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(Le)agility in Humanitarian Aid Supply Chains

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Abstract

Purpose - This paper explores the concept of agility in the context of supply chains of humanitarian aid (HA) organizations, particularly Non Government Organizations (NGOs). This responds to the increasing pressure on NGOs to use their resources more strategically if they are to gain donor trust and long term commitment.

Design/ Methodology/Approach - A literature based approach that extends the commercial supply chain concept of agility to NGOs is combined with the first exploratory semi structured interviews of these concepts with five NGO supply chain directors.

Findings – The commercial concept of agility when responding to disaster relief holds strong potential for increasing efficiency and effectiveness, but this application is restrained by the absence of supporting Information Technology (IT) and the relegation of supply chain management (SCM) to the 'back office' by NGOs. This has potential implications for NGOs and other humanitarian aid agencies.

Research Limitations - This paper represents an exploratory study, and an extended pool of interviewees would reinforce the qualitative findings. Planned future research will address this issue.

Practical Implications - Practical guidance on how NGOs can proactively manage their organization's ability to respond with agility in a highly pressured environment is provided.

Originality - This paper is the first to offer practical guidance to managers of NGOs on strategies available to improve their organization's flexibility and agility, based on theoretical concepts and initial exploratory data. In addition, evidence of how commercial tools apply in a different arena may prompt commercial managers to be more innovative in utilizing and customizing supply chain principles to their particular context of operation.

Keywords – Supply Chain Management, Agility, Leagility, NGO

Paper type – Research Paper

Introduction

Donors increasingly demand accountability, transparency and value for money in return for their sponsorship of Humanitarian Aid (HA) agencies. Meeting these more challenging performance and accountability standards requires HA agencies to be more professional in their approach to managing their operations (Thomas and Kopczak, 2005). As 80% of HA operations comprise SCM activities (Van Wassenhove, 2006), the application of commercial SCM techniques may at least partially address this problem. However, to date HA agencies continue to rely on standards used in the for-profit sector in the 1970s and 80s (Fenton, 2003, Rickard, 2003) and largely ignore emerging techniques developed to help businesses respond to an increasingly challenging environment. From a theoretical perspective the application of SCM principles to HA has been largely overlooked, despite the stakes and size of the aid industry and the increasing flow of HA funding to the developing world (Beamon and Balcik, 2008)- See Figure 1. This is particularly problematic given the

nature of managing humanitarian aid supply chains. For example, supply chains to provide emergency humanitarian assistance (water, sanitation, shelter, food aid, re-establishment of physical and social infrastructure) all had to be assembled and working within a couple of days following the Haiti earthquake in 2010 that effected 30% of the Haitian population (United Nations Office for the Coordination of Humanitarian Affairs, 2010).

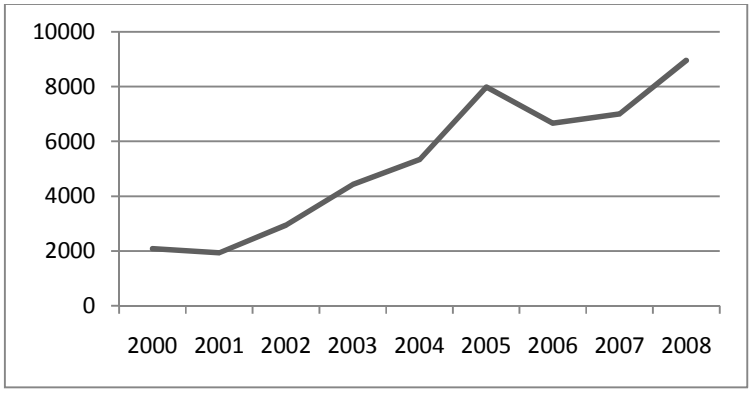

Figure 1 Humanitarian Aid funding to the developing world from 2000-2008 in million US$ (Organization for Economic Co-operation and Development, 2010)

