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Transforming Humanitarian Logistics: The Journey to Supply Network Management

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Abstract

Purpose

The purpose of this paper is to provide an introduction of the two parts of the Special Edition of the Journal devoted to the challenges of humanitarian aid logistics. To achieve this, we provide an overview of the humanitarian logistic field and focus on a number of key areas in which the principles and practices supporting commercial supply network management have the potential to offer significant improvement in the efficiency and/or effectiveness of the humanitarian logistics preparation and response.

Design/methodology/approach

The paper is based on a conceptual discussion of issues of Supply Network Management in a humanitarian aid context, linked to the more specific discussions of the contribution of the research presented by the authors of the papers accepted for the special editions.

Findings

The paper discusses the concept of Supply Network Management and argues that the fundamental principles that have been the subject of considerable academic scrutiny are equally applicable to the humanitarian logistic field – albeit, in some cases, the specific environment may alter the balance of risk/benefit for particular approaches.

Originality/value

The application of commercial Supply Network Management theory and practice has received limited consideration within the humanitarian aid logistics literature to date. This paper is designed to redress this shortfall. As a result, we hope that it will act as a catalyst for further research and to widen and deepen the resultant debate with a view to improving the outcome for those affected by current and future disasters.

1. Introduction

Since around the turn of the millennium, the field of humanitarian logistics has been the focus of an increasingly broad range of research aimed at improving the ability of both individual countries and the international community as a whole to meet the challenges of preparing for, and responding to, natural and man made disasters. This interest has manifest itself in the publication of papers in a range of journals, in special editions such as this, and in a number of conferences devoted to the subject (Kovács and Spens, 2009). These contributions have considered the subject from what Collins and Kapucu (2008) characterise as social, managerial or technological perspectives. Thus, there have been calls for increased professionalisation of the humanitarian logistic community through improved personnel selection, training and education (Thomas and Mizushima, 2005). In parallel, others have argued for the application of performance measurement and management techniques (e.g. Beamon and Balcik, 2008; Schulz and Haigh, 2009); for the employment of operations research (OR) methodologies (e.g. Beamon and Kotleba, 2007; Balcik and Beamon, 2008); and for the use of critical success factors (CSFs) (Pettit and Beresford, 2009). The introduction of technology such as geographic information systems (GIS) (Benini *et al.*, 2009) or unmanned aerial vehicle systems (UAVs) (Tatham, 2009) have been proposed as ways to enhance the needs assessment process. There has also been an increasing recognition that supply network information management systems have the potential to ease the challenge of managing the subsequent delivery of relief goods (Bartell *et al.*, 2006).

Much of this burgeoning academic interest mirrors the increasing importance accorded to supply network management (SNM) in the wider world of commerce and industry, and it reflects the growing recognition that the logistic aspects of emergency aid provision are a key cost driver. Whilst the phrase "supply network management" may not be as well known or understood as that of supply chain management (SCM), we believe that the former is actually a more accurate representation of the reality found in many commercial and humanitarian scenarios. Indeed, this view coincides with that of many academics such as Chandra and Kumar (2000), Harland *et al*. (2001), Christopher (2005), and Aitken *et al*. (2005) and is exemplified by the observation of (Lambert, Cooper and Pagh, 1998, p. 1):

> "Strictly speaking, however, the supply chain is not just a chain of businesses with one-to-one, business-to-business relationships, but a network of multiple business and relationships."

Thus, within this introductory paper, we have grounded our discussion in the context of a multi-organisational network that encompasses the provision of materiel from its source to the ultimate beneficiaries. In doing so, we are including activities such as the procurement of goods by aid agencies, their transport into the affected location, and their final distribution. In this respect, our perspective is similar to that of many commercial organisations, but we would also wish to emphasise the *ad hoc* and changing nature of the means by which aid is delivered to those affected by a disaster. As such, we would argue that the use of the term supply networks is more appropriate as it helps to emphasise the complexity that is inherent in such an endeavour.

