Coordination to choreography: the evolution of humanitarian supply chains

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Abstract

Purpose – The purpose of this paper is to identify how coordination has evolved in humanitarian logistics (HL), what were the triggers for change and how have they been facilitated.
Design/methodology/approach – This paper applies a systematic literature review of academic journals.
Findings – This is the first paper to discuss the concepts of network orchestration and choreography in a humanitarian context. The research revealed that network coordination has moved on in the commercial sector to include orchestration and now, choreography concepts which have not been tested in HL literature. This reveals a lag exists between HL research and practice.
Research limitations/implications – This paper represents an exploratory study and provides the basis for further research on the concepts of orchestration and choreography in HL. The paper sets a research agenda for academics.
Practical implications – This paper is the first to discuss the concepts of network orchestration and choreography in a humanitarian context.
Originality/value – The areas of orchestration and choreography have received limited consideration within the humanitarian aid logistics literature to date. This paper is designed to redress this shortfall. As a result, it is hoped 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.

Keywords Humanitarian logistics, Systematic literature review, Coordination, Orchestration, Choreography
Paper type Research paper

1. Introduction

Bridging the gap between what is needed and what is provided continues to challenge humanitarian organisations (HOs) regarding scale and complexity. Implementing effective inter/intra-organisational humanitarian coordination can help reduce costs and improve efficiency in the supply chain but has proved to be extremely challenging for HOs and governments at all stages of the disaster cycle (Krejci, 2015; Balcik *et al.*, 2010). The problems associated with centralised and decentralised coordination approaches gain significant attention in the literature and bear the brunt, one way or the other of many disaster operational failures (Takeda and Helms, 2006; Perry, 2007; Kapucu *et al.*, 2010). Recent literature reviews in humanitarian logistics (HL) have recommended the need to apply concepts from other disciplines and explore different approaches to centralised, decentralised coordination and strategic decision making (Leiras *et al.*, 2014; Kunz and Reiner, 2012; Overstreet *et al.*, 2011). In line with these recommendations, some studies would suggest that HL research has progressed in that regard, more significantly research into service operations management (OM) and its application to HL coordination and collaboration (Heaslip, 2013, 2015; Galindo and Batta, 2013; Vega and Roussat, 2015; Abidi *et al.*, 2015; Oloruntoba *et al.*, 2016; Jensen, 2012; Bealt *et al.*, 2016). In spite of this OM is still

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under researched in the HL field (Vega and Roussat, 2015; Abidi *et al.*, 2015; Heaslip, 2015; Jahre *et al.*, 2009).

Firms in the commercial sector have long realised the advantages of integration, resource sharing and forming alliances. The use of logistics service providers (LSPs) can mitigate supply chain risk, provide flexibility, minimise costs and drive competitiveness. In general management literature, centralised and decentralised network coordination has moved on to incorporate network orchestration and choreography. Network orchestration defines the management processes used by hub firms to manage, sustain and coordinate network activities. For this research we use Dhanarj and Parkhe's definition of a hub firm. A "hub firm is defined as one that possesses prominence and power gained through individual attributes and a central position in the network structure, and that uses its prominence and power to perform a leadership role in pulling together the dispersed resources and capabilities of network members (Dhanaraj and Parkhe, 2006, p. 659). This is achieved by the ability of the hub firm playing a central role to utilise resources and capabilities of network members where they are needed most and to add and extract value in an equitable manner for all concerned. The success of the network to efficiently collaborate relies on the hub firm's prominent status, and its ability to promote trust and stability among network members (Zacharia *et al.*, 2011; Dhanaraj and Parkhe, 2006; Tatham and Kovács, 2010). Examples of the centralised orchestration concept in humanitarian supply chain networks (HSCNs) are evident in the cluster system, integrated coordination mechanisms, humanitarian LSPs and humanitarian storage depots and hubs. Ferraro and Iovanella (2015) expand the orchestration model and introduce choreography. In contrast, their decentralised model is governed through peer leadership among members of the supply chain network. Choreography networks are "self-organised and information-driven". An example of a humanitarian choreography network could be applied to humanitarian web-based platforms such as "Relief Web" and the Logistics Cluster coordination mechanisms which facilitate information sharing and resource tools for the humanitarian sector. The choreography model can also be applied to communities of practice[1] (CoP). An example of a virtual humanitarian CoP is the "Cash Learning Partnership" (CaLP). The aim of this study is to chart the evolution of HL coordination and reveal if there is a lag between research and practice?

To help achieve this, we use the following research questions:

RQ1. Identify how coordination has evolved, what were the triggers for change and how have they been facilitated?

RQ2. How does orchestration and choreography occur in HL supply chain networks and how is it facilitated?

The rest of the paper is set out as follows. The methodology in Section 2 describes the process used to conduct the review. In Section 3, we present results of the review, and from this, we propose a model to help guide future research. In Section 4, we discuss the implications of the findings. The final section concludes the study and makes recommendations for future research.

2. Methodology

A systematic review was conducted to help formulate explicit knowledge about HL coordination and limit bias (Tranfield *et al.*, 2003, 2004). In contrast to traditional reviews, the systematic literature review adheres to specific criteria and follows a protocol to enable a rigorous evaluation of available evidence (Tranfield *et al.*, 2003, 2004; Rousseau and McCarthy, 2007).

The first stage consisted of developing research questions and concepts based on previous research and the type of research approach adopted. This was followed by a search

for papers with specific and carefully developed search strings. An expanded set of keywords to search the literature was used, specifically, "logistic*" or "Supply Chain*" or "humanitarian logistics" and "Humanitarian" or "Relief" or "disaster" and "Coordination" or "Cooperation" or "Collaboration" or "Orchestration" or "Choreography". Keywords were input to the following databases, Science Direct, Proquest ABI/INFORM, Scopus, EBSCOhost, Wiley online, Emerald and Google Scholar in the title and abstract field. As part of the selection criteria, only academic peer-reviewed journals were selected for the review, disregarding other forms of non-reviewed publications such as conference papers, books and media sources.

Figure 1 explains the stages in this review. Initially, 13,166 articles were identified using the search terms. As journal articles meet high standards of academic enquiry, rigour and provide an abundance of relevant information and knowledge in any given field (Ordanini *et al.*, 2008), we felt it best to concentrate on peer-reviewed academic journals. Titles and abstracts were scanned double-blind for keywords and relevant topics. Papers without abstracts, non-peer reviewed or of non-relevance to subject matter were discarded. This reduced the articles to 4,114. The next step was to eliminate the articles that were extracted more than once, and this left 495 articles. To classify which of the remaining articles focused on coordination, collaboration, orchestration and choreography for supply chain/logistics management/HL, one of the authors coded and analysed the extent to which (if any) the