In contrast, commercial organisations actively adopt emerging SCM techniques and have responded to volatile and dynamic markets by developing *agile supply chains*. These agile supply chains build flexible and responsive capabilities in terms of their processes, networks and how they are integrated across other organisations (Van Hoek et al., 2001). We investigate the applicability of the agility concept to the HA supply chain, specifically NGOs, and present the results of our exploratory investigation. This provides an exciting opportunity to develop and extend the potential originally suggested by Oloruntoba and Gray (2006), and contribute to the theoretical underpinning of this under-researched area (Pettit and Beresford, 2009). By demonstrating how agility practices are translated from commercial to HA organisations, we gain insights into how NGOs specifically, and HA agencies in general, may be encouraged to adopt these techniques. This research suggests that adoption of commercial agility practices provides a means of increasing NGO supply chain *efficiency* while enabling continued *effective* use of resources. From a practitioner perspective our study provides initial indications into how emerging SCM techniques can be utilised by NGOs to enhance their reputation among both aid donors and recipients.

The following sections review the literature on organisational agility and apply the commercially oriented framework to NGO supply chains, then describe our methodology, and present our findings. The paper concludes with a discussion of the implications of our exploratory investigation for theory and management practice.

Humanitarian Aid and Supply Chain Management

The adoption of commercial SCM practices by HA agencies is driven by donor demand for accountability and resource pressure. There are many players in HA operations such as the United Nations (UN), the military, profit seeking organizations, and NGOs (including household names such as Amnesty International, the International Federation of Red Cross and Red Crescent Society, Oxfam International and Medecins sans Frontieres). Donors favour funding NGOs, but this benefit comes at a price, as increasingly money conscious donors demand to know where and how their funds are utilised and to see tangible, measurable results. As advised by Oloruntoba and Grey (2009, pp. 494), failure to achieve efficiency may not only result in loss of lives, but 'also in the loss of vital donor funds for international NGOs'. Further pressure on resources and performance is driven by rising

levels of both natural and conflict driven disasters (Roh et al., 2008, Perry, 2007) which demand more simultaneous relief operations around the world.

In response to disasters, NGOs must quickly set up quite complex supply chains to assemble and distribute the required food, shelter and other necessities. Similarly to commercial SCM, NGO supply chains involve the process of planning, implementing and controlling the efficient, cost-effective flow and storage of goods and materials as well as related information (Thomas and Kopczak, 2005, p. 2). This includes the various stages of achieving preparedness, planning, procurement, transport, warehousing, tracking and tracing and customs clearance. Activities take place along the whole supply chain from the point of origin to the point of consumption with the aim of improving conditions for those affected by the disaster. Managing NGO supply chains also holds unique challenges, as unlike commercial supply chains, demand cannot be anticipated (Long and Wood, 1995). Disasters happen anywhere in the world at any time, often in undeveloped regions with poor infrastructure or political instability, and may necessitate a combination of military and commercial applications. As demand and supply requirements cannot be assessed without difficulty (Van Wassenhove, 2006), high levels of flexibility are required to set up distribution networks quickly.

Despite the theoretical fit in the translation of commercial SCM to NGO delivery, NGOs have failed to embrace SCM concepts, which has led to calls for greater academic interest and debate (Kovács and Spens, 2007). While playing a fundamental role in providing humanitarian relief, SCM has traditionally been perceived as a support function and relegated to the 'back office' by NGOs (Thomas, 2003). This has led to the exclusion of supply chain managers from critical decisions and failure to recognise the potential contribution of effective SCM and to invest in the area (Van Wassenhove, 2006).

While this may be historical justifiable growing donor awareness of the need to achieve value for money increasingly necessitates the adoption of commercial SCM techniques striving for by NGOs. The overall aim of any international relief or development operations should be the establishment and management of an efficient and effective supply chain (Pettit and Beresford, 2005), which necessitates the adoption of strategic approaches. The inherent instability and unpredictability of humanitarian needs demands flexible supply chains, which prompted Oloruntoba and Gray (2006) to initially suggest that the concept of agility may apply to humanitarian supply chains.

Agile Commercial Supply Chain Management

Evolving from flexible manufacturing systems, the concept of *supply chain agility* captures the integration of the organisation's suppliers, business processes, customers and product use and disposal (Power et al., 2001). Originally focused on achieving reduced set up times and greater responsiveness to changes in produce mix and volume, agility then extended into the wider business context (Nagel and Dove, 1991). Despite considerable confusion as to the content and temporal dependencies that there may be in its implementation (Narasimhan et al., 2006), the concept of agility captures how an organisation can synthesise new productive capabilities from the expertise of its members, through knowledge and skill development, promoting innovative thinking, emphasising management, and providing appropriate physical facilities (Aitken et al., 2002).