The importance of such networks in the humanitarian field cannot be over-estimated and, to support this view, it has generally been suggested that some 60%-80% of the expenditure of a non-governmental organization (NGO) is consumed in support of this aspect of their work. Given that around a dozen NGOs deliver over 90% of the funds mobilised by the humanitarian community (Ferris, 2007), a very conservative estimate shows that the sector's

annual expenditure exceeds $25Bn (Table 1) and, hence, that the annual sum devoted to SNM is of the order of $15Bn.

Furthermore, in this era of rolling 24 hour news, the public impression of the effectiveness of the response to a disaster is, at least in part, based on the reported presence (or absence) of key commodities such as shelter, food, water and medical supplies. Thus, there is a further parallel with the "for profit" environment where the ability to ensure the availability of commodities on the retail shelf is also seen as a direct reflection of the effectiveness of a given supply network.

Insert Table 1 about here

However, it is also relevant to note that the phrase humanitarian logistics (and, hence, the job title of the humanitarian logistician) appears to have "stuck" – notwithstanding the frequently quoted definition for the role as:

> "The process of planning, implementing and controlling the efficient, cost-effective flow and storage of goods and materials as well as related information, from the point of origin to the point of consumption for the purpose of meeting the end beneficiary's requirements." (Thomas and Mizushima, 2005, p. 60)

Clearly this description can be seen as reflecting an end-to-end supply network perspective, and yet an analysis of vacancy notices placed by United Nations (UN) agencies and NGOs on the most commonly used website (www.reliefweb.int) found 63 such advertisements in the period Oct-Dec 2009 that sought "logisticians", whilst only 4 asked for "supply chain managers" (Tatham *et al.*, 2010). Furthermore, the preponderance of the skills sought from the prospective employers were functional rather than strategic in nature. This distinction in skill requirements has previously been considered in a business context by Mangan and Christopher (2005, p. 180) who neatly summarised the position by arguing that:

> "supply chain managers" regard themselves as "managers first and logisticians second . . . with requisite skills and competencies sets that comprise both general managerial skills and competencies and specific logistics/supply chain skills and competencies."

Indeed, this seems to be the consensus view within the literature, and the result can be seen as similar to the distinction offered by Mason Jones *et al.* (2000) between "market qualifiers" and "market winners", with the logistic technical skills being seen as a qualifier but not a differentiator (van Hoek *et al.*, 2002). Thus, there appears to be something of a disconnect – on the one hand, the academic community is clearly arguing for the need to develop current thinking and practice and to overcome the challenges implicit in management of an end-to-end supply network, whilst organisations in the "not for profit" sector appear to be reluctant to accept the requirement for a commensurately enhanced status for the logistician.

But does this distinction between the functional nature of the logistics role in the "not for profit" world and the more strategic nature of the task in the "for profit" environment reflect a real difference in the underlying requirements of the job? Or, as argued by Thomas and Kopczak (2005), does it suggest that this sector is still at a "pre-supply chain management" stage that is akin to the situation previously faced by other sectors of the economy – for example food retailing in the 1980s, or the automotive industry in the early 1990s?

To help answer this question, we will conduct a brief overview of what we perceive to be the key challenges currently facing the field of humanitarian logistics. In doing so, we will conclude that the perspective of Thomas and Kopczak (2005) is, indeed, one that has considerable merit. In other words, in choosing the title for this editorial, we align ourselves with the direction of travel implied in the title of their paper: "From Logistics to Supply Chain Management: The Path Forward for the Humanitarian Sector". As a result, we would argue that, notwithstanding clear environmental differences between "for profit" and "not for profit" sectors, the latter has much to learn from the former. Furthermore, given that the most successful supply networks in the commercial world have demonstrated how it is possible to optimise the efficiency/effectiveness balance, it should be equally possible for the humanitarian world to move forward quickly to deliver tried and tested solutions without having to undergo the development pains suffered by innovators in the commercial sector.

