, pp. 199-204.

Beamon, B. M. 1999, "Measuring supply chain performance", *International Journal of Operations & Production Management*, vol. 19, no. 3, pp. 275-292.

Beamon, B. M. & Kotleba, S. A. 2006, "Inventory management support systems for emergency humanitarian relief operation in South Sudan", *International Journal of Logistics Management*, vol. 17, no. 2, pp. 187-212.

Beamon, B. M. & Balcik, B. 2008, "Performance measurement in humanitarian relief chains", *International Journal of Public Sector Management*, vol. 21, no. 1, pp. 4-25.

Bertrand, R. & Lajtha, C. 2002, "A new approach to crisis management", *Journal of Contingencies and Crisis Management*, vol. 10, no. 4, pp. 181-191.

Booth, R. 1996, "Agile manufacturing", *Engineering Management Journal*, vol. 6, no. 2, pp. 105-112.

Christopher, M. & Towill, D. R. 2001, "An integrated model for the design of agile supply chains", *International Journal of Physical Distribution & Logistics Management*, vol. 31, no. 4, pp. 235-246.

Ergun, O., Karakus, G., Keskinocak, P., Swann, J., & Villarreal, M. "Humanitarian Supply Chain Management - An Overview".

Fritz Institute 2005, *Logistics and the Effective Delivery of Humanitarian Relief* Fritz Institute, San Francisco.

Hensgen, T., Desouza, K. C., & Kraft, G. D. 2003, "Games, signal detection, and processing in the context of crisis management", *Journal of Contingencies and Crisis Management*, vol. 11, no. 2, pp. 67-77.

Hervani, A. A. & Helms, M. M. 2005, "Performance measurement for green supply chain management", *International Journal of Benchmarking*, vol. 12, no. 4, pp. 330-353.

Holmberg, S. 2000, "A systems perspective on supply chain measurements", *International Journal of Physical Distribution & Logistics Management*, vol. 30, no. 10, pp. 847-868.

Jahre, M., Jensen, L. M., & Listou, T. 2009, "Theory development in humanitarian logistics: a framework and three cases", *Management Research News*, vol. 32, no. 11, pp. 1008-1023.

Jones, R. M., Naylor, B., & Towill, D. R. 2000, "Lean, agile or leagile? Matching your supply chain to the marketplace", *International Journal of Production Research*, vol. 38, no. 17, pp. 4061-4070.

Keebler, J. & Plank, R. E. 2009, "Logistics performance measurement in the supply chain: a benchmark", *International Journal of Benchmarking*, vol. 16, no. 6, pp. 785-798.

Kovacs, G. & Spens, K. M. 2007, "Humanitarian logistics in disaster relief operations", *International Journal of Physical Distribution & Logistics Management*, vol. 37, no. 2, pp. 99-114.

Kovacs, G. & Spens, K. M. 2009, "Identifying challenges in humanitarian logistics", *International Journal of Physical Distribution & Logistics Management*, vol. 39, no. 6, pp. 506-528.

Lettieri, E., Masella, C., & Radaelli, G. 2009, "Disaster management: findings from a systematic review", *Disaster Prevention and Management*, vol. 18, no. 2, pp. 117-136.

Long, D. C. 1997, "Logistics for disaster relief: engineering on the run", *IIE Solutions*, vol. 29, no. 6, pp. 26-29.

Ludema, M. & Roos, H. "Military and civil logistics support of humanitarian relief operations", Minnepolis.

Moe, T. L. & Pathranarakul, P. 2006, "An integrated approach to natural disaster management: public project management and its critical success factors", *Disaster Prevention and Management* , vol. 15, no. 3, pp. 396-413.

National Governors Association 1979, *Emergency Preparedness Project* DCPA, Washington, DC.

Naylor, J. B., Naim, M. M., & Berry, D. 1999, "Leagility: integrating the lean and agile manufacturing paradigm in the total supply chain", *Engineering Costs and ProductionEconomics*, vol. 62, pp. 107-118.

Nisha, S. 2001, "Providing special decision support for evacuation planning: a challenge in integrating technologies", *Disaster Prevention and Management*, vol. 10, no. 1, p. 11.

Oloruntoba, R. & Gray, R. 2006, "Humanitarian aid: an agile supply chain?", *International Journal of Supply Chain Management*, vol. 11, no. 2, pp. 115-120.

Pan American Health Organization (PAHO) & World Health Organization (WHO) 2001, *Humanitarian Supply Management and Logistics in the Health Sector* Pan American Health Organization, Washington D. C.

Perry, M. 2007, "Natural disaster management planning: A study of logistics managers responding to the tsunami", *International Journal of Physical Distribution & Logistics Management*, vol. 37, no. 5, pp. 409-433.

Pettit, S. & Beresford, A. 2009, "Critical success factors in the context of humanitarian aid supply chains", *International Journal of Physical Distribution & Logistics Management*, vol. 39, no. 6, pp. 450-468.

Roh, S., Pettit, S. J., & Beresford, A. K. C. "Humanitarian aid logistics: response depot networks", Helsinki.

Schulz, S. F. & Heigh, I. 2009, "Logistics performance management in action within a humanitarian organization", *Management Research News*, vol. 32, no. 11, pp. 1038-1049.

Thakkar, J., Kanda, A., & Deshmukh, S. G. 2009, "Supply chain performance measurement framework for small and medium scale enterprises", *International Journal of Benchmarking*, vol. 16, no. 5, pp. 702-723.

United Nations 1992, *Glossary: Internationally Agreed Glossary of Basic Terms Related to Disaster Management*, UN International Decade for Natural Disaster Reduction, Geneva.

Wassenhove, L. V. 2006, "Humanitarian aid logistics: supply chain management in high gear", *Journal of the Operational Research Society*, vol. 57, pp. 475-489.