Change and unpredictable business environments require agile supply chains (Lin et al., 2006) which attempt to reliably meet market demands while minimising costs and reducing security risks. This incorporates flexibility (Agarwal et al., 2006), in terms of both resources and coordination of activities (Sanchez, 1995). Achieving resource and co-ordination flexibility allows organisations to cope with high levels of environmental and operating uncertainty (Manuj and Mentzer, 2008). However, according to Christopher and Towill (2000) agility transcends flexibility, as it is a business-wide capability that embraces organisational structures, information systems, logistics processes and overall mindsets. All organisations within a supply chain network need to be integrated to achieve an

impact beyond the individual unit (Van Hoek et al., 2001) as the effectiveness of an organisation's response is largely determined by the capabilities of its trading partners (Power et al., 2001).

The critical elements of agility as identified by Hoek et al. (2001) are displayed in Figure 2. Hoek et al. (2001) propose that achieving *market sensitivity* requires that the focal organisation, its suppliers and its customers share information and knowledge across common systems. Ongoing *network integration*, both upstream and downstream is achieved through building appropriate IT systems, leading to *virtual integration* of the members' supply chains. But achieving market sensitivity in volatile and uncertain supply chains (such as those experienced by NGOs) requires incorporation of the principle of *postponement* (Christopher and Towill, 2000).

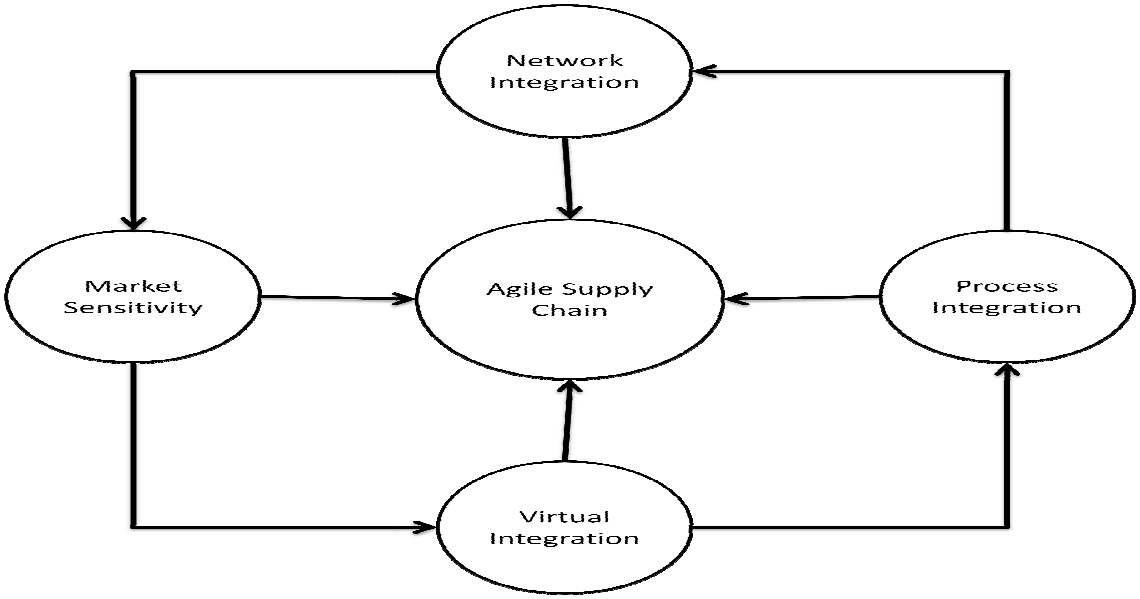

Figure 2 Elements of an agile supply chain (Van Hoek et al., 2001)

Postponement

One of the SCM techniques which is consistently combined with agility under conditions of uncertainty is the concept of *postponement*, as it contributes an important building block in the construction of an agile supply chain (Aitken et al., 2002, Christopher and Towill, 2000, Van Hoek, 2000). Hoek (2000) identifies postponement as an initiative that supports the realization of the agility vision in practice through the use of common platforms, components or modules so that final assembly or customization of the product can take place when the final customer is identified (Christopher and Towill, 2000). This reduces uncertainty and enhances *efficiency* (Van Hoek, 2001). From a commercial perspective postponement allows for more sensitive responses to market demand by facilitating customized and localized assembly, virtual integration by supply chain operations that are linked to customer orders and process integration through cross functional links (Van Hoek, 2000).