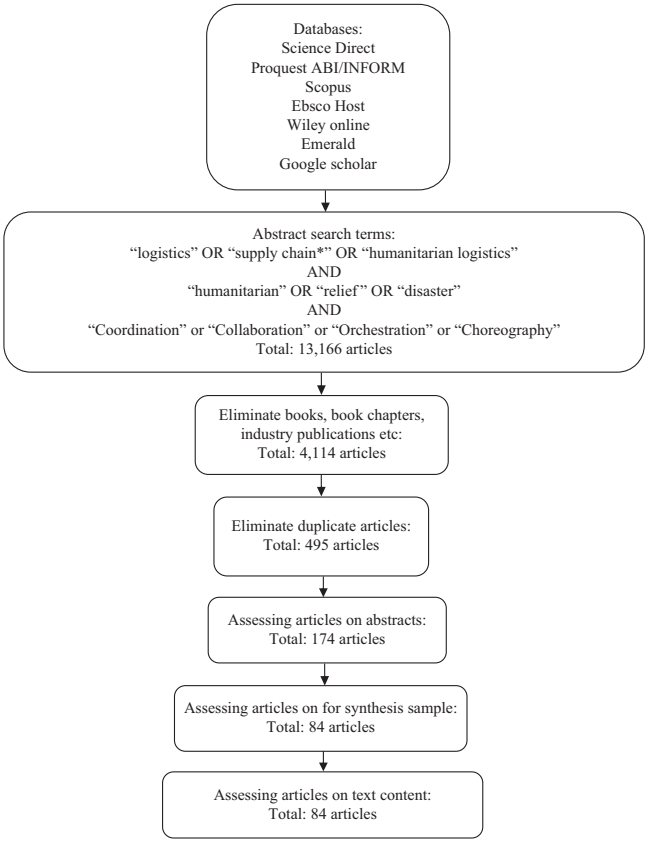

Figure 1.
Systematic literature review process

articles focused on coordination, collaboration, orchestration and choreography for supply chain/logistics management in HL by rating each article's title and abstract on separate four-point scales anchored at "not at all" and "clearly" (Nag *et al.*, 2007). In total, 174 articles satisfied this requirement, and these were forwarded to the synthesis sample. Next, we looked at the number of citations each individual article received in order to maximise the relevance of the set of articles. Rather than using an arbitrary cut-off point (Keupp *et al.*, 2012) of how many citations an article had to receive (which would place newer articles at a disadvantage), we compared the number of citations each article received with the average number of citations received by articles appearing in the respective year in the respective journal. Thus, 84 articles remained for analysis and Table I provides an overview of the articles included in the review.

Articles were assigned to an electronic database (excel) with specific headings depicting the type of study, author and year. Further categorisation included themes, keywords and abstracts. A filter was then added to categories and themes to allow access to specific topics of interest. This allowed further development and categorisation of critical issues and themes. Using Jahre and Jensen (2010) framework for developing theory in HL provided a basis for the research framework. Their theory considers: networks as temporary or permanent, structure as centralised or decentralised and coordination as vertical and horizontal constructs, these were used as research categories. Main themes chosen were: coordination, orchestration and choreography. The rest of the table consists of sub-themes chosen from the review and plotted according to findings (Table II).

Table II provides a framework for the research and depicts the different coordination mechanisms (coordination, orchestration and choreography) according to the findings in relation to centralised and decentralised structures, permanent and temporary networks and vertical and horizontal coordination (Jahre *et al.*, 2009).

3. Findings

This section will discuss the findings of the research and describe the evolution of HL from coordination to choreography. Before discussing the findings it is important to clearly define what is meant by "triggers" and "facilitators". Drawing on the emergency management literature, a trigger may be defined as "an event causing significant change or having the potential to cause significant change" (Keown-McMullan, 1997, p. 8). A trigger will cause significant change if conditions exist to facilitate or support this change. The triggers may be technical, economic, human, organisational or social events (Keown-McMullan, 1997). Similarly, the facilitators may fall into these categories but are, in the HL environment, more likely to be technical, economic or organisational.

3.1 The emergence of humanitarian logistics coordination

Kent (1983) points to the spate of natural and man-made disasters during 1968–1971 as placing the spotlight on the limitations of international organisations, particularly the United Nations (UN). The largest man-made disaster during this period was the Biafran war. The war lasted two-and-a-half years, during which almost 2m Biafran civilians died from starvation caused by the blockade of the region by the Nigerian government and the migration of Biafra's Igbo people into increasingly shrinking territory (Phillips, 2018). As a result, the United Nations Disaster Relief Office (UNDRO) was established in 1972 to facilitate the dissemination of information on disaster management and support inter-intra humanitarian coordination. However, UNDROs ability to implement inter-organisational coordination and collaboration was greatly diminished by the mutual mistrust, and silo mentality of UN agencies and their reluctance to share information with each other. Long and Wood (1995, p. 4) argue that, "inter-organisational relations are usually a challenge to the relief effort rather than a source of support". At this

No.	Author	Year	Journal	Type of study	Network themes		
					Coordination	Orchestration	Choreography
1	Abidi *et al.*	2014	*SCM:IJ*	Conceptual	✓		
2	Abidi *et al.*	2015	*JHLSCM*	Analytical		✓	
3	Akhtar *et al.*	2012	*JHLSCM*	Case study	✓	✓	
4	Alexander	2002	*DPM*	Case study	✓		
5	Allan *et al.*	2013	*JHLSCM*	Case study	✓		
6	Allen *et al.*	2013	*JHLSCM*	Analytical		✓	
7	Alonso *et al.*	2008	*AER*	Analytical	✓		
8	Balcik *et al.*	2010	*IJPE*	Conceptual	✓		
9	Bealt *et al.*	2016	*JHLSCM*	Applied		✓	
10	Charles and Lauras	2011	*OR Spectrum*	Analytic	✓		
11	Cozzolino *et al.*	2012	*JHLSCM*	Case study		✓	
12	Day	2014	*IJPR*	Empirical			✓
13	Dhanaraj and Parkhe	2006	*AMR*	Conceptual		✓	
14	Drabek and McEntire	2003	*DPM*	Conceptual			✓
15	Duffield	1994	*IDS Bulletin*	Case study	✓		
16	Ergun *et al.*	2014	*POMS*	Case study	✓	✓	✓
17	Ferraro and Iovanella	2015	*IJBM*	Conceptual			✓
18	Galindo and Batta	2013	*EJOR*	Conceptual	✓		
19	Gatignon *et al.*	2010	*IJPE*	Case study			✓
20	Gavidia	2017	*JHLSCM*	Analytical		✓	
21	Gelan	2006	*DPR*	Case study		✓	
22	George	2002	*PMR*	Case study	✓		
23	Goffnett *et al.*	2013	*JHLSCM*	Case study		✓	
24	Gunasekaran *et al.*	2004	*IJPE*	Conceptual		✓	✓
25	Heaslip	2013	*JHLSCM*	Conceptual		✓	✓
26	Heaslip	2015	*JHLSCM*	Conceptual		✓	✓
27	Heaslip and Barber	2014	*JHLSCM*	Conceptual	✓		
28	Heaslip *et al.*	2012	*IJPE*	Analytical	✓		
29	Hinterhuber	2002	*LRP*	Case study		✓	
30	Jahre and Jensen	2010	*IJPDLM*	Conceptual	✓	✓	
31	Jahre and Jensen	2010	*MRN*	Conceptual	✓	✓	✓
32	Jensen	2012	*JHLSCM*	Case study		✓	
33	Jérôme and Gilles	2010	*JMTM*	Case study		✓	
34	Kabra and Ramesh	2015	*BIJ*	Analytical	✓		
35	Kapucu *et al.*	2010	*DPM*	Conceptual			✓
36	Kent	1983	*RIIA*	Conceptual	✓		
37	Kovács *et al.*	2010	*IJLRA*	Case study			✓
38	Kovács and Spens	2009	*IJPDLM*	Conceptual	✓		
39	Kovács and Spens	2007	*IJPDLM*	Conceptual	✓		
40	Kovács and Spens	2011	*IJPDLM*	Conceptual		✓	
41	Kovács and Tatham	2009	*JBL*	Conceptual	✓		
42	Kovács *et al.*	2012	*JBL*	Conceptual	✓		
43	Krejci	2015	*JHLSCM*	Analytical	✓		
44	Kruke and Olsen	2012	*Disasters*	Case study			✓
45	Kunz and Reiner	2012	*JHLSCM*	Conceptual	✓		
46	L'Hermitte *et al.*	2015	*JHLSCM*	Analytical	✓		
47	Lechat	1990	*Disasters*	Conceptual	✓		
48	Jensen	2012	*JHLSCM*	Case study		✓	
49	Leiras *et al.*	2014	*JHLSCM*	Conceptual	✓		
50	Li *et al.*	2016	*JSSM*	Case study		✓	
51	MacCarthy *et al.*	2016	*IJOPM*	Conceptual		✓	
52	Makepeace *et al.*	2017	*JHLSCM*	Case study		✓	

