

# **THE APPLICABILITY OF COMMERCIAL SUPPLY CHAIN MODELS IN HUMANITARIAN SUPPLY CHAIN THINKING**

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## **Abstract**

This research argues that there are a number of potential pitfalls when using traditional commercial supply chain models for humanitarian supply chain issues and it examines the extent to which existing humanitarian supply chain thinking is based on commercial supply chain concepts. The issues and challenges faced by humanitarian supply chains are distinctive, with their own complexities and this paper examines the limitations of existing models and takes a new holistic approach.

## **Keywords**

Commercial Supply Chain Models; Holistic Approach to Humanitarian Supply Chains; Complexity; Systems Thinking.

## **Introduction**

This year's conference theme of 'Building a Platform for International Success' is one of the building blocks which underpins disaster relief operations around the world. In comparison to Supply Chain Management in the commercial context, humanitarian supply chain management is a relatively new discipline which only became accepted as being distinct after the 2004 Boxing Day Tsunami, an era heralded by the establishment of the Journal of Humanitarian Logistics and Supply Chain Management. Individual elements of the humanitarian supply chain such as procurement, in-country logistics management and the delivery of humanitarian commodities can be studied and analysed using existing supply chain models and frameworks emanating from, for example established economic and management theory. However, the authors argue that there are few if any models that take a holistic view that can represent the humanitarian supply chain with all its complexities. Taking a holistic view is essential when attempting to study and analyse supply chain information flows, or understand how a disaster relief operation can derive increased effectiveness and efficiency through coordination, cooperation or collaboration. This is because it is necessary to understand what effect information and decision-making in one part of the supply chain has on the rest of the supply chain.

Existing models take a reductionist approach by looking at individual functions or processes of the humanitarian supply chain in relative isolation. However, by considering the humanitarian paradigm not as a chain, but as a network with inter-dependent stakeholder and decision-making elements, it is possible to make sense of the linkages and information flows between the constituent parts. This can be done by taking a Systems Thinking approach to deliver a holistic view of the humanitarian supply chain as an inherent complex network.

This paper forms part of an ongoing PhD which looks specifically at the flow of information in humanitarian supply chains, and in particular, the role of coordination, cooperation and collaboration.

## **Literature Review**

When considering humanitarian supply chain issues, early contributors merely applied commercial practice and commercial supply chain thinking. For example, in defining humanitarian supply chain management, Thomas and Mizushima (2005) simply relabel the Council of Supply Chain Management Professionals definition 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

point of origin to point of consumption for the purpose of meeting the end beneficiary's requirements'. The straight substitution of the term 'end beneficiary' for the existing word 'customer' demonstrates the reductionist thinking and lack of understanding of the complexities of the humanitarian paradigm at the time. Chandes and Paché (2010) are amongst the first to recognise the challenge of using commercial logic when attempting to describe the emerging discipline of humanitarian logistics using hitherto traditional models through their acknowledgement that the 'manufacturing perspective and service perspective is not necessarily relevant' (p.322). They explain that humanitarian logistics is a service because it provides assistance not just to the victims of a disaster, but also to those providing the relief; however, it also parallels the manufacturing sector because 'the delivery process requires a great deal of material and technological resources, notable in terms of transportation, handling and warehousing of products'.

The need for frameworks to be developed to assist logistic practitioners is acknowledged by Overstreet, et al (2011), D'Haene (2015) and Carroll and Neu (2009), but attention is drawn to the issues of ownership and control by Kovacs and Spens (2009), MacLachlin and Larson (2011) and Christopher and Tatham (2011). For example, an aspect of inventory strategy which has greater ramifications in the humanitarian supply chain than in the commercial world is the dynamics of Push and Pull logistics, where tight control must be exercised. Oloruntoba and Kovacs (2015) look at this in some detail and Chandes and Pache (2010) consider this in the wider context of NGO reaction and collective action. However, to recognise which of these strategies is applicable in a particular set of circumstances requires coordination throughout the supply chain. To actually switch from one to the other when the time is right not only requires coordination, but a level of cooperation.

Considerable literature exists which describes the design of humanitarian supply chains as being bespoke (Altay (2008); Besiou and Van Wassenhove (2011); Charles, *et al* (2011); Cozzolino (2012); Olorundoba and Kovacs (2015); and Pettit and Beresford (2009)), and by inference, it suggests that by attempting to map a humanitarian supply chain, only a general description can be produced which can mainly be attributed to the high degree of complexity of such structures. In concurring that humanitarian supply chains are designed to meet the needs of each individual operation, others have mapped the design in terms of their qualities: agility, adaptability and alignment (Bhattacharaya, et al (2016); Dubey and Gunasekaran (2016) and L'Hermitte, *et al* (2016)).

Seven models and frameworks have been identified in the literature which have either been used to analyse specific areas of the humanitarian supply chain or have been adapted locally for use in analysing the humanitarian supply chain. All were initially developed for use in commercial supply chain management and no single framework can be found that encompasses the humanitarian supply chain as a bespoke and separate entity, reflecting its own unique challenges and issues.