Supply chains are often forecast driven due to their limited ability to anticipate real demand (Christopher and Towill, 2000). Ideally the material decoupling point (the point before which inventory should be kept in a generic form awaiting final assembly) should lie as far downstream in the supply chain as possible. This increases the proportion of the supply chain that is based on real demand and therefore reduces uncertainty (Stevenson and Spring, 2007). Christopher and Towill (2000) observe that managing the material decoupling point, and the information decoupling point (the point where real demand is fed upstream into a supply chain and can be used to amend

forecasts) presents a powerful opportunity for developing agility. In such cases, inventory is ideally kept in a generic form awaiting final assembly (the material decoupling point) as far down the supply chain as possible.

Leagility

While agility and postponement are implemented to achieve effectiveness within the supply chain (Hoek et al. (2001), lean production within commercial SCM is aimed at achieving *efficiency*. More developed than the concept of agility (Narasimhan et al., 2006), leanness achieves 'more with less' and eliminates waste along the supply chain. While in terms of practice leanness does not imply agility, an agile supply chain implies that many of the principles of leanness have been adopted (Narasimhan et al., 2006). However, what constitutes 'waste' in lean production maybe considered essential in agile production (Mason-Jones et al., 2000), as cutting out too much slack can lead to rigidity in operations. Childerhouse and Towill (2000) propose that leanness is particularly relevant when consumer demand is relatively stable and predictable. In contrast, when the market is volatile or uncertain (as for NGOs), leanness needs to be decoupled from part of the supply chain process and combined with agility into a hybrid 'leagile' strategy where lean principles are applied downstream in the chain and the concept of agility upstream (Childerhouse and Towill, 2000).

Humanitarian Aid and Agile Supply Chain Management

The concept of agility is increasingly accepted as essential for the growth and survival of commercial organisations in most business contexts (Ismail and Sharifi, 2006). Achieving agility is more relevant to those organisations which need 'physically effective and efficient' supply chain operating structures (Fisher, 1997), which suggests that its concepts are particularly applicable to NGO supply chains. While achievement of an integrated agile supply chain may be currently overly ambitious for many NGOs (due to their size and limited funding), several of the concepts which have been adopted so successfully by commercial organisations are particularly relevant in their operating context. The strong evidence in the commercial world indicates that placing an emphasis on SCM can achieve major cost savings (Christopher and Towill, 2000) and improved efficiency will increasingly direct NGOs to adopt these techniques, despite the short duration of emergency relief supply chains (Pettit and Beresford, 2005).

The need for flexibility in terms of both resources and co-ordination of operations is particularly applicable to those NGOs which operate in a constantly changing unpredictable environment. Co-ordination flexibility in this context applies to reconfiguring the chains to deploy the required goods to the identified recipient as speedily as possible. Similarly to commercial agility, NGO supply chain agility is expected to transcend the individual organisation's flexibility, as it captures the responsiveness of the whole virtual supply chain. This however, is where the additional complexities of NGO supply chains emerge. Unlike the commercial supply chain where the survival / profit motive is paramount, players in the humanitarian relief arena have complex motivations and differ dramatically in terms of their delivery priorities (Petit and Beresford, 2009).

Oloruntoba and Gray (2006) in their initial conceptual paper, suggest holding inventory in a generic form instead of using prepositioned stock, allowing aid goods to be distributed according to the evolving needs of the end user. We suggest that this practice evidences postponement, and the adoption of postponement practices would allow NGOs to achieve market sensitivity, one of the elements of an agile supply chain (Figure 2). Improved information on real demand would also facilitate market sensitivity. Quick estimates of needs calculated when a disaster strikes often incorporate errors. There are wastage rates of up to 30% in aid delivery in some post-crisis situations (Pettit and Beresford, 2009). However, if real demand was known (or at least reliably estimated) and measured, these errors could be reduced or eliminated, leading to more efficient operations and potentially decreasing suffering. In addition, for NGOs to achieve agile supply chains adoption of leagility principles may be limited to decoupling part of the supply chain process with the aim of

operating a lean supply chain downstream of the decoupling point and an agile supply chain upstream of this point. Another possibility for NGOs in combining lean and agile supply chains is operate different supply chains simultaneously but in different space depending on how goods are classified, e.g. classification by volume.