(*continued*)

Table I.
Systematic literature review

No.	Author	Year	Journal	Type of study	Network themes: Coordination	Orchestration	Choreography
53	Maon and Lindgreen	2009	*SCM*	Case study	✓		
54	Oloruntoba	2005	*DPM*	Empirical	✓		
55	Oloruntoba and Gray	2009	*IJPDLM*	Conceptual		✓	
56	Oloruntoba *et al.*	2016	*AOR*	Conceptual	✓		
57	Overstreet *et al.*	2011	*JHLSCM*	Analytical	✓		
58	Ozdamar and Ertem	2015	*EJOR*	Analytical		✓	
59	Peltz	2003	*Computer*	Conceptual		✓	✓
60	Perry	2007	*IJPDLM*	Conceptual	✓		
61	Pettit and Beresford	2009	*IJPDLM*	Conceptual	✓		
62	Pettit and Beresford	2005	*IJPDLM*	Analytical	✓		
63	Pramatari	2007	*SCM:IJ*	Case study		✓	✓
64	Schulz and Blecken	2010	*IJPDLM*	Case study	✓		
65	Simon *et al.*	2015	*IJIM*	Case study			✓
66	Soosay and Hyland	2015	*SCM*	Conceptual		✓	✓
67	Sorbi *et al.*	2017	*EJMMS*	Conceptual		✓	
68	Takeda and Helms	2006	*IJPSM*	Case study	✓		
69	Tapia *et al.*	2012	*EJMMS*	Case study		✓	
70	Tapia *et al.*	2013	*ITP*	Case study		✓	
71	Tatham *et al.*	2017	*Disasters*	Conceptual		✓	
72	Tatham and Kovács	2010	*IJPE*	Conceptual	✓		
73	Tatham and Rietjens	2016	*Disasters*	Conceptual	✓		
74	Tewoldeberhan and Janssen	2008	*ECRA*	Analytical		✓	
75	Thevenaz and Resodihardjo	2010	*IJPE*	Conceptual			✓
76	Thomas and Kopczak	2005	*FI*	Conceptual	✓		
77	Tomasini and Van Wassenhove	2009	*ITOR*	Case study	✓		
78	Van Wassenhove	2006	*JORS*	Conceptual	✓		
79	Vega and Roussat	2015	*IJPDLM*	Conceptual		✓	
80	Walker *et al.*	2010	*Health Affairs*	Conceptual	✓		
81	Wenger	2000	*Organisation*	Conceptual			✓
82	Yates and Paquette	2011	*IJIM*	Case study			✓
83	Yoho *et al.*	2013	*IJPDLM*	Conceptual	✓		
84	Zacharia *et al.*	2011	*JBL*	Conceptual		✓	

Notes: *AER*, *American Economics Review*; *AMR*, *Academy of Management Review*; *AOR*, *Annals of Operations Research*; *BIJ*, *Benchmarking: An International Journal; DPM*, *Disaster Prenetion Management An Internaitonal Journal*; *DPR*, *Development Policy Review*; *ECRA*, *Electronic, Commerce, Research and Applications*; *EJMMS*, *European Journal of Management and Marketing Studies*; *EJOR*, *European Journal of Operational Research*; *FI*, *Fritz Institute*; *IDS Bulletin*, *Institute of Development Studies Bulletin*; *IJBM*, *International Journal of Business Management*; *IJIM*, *International Journal of Information Management*; *IJLRA*, *International Journal of Logistics: Research and Applications*; *IJOPM*, *Internaitonal Journal of Operations and Prodcution Management*; *IJPDLM*, *Internaitonal Journal of Physical Distribution and Logisitcs Management*; *IJPE*, *International Journal of Production Economics*; *IJPR*, *International Journal of Production Research*; *IJPSM*, *International Journal of Public Sector Management*; *ITOR*, *International Transactions in Operational Research*; *ITP*, *Information Technologies and People*; *JBL*, *Journal of Business Logistics*; *JHLSCM*, *Journal of Humanitarian Logisitcs and Supply Chain Management*; *JMTM*, *Journal of Manufacturing Technology Management*; *JORS*, *The Journal of the Operational Research Society*; *JOSSM*, *Journal of Service Science and Management*; *SCM*, *Journal of Supply Chain Management*; *LRP*, *Log Range Planning*; *MRN*, *Management Research News*; *OR Spectrum*, *Operations Research Spectrum*; *PMR*, *Policy and Management Review*; *POMS*, *Production Operations Management Society*; *RIIA*, *Royal Institute of International Affairs*; *SCM:IJ*, *Supply Chain Management An Internaitonal Journal*

Table I.

Category	Network		Structure		Coordination		Type of coordination	Example-facilitators
	Temporary	Permanent	Central	Decentral	Vertical	Horizontal		
Civil-mil SC	✓		✓			✓	Coordination-Civil-Mil Cooperation	PKOs/Natural disaster response/complex emergencies
Commercial LSPs	✓	✓	✓		✓	✓	Orchestration	Partnerships-alliance/outsourcing
Humanitarian LSPs	✓	✓	✓		✓	✓	Orchestration	Humanitarian response depots/Global cluster lead (WFP)
Clusters	✓		✓			✓	Orchestration	Cluster lead
HSC in preparedness phase		✓	✓		✓	✓	Orchestration	Humanitarian Storage depot
	✓	✓		✓	✓	✓	Choreography	Virtual network CoP/digital network coord mechanisms/IFRC RLUs/SCM training
HSC in response phase	✓		✓			✓	Orchestration	Clusters
				✓		✓	Choreography	Fragmented coordination
							Choreography	IFRC RLUs
HSC in recovery	✓				✓	✓	Orchestration	Lean SC strategy
				✓			Choreography	Cross functional coordination between programme and logistics/HSC, i.e. CTPs, cold chain
Information technology		✓	✓		✓	✓	Orchestration	SC integration/collaboration/partnership
	✓	✓		✓	✓	✓	Choreography	Virtual coordination mechnaisms/CoP/customer centric approach
Social media	✓	✓		✓	✓	✓	Choreography	Social media apps-Twitter, Facebook, LinkedIn
UN IASC		✓		✓		✓	Choreography	CoP-Cluster coordination
UN OCHA		✓	✓		✓		Orchestration	Leadership role/coordinates humanitarian action through Emergency Relief Coordinator (ERC), Resident Coordinator and Humanitarian Coordinator (RC/HC)

Table II.
Research framework based adapted from: (Jahre and Jensen, 2010)

time, humanitarian agencies and UN agencies had little or no logistics capacity, expertise, governance and lacked any type of collective strategy, adequate funding or political support to provide relief in the event of a disaster (Long and Wood, 1995). To further compound relief efforts, implementing coordinated logistics is hampered by the destructive nature of disasters, more so in developing regions and hostile environments (Kovács and Spens, 2007, 2009). Logistics support and humanitarian relief relied mostly on military and civil defence interventions, with fragmented efforts by individual humanitarian and charitable agencies. The findings would suggest, however, with the emergence of UNDRO the seeds were sown for systematic humanitarian coordination.