2. Key Humanitarian Logistics Challenges

In practice, as anyone observing the unfolding of a disaster will readily appreciate, there are a plethora of challenges waiting for the responding agencies. Inevitably, therefore, our selection will be partial – but it has been developed as a result of our research over the last five years and had been informed through discussion with both practitioners and members of the international humanitarian logistics group of academics working in this field (www.humloggroup.org). It is also designed to highlight some of the key differences between commercial and humanitarian supply networks, but at the same time to demonstrate our central argument of the underpinning similarity between the challenges facing the two communities.

The position of logistics as a component of a whole system response

> *"The global demand for humanitarian assistance, including requests for assistance by national Governments, continues to rise. This is triggered and sustained by the increased severity of natural hazards, escalating conflict, and a dramatic increase in vulnerabilities caused by the global financial crisis, continuing high food prices, the scarcity of energy and water, population growth and urbanization."* (UN, 2009, p. 2)

The above quotation, drawn from a recent report by the United Nations Secretary General, offers a bleak assessment of the reality in which those working in the humanitarian field must operate. Indeed, one might easily add the impact of global warming to the list of potential challenges facing mankind – and, although it is accepted that some commentators maintain a degree of scepticism over the science underpinning the issue of global warming, certainly vulnerable countries such as Bangladesh where over 25% of the 150 million population lives at less than 2 metres above the water line, would appear to have ample and justified cause for concern.

Perhaps even more importantly, a large proportion of the 350 or so natural disasters that strike the world annually do so in countries that are the least prepared, both economically and socially, to deal with them (Rodriguez, *et al.*, 2009). Thus the 7.1 magnitude earthquake that struck Haiti in January 2010 resulted in a loss of life of some 230,000 - a figure that was more than double that of any previous magnitude 7 event (Bilham, 2010). To a significant extent, this was due to the pre-existing social conditions as exemplified by the Bilham's description of the lack of appropriate construction standards:

> "...the buildings had been doomed during their construction. Every possible mistake was evident: brittle steel, coarse non-angular aggregate, weak cement mixed with dirty or salty sand, and the widespread termination of steel reinforcement rods at the joints between columns and floors of buildings where earthquake stresses are highest. The death and injury ... is a consequence of many decades of unsupervised construction permitted by a government oblivious to its plate-boundary location". (Bilham, 2010, p. 878).

However, by comparison, the 8.8 magnitude earthquake in Chile (which, due to the logarithmic scale for measurement, was some 350 times more powerful that its Haiti counterpart) killed some 800 people, not least due to the development and implementation of the "highly advanced anti-seismic construction standards in Chile" (Swiss Re, 2010). Not for nothing, therefore, has it been observed that the *per capita* GDP is a key indicator of disaster casualty rates (Kahn, 2005).

But clearly the state of relative impoverishment of a country is not the only factor, and this is exemplified by the response of Bangladesh to the regular impact of severe cyclones. The country itself has a *per capita* GDP that places it 193 out of 227 countries in the world (CIA, 2009) and its deltaic location in the Bay of Bengal makes it vulnerable to a broad range of disasters (Kahn, 2008). However, the adoption of a "whole system" approach to disaster mitigation has helped reduce the death rate due to major cyclonic events from the estimated 300,000 to 500,000 killed in the aftermath of Cylcone Bhola (12 Nov 1970) just over 4,200 who died following Cylone Nargis (15 Nov 2007). This represents an improvement of around two orders of magnitude over some 40 years between two events with essentially similar wind strengths and tidal surges (Tatham *et al.*, 2009).