Applying the theoretical concepts of agility to NGOs suggests a need to integrate processes along the supply chain and achieve virtual integration from suppliers to their end consumers, the aid recipients. This would require a transparent supply chain, enabling timely and accurate exchange of information. This increased *effectiveness* and *efficiency* should lead to reduced costs, reduction in bottlenecks and more timely recipient aid, which has prompted the following exploratory investigation into the concept of (le)agility within NGO supply chains.

Methodology

A range of techniques were used to collect data, including study of secondary sources, and semi-structured interviews with logisticians in humanitarian aid NGOs. Our initial analysis of secondary data, comprised reviewing sectoral reports, press releases, websites and a detailed sectoral survey by Thomas and Kopczak (2005), which helped us to understand the complex operating context of NGOs. As described in Table 1, a series of interviews with NGO logisticians was the main source of our data. While we approached 15 agencies working in the NGO sector, unfortunately we were only able to get access in five instances (pressure of time was cited as the main reason for unavailability).

All of the interviews were recorded and transcribed verbatim, and themes were then extracted (Miles and Huberman, 1994). The interviews covered a range of general issues relating to the organisation, including history, size and a description of the specific role of the manager. The interviews were followed up with informal discussions which provided additional context for our analysis. The interview questions focused on current practices of SCM in NGOs to attempt to build a picture of humanitarian supply chains. The key segment of the interview incorporated a standard schedule of open ended questions to encourage detailed responses of how the organization's supply chain was configured.

Table 1 Interviewee Group (Adapted from Perry, 2007)

Organization Type	Position Held	Type of Relief Involvement	Size / estimated global humanitarian contribution in 2010
International NGO A	Supply Chain Manager	- Over 50 countries - Emergencies, Health, Livelihoods, Education	- 3200 employees - 0.1% of grand total
International NGO B	Logistics Manager	- 11 countries - Emergencies, Health, Livelihoods, Education	- 2500 employees - 0.01% of grand total
International NGO C	Emergency Contracts and Product Development Manager	- Over 50 countries - Emergencies, Health, Livelihoods, Child Protection	- 5430 employees - 0.25% of grand total
International NGO D	Procurement and Logistics Coordinator	- 35 countries - Livelihoods, Education, Peace building, Mine removal	- 2400 employees - No data on % of grand total available

International NGO E	International Logistics Officer	- Over 50 countries - Emergencies, Health, Livelihoods, Education	- 2000 employees - 0.7% of grand total

The interviews were generally of one hour duration (two face-to-face, three telephone) with logisticians in HA organizations in Ireland, the UK and the USA. These represented a broad range of HA agencies in terms of the type of relief involvement, which included multi country, food, water, shelter, education, health and peace keeping missions. Further background information concerning the interviewees has not been included in this paper as anonymity was a condition of involvement.

Results and Analysis

Agility and Market Sensitivity

The interview data indicates that NGO supply chains are flexible and that they also, at least superficially meet Ismail and Sharif's (2006, p.431) definition of agility as 'the ability of a supply chain as a whole and its members to rapidly align the network and its operations to the dynamic and turbulent requirements for the demand network', in that they are able to quickly assemble their supply chains in response to disasters. While there were some indications of sensitivity to the particular needs of the aid recipient in different disaster areas, this fell short of the *market sensitivity, virtual integration, process integration and network integration* outlined by Hoek et al (2001). Agility implies that the supply chain is demand driven, reading and responding to real demand. While the supply chains of the NGOs examined evidenced agility for *development aid* as goods are ordered when a need occurs and not stored according to forecasted needs, their *emergency aid* relief chains differ; goods are pre-positioned in warehouses around the world to be able to react quickly when disaster strikes.