3.1.1 UN reform. The UN report "An Agenda for Peace" set out a multi-faceted and comprehensive approach to peacekeeping. As with peacekeeping, humanitarian activity, in the sense of action to relieve or prevent human suffering arising out of conflict or calamity, is not a new invention. It is only relatively recently, however, that its rules and principles have been codified, and its practitioners formed into lasting professional groups. In previous centuries, the military and their camp followers usually had the responsibility for dealing with the immediate humanitarian consequences of war (White, 1999). Alexander (2002) points to the emergence of civil protection[2] in the latter years of the Cold War due to an influx of serious natural and man-made disasters and public demand to tackle them. The shift from civil defence to civil protection was further influenced by the United Nations Decade for Natural Disaster Reduction which proposed an integrated global approach to mitigating the effects of disasters particularly in developing countries (Lechat, 1990). The Oslo guidelines published in 1994 on the Use of Military and Civil Defence Assets in Disaster Relief, introduced a framework for effective use of civil and military assets in disaster relief.

3.1.2 Complex emergencies and civil-military coordination. Cooperation and collaboration between civil-military actors has proved a complex and uneasy affair (Pettit and Beresford, 2005; Heaslip *et al.*, 2012; Kovács and Tatham, 2009; Van Wassenhove, 2006; Jahre *et al.*, 2009). It is acknowledged in the literature that civilian and military actors in response to disasters are more willing to collaborate, while collaboration in complex emergencies is a more awkward affair particularly with humanitarian actors (Balcik *et al.*, 2010; Kovács and Tatham, 2009; Heaslip and Barber, 2014). Heaslip *et al.* (2012, p. 390) applying a systems analysis and design technique model in an empirical setting (complex humanitarian emergency) reveal seven shared factors for a positive civil-military partnership: "Partner fit, complimentary resources, compatibility of organisational cultures, compatible strategies and objectives, network of partner organisations, flexibility and reliability. Similarly, Yoho *et al.* (2013, p. 88) identify "culture, organisational structure, procedures and training" as factors that can influence interoperability between the military and humanitarian organisations in relief supply chains. Tatham and Rietjens (2016, p. 16) study on civil-military networks suggest the use of "temporarily viable structures that enhance and support inter-organisational coordination" Humanitarian relief supply chain networks and military supply chain networks are structured in a similar fashion. Both operate in a not-for-profit context and operate in interrupted environments (Kovács and Tatham, 2009). Kovács and Tatham (2009, p. 225) argue that military and humanitarian supply networks are compatible to mainstream logistics concepts in various context, especially the areas of "people, processes and technology". Using organisational theory, George (2002) states the need for policy makers to influence the military to coordinate more effectively with relief agencies. Heaslip and Barber (2014) use a systematic literature review to categorise HL and argue that military participation differs (systematically) depending on the nature of the disaster and the operational phase, and considers its impact on civil-military cooperation and coordination.

The culmination of the Cold War in 1989 brought new coordination challenges in the form of high profile complex emergencies. By the mid-1990s, the proliferation of population displacement, poverty, ethnic and internal state tensions in Eastern Europe, Africa and Asia often exacerbated by natural disasters, came under the spotlight and triggered a surge in combined civil and military humanitarian interventions (Duffield, 1994). In response, UN resolution 46/182 (UN 46/182, 2012) paved the way for the Office for the Coordination of Humanitarian Affairs (OCHA), Interagency Standing Committee (IASC) and Department of Humanitarian Affairs (DHA). The shortcomings of integrated UN peacekeeping operations and poor humanitarian coordination in Rwanda and Bosnia in the 1990s resulted in constitutional reform of the UN in 1998 that saw the DHA merge with OCHA (Alexander, 2002).

3.1.3 Southern Asian earthquake and tsunami. Triggered by a catastrophic event, the Southern Asian earthquake and tsunami in 2004 exposed serious deficiencies on the operational side of the humanitarian sector especially the coordination of supply and logistics or lack thereof. These included, poor assessments, inadequate sharing of information, poor collaboration, cooperation and coordination among NGOs and communities. In particular, the humanitarian supply chain was singled out for criticism of which, supply bottle-necks, lack of logistics experts and poor preparedness were some of the themes highlighted (Perry, 2007). Increasing pressure came upon HOs and the UN to improve inter-organisational logistics coordination in the form of preparedness, response, recovery, information sharing and efforts to professionalise the humanitarian sector. It was estimated at the time that HL and supply chain management was 10 years behind the business sector (Thomas and Kopczak, 2005). The cluster approach was implemented following humanitarian reform in 2005. The cluster is made up of 11 UN and non-UN agencies at a global level. The goal of the cluster system is to provide services through interagency coordination through specific sectors such as, shelter, health, sanitation, food and nutrition. The logistic cluster provides information management and coordination in support of HL operations. They also facilitate logistics services (Jahre *et al.*, 2009). The World Food Programme (WFP) is the global lead and provider of last resort (IASC, 2008). The "provider of last resort" concept is critical to the cluster approach, and without it the element of predictability is lost. Where there are critical gaps in humanitarian response, it is the responsibility of cluster leads to call on all relevant humanitarian partners to address these. If this fails, then depending on the urgency, the cluster lead as "provider of last resort" may need to commit itself to filling the gap (IASC, 2008). IASC facilitates and supports the clusters.

3.1.4 The evolution of HL coordination. Early evolution of humanitarian coordination (Figure 2) was greatly influenced by highly publicised global events, in the form of natural and man-made disasters. This, in turn, led to reform within UN organisations. The culmination of the Cold War and the emergence of complex emergencies was the catalyst for systematic coordination between civil and military actors under the umbrella of the UN and often including international non-governmental organisations and national NGOs (Heaslip and Barber, 2014). The introduction of the cluster approach under the auspices of IASC came about as a result of the Southern Asian earthquake and tsunami. In particular, the spotlight was placed on the lack of inter-organisational coordination and poor HL planning and preparedness.

3.1.5 Inter-organisational coordination. Several studies have explored the drivers and barriers to coordination. Kabra and Ramesh (2015) categorised the following barriers to humanitarian supply chain management (HSCM) coordination: operational barriers, strategic barriers, cultural barriers, technological barriers and organisational barriers. They identified long-term planning, developing long-term relationships with the commercial

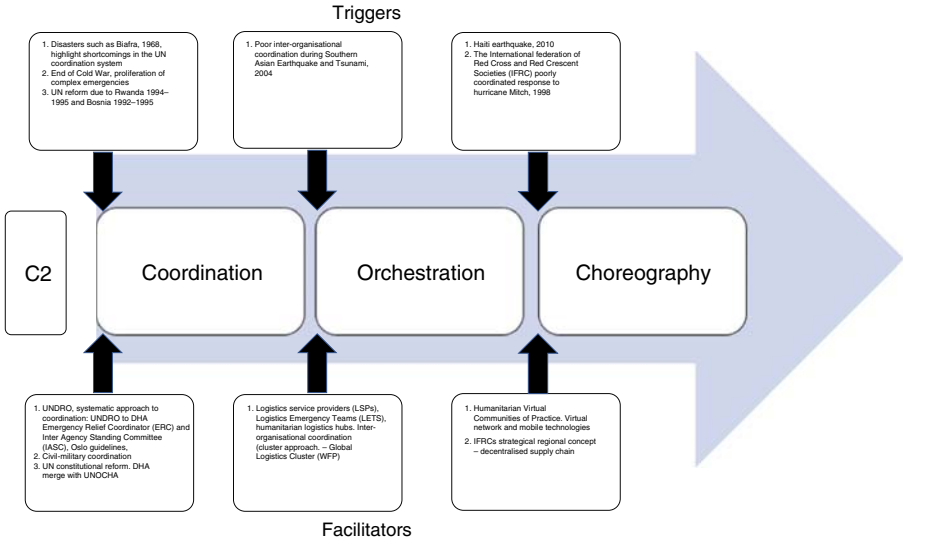

Figure 2.
Evolution of humanitarian logistics

sector, strategic alliance and developing cross functional skills of logistics managers as key drivers to enhance coordination. Heaslip, Vaillancourt, Tatham and Kovacs (2018) propose a humanitarian logistics competency framework (HLCF) to assist with the professional development of humanitarian logisticians. In creating the HLCF, nine competency domains containing 29 specific competencies across four levels (entry to senior management) were identified. Schulz and Blecken (2010, p. 650) examine horizontal cooperation in relief supply chains and identify the following four barriers: "the conviction of some organizations that logistics belongs to their own core competencies, cultural differences and mistrust, a lack of transparency regarding existing and potential benefits and a lack of sufficient resources". They argue that smaller HOs can benefit from the use of LSPs, however, Heaslip, Kovacs and Grant (2018) suggests that humanitarian LSPs are better placed to meet their needs. Other barriers include lack of investment for information technology infrastructure (Kabra and Ramesh, 2015; Ergun *et al.*, 2014; Schulz and Blecken, 2010) and failure to embrace HSCM practice (Balcik *et al.*, 2010; Maon and Lindgreen, 2009).