Such an understanding of the inter-relationship between elements of a total system response is increasingly being manifest in other fields – for example, the United Kingdom's approach to the development and maintenance of a military capability has adopted a framework that reflects the Resource Based View (RBV) of a firm (Barney, 1991). This recognises eight components of such a military capability (training, equipment, personnel, information, doctrine, organisation, infrastructure and logistics) (Kovács and Tatham, 2009) and, in doing so, emphasises the need to ensure the inter- and intra-organisational coherence that is fundamental to the concept of supply network management (Richey *et al.*, 2010).

The parallels between military and humanitarian logistics are also important not least of all because the NATO definition of logistics is remarkably similar to that offered by Thomas and Mizushima which, as indicated earlier, actually describes a broad end-to-end perspective. By the same token, Gattorna (2006 and 2009) has classified both military and humanitarian logistics as examples of "fully flexible" supply chains which are to be distinguished from his other categories of "continuous replenishment", "lean" and "agile". Yet, in both cases, the veracity of Napoleon Bonaparte's observation "*C'est la soupe qui fait le soldat"* ("An army marches on its stomach") is increasingly appreciated as being as true now as it was in 1812.

In short, it is argued that improving the practice of humanitarian logistics is, in its own right, of major significance, but it is also stressed that this must be undertaken in the full recognition that it is but one component of the complete response. Such a response must, therefore, incorporate not only a suitably empowered logistic component but, equally importantly, that the logistic component cannot and does not operate in isolation. This observation reflects a similar view to the underlying principles of the work of both Barney and, indeed, Porter's

value chain (Porter, 1985) and which has featured in myriad subsequent academic contributions. The point that is underlined in this editorial is that this same perspective is to be found in the humanitarian field as in those of business and commerce.

Preparation v Response

A further clear lesson that can be gleaned from the comparison of the recent earthquakes in Haiti and Chile is the enormous benefit to be gained from preparatory activity. Indeed, it is suggested in a report from the United States that "On average a dollar spent by FEMA [Federal Emergency Management Agency] on hazard mitigation (actions to reduce disaster losses) provides the nation about $4 in future benefits" (MMC, 2005, p. iii). Similarly, according to the then UN Under-Secretary for Humanitarian Affairs (Jan Egeland): "In Niger in 2005, it would have cost $1 a day to prevent malnutrition among the children if the world had responded immediately. By July 2005, it was costing $80/day to save a malnourished child's life." (Meikle and Rubin, 2008, p.4).

Unfortunately, but understandably, donor governments and organisations are uncomfortable with paying the cost of what is, in effect, an insurance policy against the scenario of an uncertain future event that typifies a natural disaster. As a result, and as shown in an example from the International Federation of Red Cross and Red Crescent Societies (IFRC) (Figure 1), the amount of funding that can be guaranteed to be available and, therefore, that can be earmarked for planning and prevention activities, is relatively small. This, in turn, can lead to a lack of preparedness and, potentially, to high (and costly) competition with other relief organisations for those assets (eg aircraft, trucks, stocks of key items of material) that are available in the aftermath of a disaster. In short, were more funding to be made available in the pre-disaster preparation phase, the overall cost of the response would be significantly reduced (Jahre and Heigh, 2008).

Insert Figure 1 about here

Nevertheless, the lesson from the commercial world is that such preparatory work really does reduce costs. Thus, supply networks and the location of warehouse and retail outlets are carefully planned, and the spatial location and volumes of stock are equally carefully modelled with the result that, even when there are major disruptions to the network, business continues much as before. Indeed, in one sense the problem should be significantly simpler in the humanitarian world as the number of Stock Keeping Units (SKUs) involved is significantly less - for example, the IFRC catalogue contains some 4,000 items compared with a typical supermarket inventory of 20-50,000 items (Fernie and Sparks, 2004). On the other hand, of course, the challenge of accessing the location of a disaster is immeasurably more difficult given the inevitable disruption to the physical, communications and social infrastructure. However, as before, it is argued that the tools and techniques (especially those drawn from the OR world) are readily available and, indeed, as demonstrated in this Special Edition, are capable of being modified to support NGOs in the preparation and execution of their humanitarian aid response.