Manager A: *We have a Logistics roster for quick deployment in emergencies and stocks we keep are aimed at despatch within 24 / 48 hours of the onset of an emergency.*

Agility and Virtual Integration

Virtually integrated IT is a necessity for agility as it enables data sharing between buyers and sellers. The interviews indicate that NGOs are only starting to deploy the required technology and are some distance from data sharing with suppliers. This tentatively supports the findings of Thomas and Kopczak's (2005) study that only 26% of agencies have access to track and trace softwares that anticipate the receipt of procured goods in the field. The NGOs interviewed continue to rely on manual process or Excel spreadsheets. The emergency aid supply chain is excluded from achieving virtuality, given that it must be based on inventory due to its nature. However, the supply chain for development aid is information driven and therefore has the potential to achieve virtuality.

Agility and Process integration

Process integration requires co-operation and elimination of barriers all along the supply chain. Both our exploratory study and the secondary data indicate that NGOs are now in the early stages of testing and installing IT, but current systems for emergency aid are not yet capable of achieving the integration processes with suppliers such as vendor managed inventory. As a result, process integration is unlikely to take place in either the development or the emergency aid supply chain, although there is potential at least in the development aid for its application.

Manager E: *We can set up a distribution network within 24 -48 hours of an emergency. But we can't monitor it effectively as we don't have electronic management systems over there, there just isn't the technology.*

Agility and Network Integration

Network integration which aligns the supply chains of different partners into one supply chain is based on process integration. It requires all participants in the supply chain to be included to achieve information sharing and transparency throughout. As there appears to be limited evidence of process integration in NGOs, the foundation for network integration is absent.

Agility and Postponement

Postponement contributes an important building block and additional pillar of strength to the construction of an agile supply chain. Based on the principle of designing products in a way that common modules can be used enabling customization to take place after the final market or customer is known, postponement leads to an information based and demand driven supply chain which is one of the characteristics for achieving agility. Decoupling points that decide on where in the supply chain real demand meets forecast driven demand need to be set depending on the kind of postponement needed. In emergency situations the interview data confirms that NGOs use standardised kits that cover the basic needs of the suffering population, which are often not 100% adequate. However, this approach enables the postponement of inventory allocation to specific countries and reduces the amount of goods that need to be stored in general. Both interview and secondary data suggest that many NGOs have several warehouses in key areas to keep pre-positioned stock that is only used for emergency situations.

Manager A: We do keep stocks in various key hubs around the world - Nairobi, Islamabad, Delhi, Dubai, Beijing, in order to give us flexibility to respond to any emergency, anywhere in the world.

Manager C: When a disaster strikes, a national incident, we as a subunit request stock from the main distribution centre or use the emergency channel via the state warehouses.

Stock is allocated when disasters occur, rendering the supply chain as demand driven from the regional warehouse, the decoupling point. While the limited number of NGOs involved in this research kept some inventory for development aid, they ordered or acquired these goods when the need was recognised. If their approach is indicative of industry practices, this will lead to a demand driven supply chain with accompanying longer lead times.

The interview data suggests that disaster aid stock needs to be pre-positioned. If stock is stored in a generic form, then when an emergency arises, greater distances must be covered adding significant costs to all operations as well as reducing responsiveness and flexibility. The interviews indicate that goods are already pre-positioned in warehouses according to their suitability for different regions given different cultures, religions and climates of potential recipients.

NGO Supply Chains and Leagility

Both, the interview and secondary data imply that NGO supply chains are lean for development aid as goods are only ordered when needed and to some degree in emergency relief supply chains as the level of stock pre-positioned appears to be kept to a minimum. This is particularly interesting as the emergency relief supply chain can then be tentatively described as leagile as it is decoupled in the warehouses and operates in a responsive and agile way when leaving there. IT is needed to combine both supply chains into one; enable postponement for development aid supply chains and with it leagility. This concept is likely to become increasingly relevant as pressure on funding increases and elimination of waste, even when providing emergency aid, receives greater scrutiny.

Manager C: We do have to some extent a lean supply chain. We keep pre-positioned stock, kept to minimum only for emergencies level, no buffer stock / no stock for developing countries.

The Role of Technology in achieving Agility in NGO Supply Chain

The interviews provide initial indications that NGO logistics managers are both cognisant of and willing to adopt IT. However, our exploratory interviews indicate that both the pressure to utilise resources for direct aid and the political support within the organisation are delaying the required investment in new enabling IT systems. In addition, the current global economic crisis has put further

constraints on the budgets of NGOs. For example, in two of the interviewed organizations, the implementation of supply chain technology had to be put on hold, without a future date of recommencing its introduction.