Coordination between the multiple actors and stakeholders can be very challenging considering cultural, social, ethnic diversity and strategic organisational or personal goals (Balcik *et al.*, 2010; Oloruntoba, 2005; Tatham and Kovács, 2010; Kabra and Ramesh, 2015; Pettit and Beresford, 2009). Coordination in HL can also be considered in terms of vertical or horizontal coordination (Schulz and Blecken, 2010; Akhtar *et al.*, 2012; Jahre *et al.*, 2009). Jahre *et al.* (2009) argue that while the cluster coordination is generally horizontal at operational level, the challenge is to synchronise the cluster with other clusters and the rest of the supply chain in order to achieve vertical and strategic coordination. Akhtar *et al.* (2012) highlight horizontal and vertical coordination in relation to the competencies and characteristics of the chain coordinators and the value they add to the relief network. They list value added components as "tangible resources, workers, technology, transport, finance and intangible assets as leadership, relevant education, and experience" (p. 86). The control and structure of decision making during any phase of a disaster is described within the literature as centralised or decentralised (Alonso *et al.*, 2008). Centralisation is associated with senior management at headquarters level and adheres to a top down hierarchal decision-making process. The decentralisation model supports decision-making process

being made on the ground (Thevenaz and Resodihardjo, 2010). Managing HL throughout the different phases of disaster requires different actions, skills and resources. The phases are planning and preparation, immediate response, and reconstruction (Kovács and Spens, 2007; Kovács and Tatham, 2009).

3.2 Coordination to orchestration

The next shift in HL was a move from coordination to orchestration. In HL orchestration is a single centralised agent (the orchestrator) that coordinates the interaction among different HL actors. The orchestrator is responsible for invoking and combining the services of the HL actors. The orchestration includes the management of transactions between individual actors. Orchestration employs a centralised approach for service provision.

3.2.1 Information technology and orchestration. The emergence of the internet, IT and the World Wide Web in the early 1990s has transformed the way information is shared at network level between vendors, suppliers[3] and their customers. The introduction of web services technology further enabled businesses to "connect customers, suppliers or partners electronically" (Peltz, 2003, p. 46). For example, the emergence of Business Process Execution Language and Service Operation Architecture allows collaboration, integration and in particular the orchestration of services from a global network perspective in a variety of settings. Peltz (2003) describe orchestration as an "executable business process that can interact with both internal and external web services, with the interactions occurring at the message level (p. 46). Peltz states that orchestration is coordinated from a singular source or party. Li *et al.* (2016) make the comparison of a supply chain orchestrator as a conductor of an orchestra, playing a central role with the firms representing the orchestra. Zacharia *et al.* (2011) argues that global supply chain networks consist of firms that are either orchestrated or act as orchestrators. While Hinterhuber (2002) defined the orchestrator as a firm or group of firms best placed to coordinate the activities within a network. This is similar to Dhanaraj and Parkhe (2006) who describe network orchestration as being controlled by a prominent central hub actor or actors, "controlling the resources and capabilities of network members" (p. 659). Orchestrators can improve cycle time and reduce risk and uncertainty by integrating resources through strategic partnerships that will help consolidate supply and demand (Li *et al.*, 2016). They describe orchestration as "a new paradigm for creating value through network integration" (p. 304). Moreover, LSPs have evolved from provider of logistics services to supply chain orchestrators strategically placed to sustain competitive advantage and value for all supply chain members (Zacharia *et al.*, 2011). Li *et al.* (2016, p. 314) state, "the orchestrator should be quick to define a supply chain based on customer needs, design and divide the supply chain based on products/service features, and identify the resources needed to deliver the highest value to the chain".

3.2.2 Humanitarian LSPs. The use of LSPs and service management in HL is not ignored in the literature. Heaslip (2013), for instance, brought to the attention of HL scholars the importance of service OM. His research presented opportunities in the area of servitisation, service standardisation, service developments and the role of HOs as LSPs. Heaslip, Kovacs and Grant (2018) discuss waves of servitisation in HL. The fourth wave is the service revolution. These are international humanitarian organisations (IHOs) that provide a range of primarily information-based services. These encompass consultancy services (including supply chain configuration) and training. Oloruntoba and Gray (2009) examine customer service in the context of humanitarian relief chains. Heaslip, Kovacs and Grant (2018) argue that a broader servitisation paradigm needs to be integrated for IHOs to maintain a competitive advantage. It is argued that fourth party logistics can have a positive influence on humanitarian supply chain collaboration and can add value for all

concerned (Abidi *et al.*, 2015; Jensen, 2012). The WFP, International Federation of Red Cross (IFRC) are some examples of humanitarian LSPs. They provide a variety of logistics services either through logistics clusters, commercial partnerships or strategically placed hubs. Significantly, partnership agreements between HOs, military and the commercial sector have provided access to supply chain assets, expertise and technological resources (Tomasini and Van Wassenhove, 2009; Heaslip *et al.*, 2012). For example, as global lead of the logistics cluster, WFP coordinates or orchestrates the Logistics Emergency Teams (LETs), (Abidi *et al.*, 2015). The LETs, a combination of commercial global logistics companies, can provide a full suite of integrated logistics and supply chain services in the early stages of a disaster response.

The alliance of these firms with WFP improves the resilience of the HSCN and strengthens the hub firms position (Dhanaraj and Parkhe, 2006; Li *et al.*, 2016). As with the orchestration model, the orchestrator (WFP) can utilise the resources within the network and assign them where they are needed most, thereby extracting value from the network and adding value for all network members, more so the beneficiaries (Oloruntoba and Gray, 2009; Dhanaraj and Parkhe, 2006; Li *et al.*, 2016). Abidi *et al.* (2015, p. 51) identify the following value adding activities in the humanitarian supply chains: "sharing transportation costs and modes, ensuring the last mile distribution, deploying new infrastructure, increasing responsiveness, promoting sharing information about the need of beneficiaries, in-kind donations and synchronizing the logistics activities at tactical and operational level efficiently". Vega and Roussat (2015) describe supply chain management processes as being orchestrated by humanitarian service providers or LSPs. Their study indicates humanitarian network structures as consistent with the collaborative efforts and evolution of firms in the LSP industry. Abidi *et al.* (2014, p. 49) present four components (p. 49) and tasks for humanitarian LSP, summarised as:

(1) Architect integrator (AC): SC design, relationship management, project management, logistics and SC innovation, SC risk management, SC systems integration, manages stability, implements SC/logistics processes.

(2) Control room: decision makers, manages and supports AC with SC strategy, manages vertical coordination, maintains neutral and impartial position, manages performance measurement and reporting, implements quality management systems.

(3) Supply chain infomediary: IT infrastructure, integration and design, data management, manages logistics and SC management systems, enhances coordination, knowledge and information sharing throughout the network.