Coordination

Given the challenge of achieving a major change to the funding mechanism described above, an alternative (but clearly not mutually exclusive) approach would be that of using the

combined resources of the "not for profit" sector more efficiently and effectively in the post-disaster situation. Whilst simply said, the reality of the numbers of such organisations is immense. For example, Roberts (2001) estimated that there are 30,000 International NGOs in existence and, thus, it is unsurprising that not only were there estimated to be 3,000-10,000 NGOs operating in Haiti prior to the 2010 earthquake, a recent directory of registered NGOs and their key contacts runs to 82 pages (OCHA, 2010). By implication, a similar number of parallel supply networks are operating and, although a similar analysis has yet to be published, the scenario painted by Völz (2005) in which over 72 coordination meetings per week were held following the 2004 tsunami in Bandar Aceh could easily have been replicated. Indeed, not only is the weekly number of meetings unacceptably high, so too is the level of attendance. Thus, in Haiti, it has been reported that 170 different organisations attended the meeting of the water and sanitation cluster with the result that they could never act in the aspired executive capacity; rather they degenerated into a means of exchanging information (Stocking, 2010).

Such a reality would be intolerable within the "for profit" arena where one can safely assume that a series of mergers and acquisitions would reduce the number of what are, in effect, competitors for donor resources (The Lancet, 2010). Unfortunately, this is unlikely to take place within the "not for profit" world given the understandable insistence of a given NGO that it is duty bound to attempt to meet its mandate and for which it has been funded. However, this does not mean that other commercially successful solutions should not be investigated and, where appropriate, adopted. As an example, many commercial companies are comfortable with the use of 3rd or 4th party logistics providers (3PL/4PL) and there is no reason, in principle, why such an approach should not be applicable within the humanitarian field.

In reality, this is beginning to be developed as the UN's "cluster" approach starts to achieve traction. This initiative was introduced in the wake of the 2004 tsunami, and is aimed at removing duplication between UN agencies many of which were essentially providing similar services. The result is 11 cross-cutting clusters (eg Camp Management, Emergency Telecommunications, Water/Sanitation), each of which is led by one of the UN Agencies, and is increasingly being supported by the International Federation of Red Cross and Red Crescent Societies (IFRC) or by an NGO. In the case of the Logistics cluster, the World Food Programme (WFP) has the lead, and building on the earlier excellent work of the UN Joint Logistics Centre (UNJLC), its role is to:

1. Fill logistics gaps and alleviate bottlenecks.
2. Prioritise logistics interventions & investments.
3. Collect/share information & assets.
4. Coordinate port and corridor movements to reduce congestion.
5. Provide details of transporters and rough indications of market rates.
6. Provide guidance on customs issues.
7. Provide information on equipment and/or relief items suppliers. (UN, 2010)

Although it has taken some time for the new approach to bed in (OCHA, 2007), in respect of logistics the indications are exceedingly positive. Thus, for example, the logistics cluster provided a common trucking pipeline from Santa Domingo to Port-au-Prince in the aftermath of the January 2010 earthquake which was available to all UN Agencies and NGOs are no cost. Thus, not only was the contention for potentially scare resources reduced and high percentages of truck load utilisation achieved, but the logistics cluster was also able to

develop a broader understanding of both needs and responses from the wider humanitarian community.

Furthermore, it is argued that such examples of the provision of common services could be expanded through the use of common purchasing arrangements (as is currently operated by the UK-based Inter-Agency Procurement Group) and, ultimately, a unitary pipeline with organisational differentiation being achieved via appropriate packaging or label printing. Thus, once again, it is argued that tools and techniques that have served well in the commercial environment have the potential to be suitably adapted to provide similar positive outcomes in the humanitarian field.