While our preliminary explorations imply that NGOs are flexible and emergency supply chains meet the definition of an agile supply chain, critically, they fail to meet the characteristics behind the concept of agility. This appears to be primarily due to the constraints of their IT processes. However, this is expected to change over time as the development and implementation of the required technology and supporting systems drives the creation of virtual networks across global value chains, even in NGOs. The next step towards an agile supply chain for NGOs, *process integration*, is dependant on IT support, as it involves integrating suppliers within planning procedures. The need to bring in new systems is clearly recognised as demonstrated by the following comment:

Manager D: *We need to professionalize what we are doing as much as we can, we need to analyse what we are doing and be able to measure our performance. Going forward, this is the only way.*

Limitations and Future Study

Our preliminary interview data indicates that while the NGO supply chain manager is ideally positioned from a technical perspective to inform on the SCM issues, not all of the interviewees were able to provide a strategic perspective of their organisation, and its strategies for both supply chain and IT development. We hope that further investigations which will involve multiple representatives from a broader range of NGOs, including logisticians, directors and CEOs. This will develop and extend the current findings and increase their generalisability across the sector.

Conclusion

The consistent message emerging from our exploratory data is that NGO supply chains are moving towards adopting the primary concepts of agile supply chains, but that failure to invest in the required supporting IT is the primary obstacle. Profit oriented organisations can prioritise the allocation of scarce resources based on cold financial criteria. In contrast NGOs must divert resources from providing immediate humanitarian aid if they are to build the IT systems and virtual organisations which will eventually lead to more efficient and effective SCM and aid distribution. For practitioners it is difficult to reconcile the choices, but the need for greater organisational transparency demanded by society is likely to drive them towards improved systems, processes and even collaboration with other NGOs. Our analysis provides initial indications that NGO supply chains are already flexible and are moving towards meeting the commercial criteria of agility. Our findings suggest that IT is an essential enabler of agility, and as the cost of IT declines more NGOs are likely to adopt the sophisticated IT systems to position for agility. IT represents a critical link, not just in achieving agility, but in enabling NGOs to adopt other SCM strategies including postponement and leagility. Building the required supporting collaboration across supply chains and between currently competing and autonomous NGOs may be more difficult to achieve. There is little doubt however that those NGOs which embrace technology and achieve efficient and effective, transparent supply chains will be better positioned in the fight to win the limited donations of increasingly sceptical sponsors.

References

AGARWAL, A., SHANKAR, R. & TIWARI, M. K. (2006) Modeling the metrics of lean, agile and leagile supply chain: An ANP-based approach. *European Journal of Operational Research,* 173**,** 221-225.

AITKEN, J., CHRISTOPHER, M. & TOWILL, D. (2002) Understanding, implementing and exploiting agility and leanness. *International Journal of Logistics,* 5**,** 59-74.

BEAMON, B. M. & BALCIK, B. (2008) Performance measurement in humanitarian relief chains. *International Journal of Public Sector Management,* 31**,** 4-25.