(4) Resource provider: provides a full suite of logistics assets, facility location and tools, provides reverse logistics capability.

Cozzolino *et al.* (2012, p. 30) calling for future research in HL services provision, poses the question "whether the humanitarian logistics provider that is devoted to emergency management can be considered the 'orchestrator' of the entire logistics chain".

3.2.3 Orchestration in HL. The findings show similarities in the literature between coordination and orchestration in a humanitarian context. For example Akhtar *et al.*'s (2012, p. 87) research on "chain coordinators" resembles many of the characteristics of supply chain orchestration as previously described. They describe relief chain coordinators as:

> In humanitarian relief chains (HRCs), the coordinators are often central to the success of coordinated organizations because they lead a number of pivotal activities such as recruiting and retaining paid workers or volunteers, managing and developing staff, managing communication and information, allocating resources, managing accounts and funds, guiding senior managers, and building effective working relationships with relevant decision makers of involved parties like government or other NGOs.

In HRCs the umbrella organisation acts as chain coordinator (for example the cluster lead, i.e. WFP) presiding over horizontal coordination, while, strategic vertical coordination may be conducted by country director or programme manager (Akhtar *et al.*, 2012, p. 85). Cluster lead agencies also play a pivotal role as chain coordinators or orchestrators. By maintaining its central position, the network orchestrator has the ability to influence the network design and attract new members (Dhanaraj and Parkhe, 2006; Jahre *et al.*, 2009). The WFP for instance, acting as a hub firm can attract new members by offering logistics services, training, storage facilities and supply chain solutions (i.e. labelling, freight management). Disaster risk reduction, sharing knowledge and capacity building are also ways of attracting new members, whom in turn add value to the network (Jahre *et al.*, 2009; Allan *et al.*, 2013).

As with network orchestration, it is possible for the cluster lead (for example WFP are the cluster lead for logistics, WHO are the cluster led for health) to manipulate the supply network design strategically, for example, through the disaster phases. Depending on the level of coordination, conditions, technology and supply chain integration the humanitarian supply chain under the control of the cluster lead adapts to meet operational requirements (Ergun *et al.*, 2014). For example, the humanitarian supply chain can switch from delivering in-kind at the response stage to cash transfers in the recovery phase, depending on the market environment (Gelan, 2006). The hub firm aligns with strategic partners accordingly (i.e. commercial/military) and manages the transition of logistics processes, e.g. from agile to lean supply chain (Jahre *et al.*, 2009; Cozzolino *et al.*, 2012; Makepeace *et al.*, 2017). Jérôme and Gilles (2010), suggest a "collective strategic vision" among stakeholders[4] to manage the humanitarian supply chain, whereby a central hub (logistics team) coordinates resources, activities and interventions.

3.2.4 Humanitarian logistics in the digital era. HL and supply chain management has made progress in the last two decades in relation to research, practice, education and training (Kovács and Spens, 2011; Allen *et al.*, 2013). Allen *et al.* (2013) survey of HL practitioners identified, logistics planning and management, information systems for logistics, technical logistics training and project management as the top desired skills required for professional development. This supports recent articles on coordination mechanisms that support integration, coordination and collaboration in humanitarian supply networks (such as the use of LSPs and clusters as previously discussed). Other examples include models which promote collaborative decision making, coordination, supply chain performance, logistics systems, and information and technology based platforms which optimise logistics, planning and integration across the sector (Gavidia, 2017; Charles and Lauras, 2011; Ozdamar and Ertem, 2015; Tatham *et al.*, 2017; Heaslip *et al.*, 2012; Pettit and Beresford, 2005; Tapia *et al.*, 2012). Use of technology is recognised as a key driver of HL coordination and collaboration. However, it is often limited due to the following reasons: high cost, limited infrastructure, poor supply chain management, reluctance to collaborate or share information, mutual mistrust and lack of incentives or benefits (Kabra and Ramesh, 2015; Ergun *et al.*, 2014; Bealt *et al.*, 2016; Tapia *et al.*, 2013; Maon and Lindgreen, 2009; L'Hermitte *et al.*, 2015; Abidi *et al.*, 2015; Balcik *et al.*, 2010; Jensen, 2012; Jérôme and Gilles, 2010; Schulz and Blecken, 2010; Pettit and Beresford, 2009).

3.2.5 The evolution of HL orchestration. The development in recent years of information management and e-commerce is changing the landscape of commercial supply chains which inevitably impacts the humanitarian supply chain (Figure 2).

3.3 Choreography

In recent times, HL has continued to evolve and has moved from orchestration to choreography. Choreography employs a decentralised approach for service provision in HL.

Choreography, in contrast to orchestration, does not rely on a central coordinator/orchestrator. Rather, each actor involved in the choreography knows exactly when to execute its operations and with whom to interact. Choreography is a collaborative effort focusing on the exchange of messages in business processes. Choreography describes the interactions between multiple services provision by HL actors, whereas orchestration represents control from one party's perspective. This means that choreography differs from orchestration with respect to where the logic that controls the interactions between the services involved should reside.

3.3.1 Orchestration to choreography. The progression from a single firm focus to cross boundary focus of complex organisations has become possible by the emergence of virtual networks, web services and adaption of new technologies such as crowd sourcing (Ferraro and Iovanella, 2015). While the orchestration model positions the hub firm at the centre of the network as the prominent network member, networks have evolved to include multiple hubs collaborating in a decentralised fashion. Ferraro and Iovanella (2015) propose the choreography model where network activities and responsibilities are coordinated by all network members with absence of single prominent member to produce network outcomes. They define choreography as "the network's capacity to address collaboration among multiple members" (p. 5). Peltz (2003, p. 46) states that: "orchestration represents control from one parties perspective, choreography on the other hand is represented as collaborative in nature" enabling autonomy among the members (Ferraro and Iovanella, 2015). Choreography attracts new members based on ontology and homophily properties. Ontology considers members sharing a conceptualised view of the network supported by knowledge domain, explicit rules and defined terminology (code of conduct). Homophily considers the preferred relationships of network members based on common attitudes and like-minded interests. Choreography relies on members to actively engage in the management processes in a self-organised fashion. Knowledge flow is safeguarded by network ontology and promotes information sharing and collaboration among members. This has a positive effect on behaviour within the network and influences the collective pursuit of goals (Ferraro and Iovanella, 2015). The choreography model can be applied to decentralised humanitarian coordination mechanisms and network activities.

3.3.2 Humanitarian community of practice and choreography. Unlike traditional hierarchal organisation approaches, CoP facilitates collective learning and development among like-minded groups (Wenger, 2000). CoPs are structured in an autonomous fashion and driven by a symbiotic relationship between members that is informal and boundary spanning. Like the choreography model, CoP activities and responsibilities are coordinated by the members without any member taking prominence. Additionally, the CoP network structure is decentralised and has a cross boundary focus. Therefore choreography in the humanitarian sector might be considered as:

(1) a CoP represented through digital/social media (SM) (virtual CoP) or an inter/intra-organisational information platforms and;

(2) decentralised approach to coordination or collaboration among humanitarian actors, donors, military, stakeholders, beneficiaries and organisations.