Summary

It would be possible to provide further examples (such as the development of appropriate metrics that capture both effectiveness as well as efficiency), and in achieving organisational learning in the face of high rates of staff turnover (Twigg & Steiner, 2002). However, it is hoped that those offered have been sufficient to demonstrate our fundamental argument that the purpose of any supply network remains the achievement of the often quoted "5 Rights" (Right Product; Right Time; Right Place; Right Price; Right Quality) albeit, one might increasingly add "Right Information" to this list. Acceptance of this proposition implies that many aspects of SNM that have proved successful in the commercial arena may, indeed, prove equally valuable and efficacious in a humanitarian context. It also follows that much of the academic thinking that has helped to transform the practice of logistics and supply network management in the areas of commerce and industry is, potentially, transferable to the humanitarian domain – accepting that modification may be necessary to reflect specific environmental differences.

3. The Contribution of this Special Edition

With this in mind, we have approached the task of editing this Special Edition from the perspective of reflecting on how such cross-disciplinary thinking can be nurtured and encouraged. To some extent we were fortunate in that there was substantial interest from prospective authors, with a total of twenty three papers being initially submitted for consideration. The standard of the papers was very high and it was, therefore, with some difficulty that the editors eventually selected twelve to go forward for Review. This has led to seven contributions being accepted for publication, and we would like to take this opportunity to underline our appreciation for the support and advice of the anonymous reviewers and the European editors.

The choice of the selected papers divides neatly into two categories, the first of which focuses on the application of academic models and approaches that target the organisational issues inherent in the management of humanitarian supply networks. In doing so, they clearly highlight and reinforce some of the challenges outlined in this introductory paper. Meanwhile, the second group, which forms Part II of this Special Edition, represent excellent examples of the application of OR techniques drawn from the commercial SNM environment to that of humanitarian logistics

Within this part of the Special Edition, the paper by first by **Kirstin Scholten** and her colleagues considers how the combination of Lean and Agile responses (Leagility) might be used to guide the development of humanitarian supply networks. This paper is set against the background of the increasing pressure on NGOs to use their resources more strategically in

order to gain and/or retail donor trust and long term commitment. A literature based approach that extends the SNM concept of leagility to NGOs is combined with a number of exploratory semi-structured discussions with five NGO supply chain directors. The authors argue that, in a disaster relief scenario, the commercial concept of leagility holds strong potential for increasing efficiency and effectiveness, but this is constrained by the absence of supporting Information Technology (IT) and it demonstrates the relegation of SNM to the status of a 'back office' activity within NGOs. This paper has a particular value through its practical guidance to NGO management on strategies that are available to improve their organization's flexibility and agility. In addition, the authors argue that the 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.

The second paper by **Sabine Schulz** and her co-authors considers the challenge of horizontal cooperation in disaster relief. To a large extent, the authors argue that the same potential synergies exist in the humanitarian as in the private sector, but not all of the potential benefits have yet been realized. In particular, the authors suggest that smaller organizations can benefit most from a cooperative approach, but four main impediments to a cooperative approach are identified. These reflect: the perception of logistics as one of the organization's own core competences; cultural differences and mutual mistrust both within and between organisations; a lack of transparency regarding the potential and existing benefits; and inadequate relief capacities. To help overcome these, a service provider model is offered as the mode of horizontal cooperation. Although the authors point out that their findings are valid only for this model, the benefits and impediments that are identified may be of assistance to humanitarian organizations assessing participation in a cooperative initiative.

In the final paper of this part of the Special Edition, **Leif-Magnus Jensen** and **Marianne Jahre** develop a similar theme through consideration of how the coordination of humanitarian aid response through the use of the cluster approach can be enhanced. As discussed earlier in this editorial, the cluster model is being implemented as a solution to the lack of coordination in many aspects of disaster response. The concept is assessed through the use of a case study and, in doing so, the paper provides a theoretically-based evaluation and discussion of the merits of the cluster system which is clearly one of the major trends in the current development of humanitarian logistics. However, given that coordination in one dimension may have a negative impact on other viewpoints, the paper usefully presents the tradeoffs between different types of coordination. Through these, basic aims such as standardisation through functional coordination must be balanced with cross-functional and vertical coordination in order to serve the users' composite needs more successfully.