CHILDERHOUSE, P. & TOWILL, D. (2000) Engineering supply chains to match customer requirements. *Logistics Information Management,* 13**,** 337-345.
CHRISTOPHER, M. & TOWILL, D. R. (2000) Supply chain migration from lean and functional to agile and customized. *Supply Chain Management: An International Journal,* 5**,** 206-213.
FENTON, G. (2003) Coordination in the great lakes. *Forced Migration Review,* 18**,** 23-24.
FISHER, M. L. (1997) What Is the Right Supply Chain for Your Product? *Harvard Business Review,* 75**,** 105-116.
ISMAIL, H. S. & SHARIFI, H. (2006) A balanced approach to building agile supply chains. *International Journal of Physical Distribution & Logistics Management,* 36**,** 431-444.
KOVÁCS, G. & SPENS, K. M. (2007) Humanitarian logistics in disaster relief operations. *International Journal of Physical Distribution & Logistics Management,* 37**,** 99-114.
LIN, C.-T., CHIU, H. & CHU, P.-Y. (2006) Agility index in the supply chain. *International Journal of Production Economics,* 100**,** 285-299.
LONG, D. C. & WOOD, D. F. (1995) The logistics of famine relief. *Journal of Business Logistics,* 16**,** 213-229.
MANUJ, I. & MENTZER, J. T. (2008) Global supply chain risk management strategies. *International Journal of Physical Distribution & Logistics Management,* 38**,** 192-223.
MASON-JONES, R., NAYLOR, J. B. & TOWILL, D. (2000) Lean, agile or leagile? Matching your supply chain to the marketplace. *International Journal of Production Research,* 38**,** 4061-4070.
MILES, M. B. & HUBERMAN, M. A. (1994) *Qualitative Data Analysis,* London, Saga Publications.
NAGEL, R. & DOVE, R. (1991) *21st Century Manufacturing Enterprise Strategy,* Lehigh University, Iacocca Institute.
NARASIMHAN, R., SWINK, M. & KIM, S. W. (2006) Disentangling leanness and agility: An empirical investigation. *Journal of Operations Management,* 24**,** 440-457.
OLORUNTOBA, R. & GREY, R. (2006) Humanitarian aid: an agile supply chain? *Supply Chain Management: An International Journal,* 11**,** 115-120.
OLORUNTOBA, R. & GREY, R. (2009) Customer service in emergency relief chains *International Journal of Physical Distribution & Logistics Management,* 39**,** 486-505.
ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, O. E. C. D. (2010) *Funds to the development world* [online]. Available at: www.http://stats.oecd.org/qwids/ [Accessed: 02 March 2010].
PERRY, M. (2007) Natural disaster management planning: A study of logistics managers responding to the tsunami. *International Journal of Physical Distribution & Logistics Management,* 37**,** 409-433.
PETTIT, S. J. & BERESFORD, A. K. C. (2005) Emergency relief logistics: an evaluation of military, non-military and composite response models. *International Journal of Logistics: Research & Applications,* 8**,** 313-331.
PETTIT, S. J. & BERESFORD, A. K. C. (2009) Critical success factors in the context of humanitarian aid supply chains. *International Journal of Physical Distribution & Logistics Management,* 39**,** 450-468.
POWER, D., SOHAL, A. & RAHMAN, S. (2001) Critical success factors in agile supply chain management. *International Journal of Physical Distribution and Logistics,* 31**,** 247-265.
RICKARD, J. (2003) A logistician's plea. *Forced Migration Review,* 18**,** 9.
ROH, S., PETTIT, S. J. & BERESFORD, A. K. C. (2008) Humanitarian aid logistics: response depot networks. *Abstract Proceedings of the NOFOMA Conference.* Helsinki.
SANCHEZ, R. (1995) Strategic flexibility in product competition. *Strategic Management Journal,* 16**,** 135-159.
STEVENSON, M. & SPRING, M. (2007) Flexibility from a supply chain perspective: definition and review. *International Journal of Operations & Production Management,* 27**,** 685-713.
THOMAS, A. S. (2003) Why logistics? *Forced Migration Review,* 18**,** 4.

THOMAS, A. S. & KOPCZAK, L. R. (2005) *From logistics to supply chain management: the path forward in the humanitarian sector.* Fritz Institute [Online]. Available at: http://www.fritzinstitute.org/PDFs/WhitePaper/FromLogisticsto.pdf [Accessed: 18 November 2009].

UNITED NATIONS OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS, O. C. H. A. (2010) Haiti: Largest ever natural disaster appeal [online]. Available at: http://www.reliefweb.int/rw/rwb.nsf/db900sid/ASAZ-82SJZP?OpenDocument&RSS20&RSS20=FS [Accessed: 25 February 2010].

VAN HOEK, R. I. (2000) The thesis of leagility revisited. *International Journal of Agile Management Systems,* 2**,** 196-201.

VAN HOEK, R. I. (2001) The rediscovery of postponement a literature review and directions for research. *Journal of Operations Management,* 19**,** 161-184.

VAN HOEK, R. I., HARRISON, A. & CHRISTOPHER, M. (2001) Measuring agile capabilities in the supply chain. *International Journal of Operations & Production Management,* 21**,** 126-148.

VAN WASSENHOVE, L. N. (2006) Blackett Memorial Lecture Humanitarian aid logistics: supply chain management in high gear. *Journal Operational Research Society,* 57**,** 475-489.