3.3.3 Humanitarian CoPs and information services. The "Cash learning Partnership" (CaLP)[5] CoP facilitate collaboration, coordination, capacity building, information sharing and resource tools for the humanitarian sector. For instance, CaLP consists of over 150 organisations actively engaged in developing policy, practice and research in relation to cash transfer programming (CTP). CTP is an alternative method of delivering aid, whereby the beneficiary receives cash or vouchers conditionally or unconditionally. CaLP fits the choreography model in terms of ontology and homophily as members are driven by

common goals and collective vision, namely, delivering cash at scale and creating value and choice for beneficiaries. Kovács and Spens (2007) allude to the positive effects of "community based approaches in supply chain design" and beneficiary empowerment through cash interventions (Kovács *et al.*, 2010). Similarly, through the use of local resources and services beneficiaries have a collaborative role to play in creating value, otherwise known as service centre logic (Heaslip, 2015). Makepeace *et al.* (2017) make a similar argument and suggest services supply chain management (SSCM) as a conduit for beneficiary participation, responsibility and input of service delivery. Furthermore, they argue that programme managers can act in the role of systems integrators and influence how beneficiaries approach competing SCs for optimal value. However, Heaslip (2015) makes the point that beneficiaries seldom participate in value added activities.

Choreography can also be applied to information databases and CoP. Sites such as WFPs Operations Database offer open access providing country specific operational data. The Logistics Cluster provide key online tools such as, logistics capacity assessment, logistical operational guide and cargo tracking, and this allows decentralised coordination opportunities between humanitarian supply chain actors. The Logistics Supply System was developed to facilitate the efficient administration of relief supplies upstream and downstream of the supply network, with the ability to link and evaluate information from different sites (Kovács and Spens, 2007). Other examples include Relief Web, Solution Exchange (UN), the Overseas Development Institute, LinkedIn and the Professional Humanitarian Assistance and Protection. The Humanitarian Logistics Association is a CoP that offers training, education, knowledge sharing resources and events with the aim of improving HL professionalism supported through a collaborative community approach at a global network scale. Web-based information platforms such as CoP provide an opportunity for smaller NGOs to take advantage of online collaboration by extracting or inputting information and resources at minimal cost.

3.3.4 Choreography as decentralised humanitarian coordination. Poor performance during Hurricane Mitch in 1998 prompted the IFRC and Red Crescent Societies to change their organisational strategy from a centralised to decentralised supply chain network (Gatignon *et al.*, 2010). The regional concept consists of three Regional Logistics Units (RLUs): Panama, Dubai and Kuala Lumpur. The RLUs provide assistance for 30–35 countries each, plus nine logistics delegates assigned from Lebanon, Chad, the Philippines, Indonesia, Sri Lanka, Pakistan, Mozambique, Sudan and Kenya (special operations). The decentralised supply chain structure was implemented to allow greater efficiency through local knowledge and proximity to disaster areas. This concept was to provide more control to the regions in terms of preparedness and response and improved performance and efficiency (Gatignon *et al.*, 2010). IFRCs societal membership allows flexibility (decentralisation) in parts of the network when needed, community based resilience and a strong volunteer network. The RLUs store and source adequate stocks as required by the IFRC. The RLU supports local national societies (NSs) and populations. The NSs consists of volunteers and are in effect a network of CoPs. Procurement, sourcing, tracking and delivery of items are now carried out at a local and regional level. RLUs and federation delegates using frame agreements coordinate country specific items. The IFRC logistic and resource mobilisation department oversees the global function and provides logistics services. IFRC fits the choreography model in terms of ontology and homophily as members are driven by common goals and collective vision. The strategic focus of IFRC is on multiple hubs coordinating at regional level in a decentralised supply chain network.

3.3.5 Social media and decentralised coordination. The Haiti earthquake in 2010 was the trigger for decentralised coordination (choreography) facilitated by SM tools and

virtual CoP. Disasters and social turmoil are inextricably linked and community participation in relief efforts is commonplace (Drabek and McEntire, 2003). In the event of a disaster, SM and IT tools can facilitate community participation and help influence decentralised coordination through online exchange of information (Ergun *et al.*, 2014; Simon *et al.*, 2015). Unlike traditional web-based online tools, SM provides real-time visibility. The Haiti earthquake, Hurricane Sandy (in 2012) demonstrated the value of SM as a key tool for accessing and disseminating information and its positive effect on decision-making process. Between them, over 24 million tweets were posted. The versatility of SM interface allows multiple applications to be accessed instantaneously, i.e. the use of URLs used as links on tweets (Simon *et al.*, 2015; Yates and Paquette, 2011). Applications such as YouTube, Facebook, e-mail, texts, Instagram, the cloud and blogs are all fragments of information that add to the overall situation on the ground (Yates and Paquette, 2011).

Understanding the situation on the ground early on is critical to the response efforts. In relation to HL and relief supply chain, mapping the state of critical infrastructure, logistics assets, resources and local capacity can have a positive effect on coordination, agility and help alleviate further suffering (Tapia *et al.*, 2012; Tatham *et al.*, 2017; Ergun *et al.*, 2014; Kruke and Olsen, 2012; L'Hermitte *et al.*, 2015). Although susceptible to misinformation, Simon *et al.* (2015) describe SM as self-regulating whereby users and authorities are quick to make corrections. The evolution of HL choreography is illustrated in Figure 2.

3.4 The evolution of HL coordination to choreography

Hurricane Mitch was the trigger for the IFRC to change its strategy to a decentralised supply chain. This was facilitated by the RLUs (hubs) strategically located around the globe and managed by local Red Cross societies. The Haiti earthquake demonstrated the value of SM and decentralised coordination and the influence that public participation has on disaster management, more so in terms of supply chain decision making and design. Virtual network technology facilitates integration of multiple remotely located computers and digital devices. For HL, it has extended the reach of CoPs and enabled decentralised coordination and collaboration in the form of knowledge management, supply chain management, information sharing, online resources and tools. Again some of the triggers for change are as a result of high profile disasters, however, the implications this time impact HSC design (SC integration) and strategic focus (outsourcing and investment in IT). The shift from a central hierarchal network position in the HSC to a decentralised HSC mirrors the choreography model (Figure 2). Furthermore, it is worth noting that the shift from military doctrines of command and control (C2) with the emergence of the UNDRO in the 1970s was an early indication of efforts to coordinate in the sector in spite of mutual mistrust between UN agencies, governments, military and humanitarian actors (Alexander, 2002). This research does not cover C2, but our model shows its place in the evolution (see Figure 2).

4. Discussion

The aim of this study was to first, chart the evolution of humanitarian coordination and determine how it has developed and evolved, what were the reasons for these changes and how has it been facilitated. Second, does orchestration and choreography occur in HL supply chain networks and does the evolution reflect this? Our findings suggest that HL coordination has evolved to include orchestration and choreography from a SSCM perspective (Figure 2). This research has provided examples of orchestration as central coordination in HL in the form of the cluster concept and the role played by humanitarian and commercial LSPs. Likewise, the study reveals choreography represented as

decentralised coordination in the form of CoP, HOs decentralised supply chain and collaboration through online HL resource and information sites. The evolution of HL coordination occurred mainly because of global politics, and high impact events caused by "natural", man-made disasters and complex emergencies, and efforts to professionalise the sector. These changes have occurred usually as structural organisational reform as in the case of the UN. It has been argued in the past that HL and supply chain management are ten years behind the commercial sector (Thomas and Kopczak, 2005). However, from a research and practitioner perspective, there are signs that this is changing (Kovács and Spens, 2011; Allen *et al.*, 2013; Goffnett *et al.*, 2013).

The advent of digital technology and SCM has influenced how supply chain networks evolve (Pramatari, 2007; MacCarthy *et al.*, 2016; Ergun *et al.*, 2014). High impact events such as the Haiti earthquake have also revealed the benefits of SM as a key tool in decentralised coordination. Moreover, the shift to orchestration and choreography is facilitated by service supply chain management, supply chain integration, virtual coordination mechanisms, humanitarian and commercial partnerships, CoP and the strategic importance of LSPs (Makepeace *et al.*, 2017; Ergun *et al.*, 2014; Soosay and Hyland, 2015; Heaslip, 2015).