In the second part of this Special Edition, four papers are presented which collectively discuss the use of modelling techniques in order to assist practitioners in their humanitarian relief preparation and response. In the first of these, **Alexander Blecken** examines humanitarian supply chain processes through the lens of a reference task model which serves as a knowledge repository. This enables the rapid visualisation of a specific humanitarian organisation's SNM and logistics tasks, allowing managers to consider the potential contention between short-term disaster relief and medium-term humanitarian assistance. Through empirical research and a supporting case study, a broad range of practices were examined and an established procedure was selected. This enabled the development of a reference task model which identified over 100 SNM tasks and which forms the basis of the process modelling method. The author argues persuasively that standardisation of such supply network processes is key to improving operational effectiveness and efficiency as well as cooperation and coordination in humanitarian operations.

In the second paper in this part, **Pamela Nolz** and her co-authors present an OR model for planning water distribution in disaster relief situations. This paper exemplifies the potential contribution of this discipline in moving towards a robust approach to decision making in such critical areas. To achieve this, the paper develops a metaheuristic search technique based on evolutionary concepts for a real world extension of a multiobjective problem in post disaster situations. The paper proposes a method that could support decision makers in finding appropriate compromise solutions where conflicting objectives exist and, in doing so, develops a model which can rapidly devise solutions for the physical location of water tanks and the selection of roads to use for the transport of drinking water in the aftermath of a disaster. The authors of this paper are also to be congratulated on their use of a realistic setting, thus the vehicle "fleet" consists of trucks, cars and donkeys and, in doing so, the paper underpins the importance of basing theoretical examples in the reality of humanitarian practice.

The third paper by **Ruth Banomyong** and **Apichat Sopadang** demonstrate the use of simulation modelling to assist in enhancing the reliability and validity of a pre-existing emergency response model. Although, as the authors themselves recognise, this research requires further validation, it is clearly a useful step in the development of decision support systems that has been included not least as a way of stimulating further consideration of this important area. In addition, the degree to which this research has been based on an important case study adds weight to the conclusions of the research and its wider applicability.

The final paper selected has been authored by **Aurelie Charles** and her colleagues who have developed a model to define and assess the agility of humanitarian supply networks. In doing so, it presents an elegant counterpoint to the observations made by Kirstin Scholten in the first part of the Special Edition by arguing that there are certain aspects of humanitarian logistic response that could usefully be incorporated within commercial supply networks. In support of this proposition, the authors argue that humanitarian organisations are frequently to be found working in environments with a high degree of uncertainty and such organisations have, therefore, become specialists in the implementation of agile systems. This paper contributes significantly to the debate by offering a clear understanding of the notion of supply chain agility and then developing a consistent, robust and reproducible method of assessing supply chain agility that is appropriate for both the humanitarian and commercial sectors.

4. Conclusions

As editors of this Special Edition, we sincerely hope that the papers presented within it will make a substantive contribution to the challenge of humanitarian logistics and present ideas, concepts and approaches on which others can build. In doing so, we imply absolutely no criticism of the phenomenally important and life-saving work being currently undertaken by aid agencies world wide. Rather, we recognise that in these times of financial austerity, there is an even more powerful incentive to achieve improved effectiveness and efficiency and, in the spirit of assisting in such an endeavour, we would commend the authors' work to all those involved in this exciting and exhilarating field. More broadly, from an educational perspective, we are particularly pleased to note that the lead author of three out of the seven papers is a doctoral student. This not only reflects great credit on the students and on their co-authors and supervisors but, arguably even more importantly, reflects the emergence of "fresh

blood" who will, hopefully, continue to prosecute and develop humanitarian logistic research to the clear benefit of all those affected by such disasters.

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Table 1. Annual Budgets of Major Humanitarian Non Governmental Organisations and Agencies

Non Governmental Organisation / Agency	Annual Budget ($US billion)
UN Childrens' Fund (UNICEF)	**3,390**
World Food Programme (WFP)	**5,000**
UN High Commission for Refugees (UNHCR)	**1,095**
World Health Organisation (WHO)	**4,225**
UN Development Fund (UNDP)	**5,000**
UN Population Fund (UNPF)	**250**
[UN] Office for the Coordination of Humanitarian Affairs (OCHA)	**240**
World Vision International (VWI)	**1,620**
Save the Children	**810**
CARE	**440**
Catholic Relief Services	**440**
Médecins sans Frontières (MSF)	**430**
Oxfam	**400**
International Federation of Red Cross and Red Crescent Societies (IFRC) (not including income of National Societies, eg American Red Cross @>$3Bn/year)	**500**
Total	**23,840**

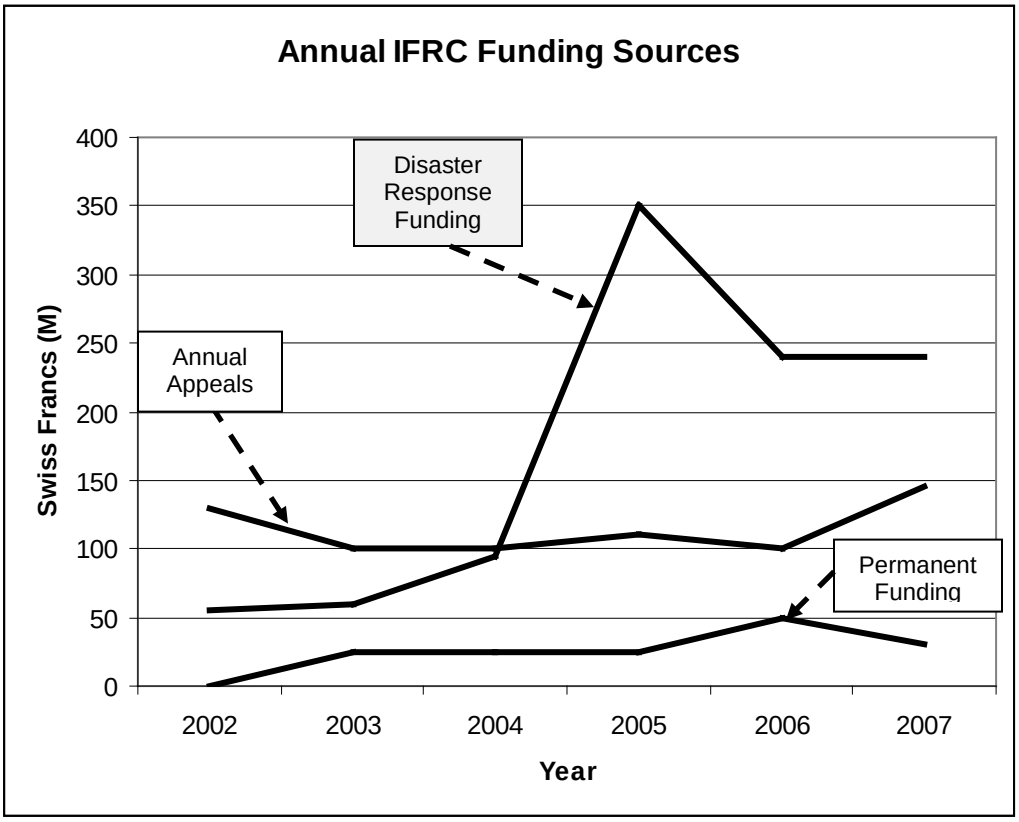

Figure 1 (Adapted from Jahre and Heigh, 2008)