4.1 Coordination

It is well documented that establishing trustful relationships in HL is deemed necessary to promote positive coordination, however, is often compounded by the nature of hastily formed relief networks (Schulz and Blecken, 2010; Tatham and Kovács, 2010; MacCarthy *et al.*, 2016). Tatham and Kovács (2010) present the concept of "swift trust" as a force multiplier, promoting inter-organisational collaboration and coordination between HOs.

Early evolution of the humanitarian sector came as a result of reform with new agencies mandated to implement effective inter-organisational policy and action, for example, the IASC and the implementation of the cluster approach (Alexander, 2002). This is in line with George (2002) research on organisational theory which identifies the need for policy makers to influence the military to coordinate more effectively with relief agencies. The lack of professionalism, systems or structures is also highlighted. Efforts in the 1990s to professionalise the sector focused on three components of humanitarian action: "institutional capacity to deliver services; governance, management structures, systems, and policies; and professional skills and competencies of staff" (Walker *et al.*, 2010, p. 2224). These issues came to the fore once again in the aftermath of Indian Ocean earthquake and tsunami, highlighting poor coordination of logistics and inferior supply chain management practice.

4.2 Orchestration and choreography

The findings of this study show that orchestration is facilitated by humanitarian or commercial LSPs and occurs centrally at network or regional level as vertical or horizontal SC coordination. On the other hand, choreography involves peer to peer coordination representing a decentralised approach occurring at network or regional level as vertical or horizontal coordination and collaboration. Choreography occurs in CoP, virtual collaborative information services (with a service dominant logic) and emergent participation through SM apps and services (Drabek and McEntire, 2003; Day, 2014; Kapucu *et al.*, 2010). It is possible that orchestration and choreography may only exist where HOs have developed trustful relationships and governance in the SC network.

The growing complexity of global networks and demands of customers has forced firms to rethink their business strategy in order to remain competitive and extract value by outsourcing non-core competencies, likewise it is important that humanitarian supply chains embrace a service approach as a means for delivering aid and adding value for

network members (Abidi *et al.*, 2015). Our findings provide some examples of this shift. Heaslip (2015, p. 2) shares a similar view making the argument that HL must accept the inevitable by "embracing new strategies, techniques and technologies for improving productivity and quality in service operations in humanitarian logistics" (p. 2). Makepeace *et al.* (2017) consider programme management vs logistics input and argue that a "service dominated view of supply chain management (SSCM) suggests that there is always a supply chain to manage" (p. 48). Similar to Heaslip, Kovacs and Grant (2018), we argue that a broader service paradigm needs integration with HL for IHOs to maintain a competitive advantage as the practice of HL for disaster response and management has shifted in the direction of providing services. Now, the execution of activities, such as deliveries, repair and maintenance, customer training, problem recovery, invoicing, can be incorporated into the service process (Heaslip, Kovacs and Grant, 2018). In effect, HSCM is a constant process from preparedness to response through the recovery stages and is supplemented where necessary by programme managers in the form of SSCM. The collaboration between commercial LSPs and HOs is not always a straight forward affair according to Bealt *et al.* (2016), who cite the reluctance of HOs to relinquish control while LSPs seek to be competitive.

In the humanitarian context, there is a tendency within the literature to use the term "coordination" and apply it across a broad spectrum of logistics, relief supply chain and collaborative activities (see for example, Kunz and Reiner, 2012; Leiras *et al.*, 2014; Overstreet *et al.*, 2011). General management literature would indicate that supply chain coordination has evolved as a result of the emergence of internet technology (IT) which in turn has enhanced the service sector (Pramatari, 2007; Soosay and Hyland, 2015; MacCarthy *et al.*, 2016; Ergun *et al.*, 2014; Heaslip, 2013). IT has facilitated supply chain network collaboration from a supplier-customer perspective and the increased use of LSPs as supply chain and network orchestrators (Dhanaraj and Parkhe, 2006; Peltz, 2003; Zacharia *et al.*, 2011; Tewoldeberhan and Janssen, 2008). In the commercial sector, collaborative information sharing is second nature and knowledge management is highly valued (Sorbi *et al.*, 2017). The HSCN has adopted a service orientation approach to HL coordination, either as provider or receiver of services (Heaslip, Kovacs and Grant, 2018). This provides HOs with access to logistics services and technology while reducing uncertainty and costs (Gunasekaran *et al.*, 2004). New technologies, e-commerce and collaborative web platforms have helped reduced order and process cycle times, while increasing real-time visibility throughout the supply network. Moreover, access to technology has been a challenge for HL, mainly due to cost and fragmented non-collaborative use among smaller NGOs (Ergun *et al.*, 2014). HOs, despite competitive funding, need to better understand their limitations and strengths and take advantage of the HSCNs resources. Significantly, the emergence of choreography from orchestration is a stark reminder of the alarming rate business models continue to morph in an attempt to keep up with rapid technological advances (Sorbi *et al.*, 2017). Significantly, the literature on choreography is quite scant and it is mostly revealed within the orchestration body of literature, whereby academics distinguish between central and decentral positions or types of coordination in a network.

5. Conclusion

This paper is conceptual – its purpose is to provide a research agenda for HL scholars. It thus initiates a discourse on the evolution of HL from coordination to choreography. Understanding how HL coordination has evolved provides new opportunities to improve existing practice by the application of contemporary coordination and collaborative concepts. This research mapped the evolution of HSCNs, describing what triggered and facilitated change.

We have demonstrated that HL evolution shows parallels to commercial supply chain networks and in doing so, applies the concepts of orchestration and choreography to HSCNs. This, we would argue, provides sufficient grounds to warrant further investigation in the humanitarian context and could lead to new research opportunities, for example, research is required to see where the concepts of orchestration and choreography interact with the disaster management cycle. The practice of HL provision for disaster response and management has shifted in the direction of providing services (Heaslip, Vaillancourt, Tatham and Kovacs, 2018; Heaslip, Kovacs and Grant, 2018; Vega and Roussat, 2015), exploring how the concepts of orchestration and choreography impact on service provision can add to our understanding of HL provision.

To summarise the contribution of this paper, this study has contributed to the HL literature by increasing the understanding of orchestration and choreography in HL and identifying issues for further research. The research revealed that network coordination has moved on in the commercial sector to include orchestration and now, choreography concepts which have not been tested in HL literature. This reveals a lag exists between HL research and practice. This study draws on multiple bodies of literature, and in doing so demonstrates a paradigm shift to network orchestration in commercial supply chain networks which transcends HL and disaster management literature.

There were a few limitations to our research. The research criteria for data selection only included peer-reviewed papers; future research might consider practitioner journals and conference papers revealing new insights. The concept of orchestration and choreography in HL requires empirical validation. HSCN such as UNHRD, IFRCs RLUs, commercial LSPs and humanitarian CoP provide an opportunity to test orchestration and choreography in an empirical setting. Despite the limitations of our study, this research provides fresh insight by establishing a novel approach that needs evaluation by further studies.

Notes

1. For this research a community of practice is groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.
2. The phrase civil protection has gradually come into use around the world as a term that describes activities, which protect civil populations against incidents and disasters (Alexander, 2002).
3. The one who sells product to the customer is called a vendor, whereas the one who supplies goods to a company or provides services to a vendor is supplier. So to be more exact, the vendor is last man of supply chain and supplier is middleman of the supply chain (Gunasekaran *et al.*, 2004).
4. The authors in this context adopt the definition provided by Tatham and Kovács (2010) wherein stakeholders, those impacting on disaster relief, while actors are those actively involved in delivering relief.
5. The Cash Learning Partnership (CaLP) is a global partnership of humanitarian actors engaged in policy, practice and research within Cash and Voucher Assistance (CVA). CaLP currently has over 80 members who collectively deliver the vast majority of CVA in humanitarian contexts worldwide.

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