### **The Challenge**

Even though they share critical elements such as procurement, transport and warehousing, there are significant differences between commercial and humanitarian supply chains. A wealth of knowledge and experience of commercial supply chains has developed since the term supply chain was coined in 1982 and several models have been developed to help understand the supply chain and elements of it in a commercial context. However, this is not the case for humanitarian supply chains. Two models which have been borrowed from the commercial world and applied to specific elements of the humanitarian environment are the SCOR Model, and the model designed for the Global Supply Chain Forum as described by Cooper, *et al* (1997) for integrating and managing business processes across the supply chain. Whilst their application is appropriate in the management of transport assets or the procurement of storage facilities, they often fall short when applied to an entire supply chain operating in highly volatile political situations and in austere infrastructure conditions, staffed by a well-meaning, enthusiastic volunteer workforce that is not necessarily trained for the job they are undertaking.

Added to the challenge is the theoretical complication of the absence of supply chain theory which has been recognised for many years. Several contributors have applied Value Chain theory by Porter (1985) as their basis (Christopher (1992), Chopra and Meindl (2004), Lysons and Farrington (2006) and Grant, *et al* (2006)). Haberberg and Rieple (2001) developed value chain analysis to be applicable to service organisations while recognising that even this needed to be adapted if it were to be of use to non-competitive organisations such as in the public sector. Wikström and Normann (1994) considered the value contributions of stakeholders to public sector and third sector businesses in their Value Star, but all these models are of limited use to the humanitarian sector.

Overstreet, *et al* (2011) observe that humanitarian operations are complex and reiterate that the field of supply chain management has little specific theoretical basis. Instead, supply chain management relies on several models and frameworks which link into what Sweeney, *et al* (2015) describe as the Four Fundamentals Construct and theoretical foundations such as Porter's Value Theory, Commons' Transactional Cost Economics (TCE) Theory and Freeman's Stakeholder Theory, as shown below in Fig. 1. These three theories are applied consistently in commercial supply chain scenarios. However, with the developments in specific humanitarian supply chain management, other theoretical bases are now being considered including Macneil & Macauley's Channel Coordination Theory which is derived from Relational Contract Theory, Von Neumann & Morgenstern's Games Theory and Barney's Resource-Based Theory. Despite being grounded in industrial and commercial economics, these have contributed to the concept Bowersox, *et al* (1985) refer to as Materials Logistics Management (MLM).

### **The Research**

This research recognises an interesting use of terminology. Tatham and Pettit (2010) cite several authors in their agreement that the phrase 'supply network management' rather than 'supply chain management' is a more accurate reflection of the reality found in humanitarian scenarios. Zhao and Xia (2014) describe how network interoperability is an essential element of networks and that interoperability is best achieved through collaboration and the resulting interoperability of partner systems, as found in humanitarian operations. In their qualitative study, Jahre, *et al* (2016) identify demand characteristics, logistics and the policy and security situation as the factors which influence the design of what they refer to as a humanitarian supply network. This research also embraces this term for use in the humanitarian context. This paper seeks to identify the most appropriate conceptual approach to take when viewing the humanitarian supply network holistically. Specifically, it concentrates on the distinct issues and challenges that are characteristic of the humanitarian supply network which, if they feature in a commercial supply chain, only do so on a much smaller scale.

### **The Concept of The System**

In describing the 'single system' of direct transaction between a commercial provider and the customer and the 'dual system' between a humanitarian donor and an NGO and then the NGO and the recipient, Carroll and Neu (2009) acknowledge the complexity of the humanitarian supply network reflecting the funding, stakeholder relationships and the in-country context where infrastructure, resources and societal instability can severely impact on aid delivery. Meanwhile, Senge (1990) describes Systems Thinking as 'a discipline for seeing the structures that underlie complex situations'. In the literature, Li, *et al* (2010), Hearnshaw and Wilson (2013) and Bowersox, *et al* (1985) show that there is broad consensus that the humanitarian supply network is systemic in nature, but despite Nassimbeni and Sivadasari, *et al* suggesting a strong correlation between supply chains generally and Systems Thinking in New and Westbrook (2005), there is little evidence to suggest that Systems Thinking has been used as a theoretical base for studying supply chain management in either the commercial or humanitarian context. It therefore seems logical to look at existing concept models and frameworks through a Systems Theory lens. Checkland (1981) defines

'root definition' as 'the description of the set of purposeful human activities conceived as a transformation process' (p.169), and therefore determining a root definition for the humanitarian supply network will involve understanding these purposeful human activities by studying them subjectively using qualitative methodology. Within the Systems concept model, Checkland (1981) shows how the system transforms inputs into outputs: 'the concept model is what will accomplish that which is defined'. This root definition is an account of what the system *is*, the conceptual model is an account of the activities which the system must *do* in order to *be* the system named in the definition (p.169) and together, they identify the actions required to improve the problem situation.

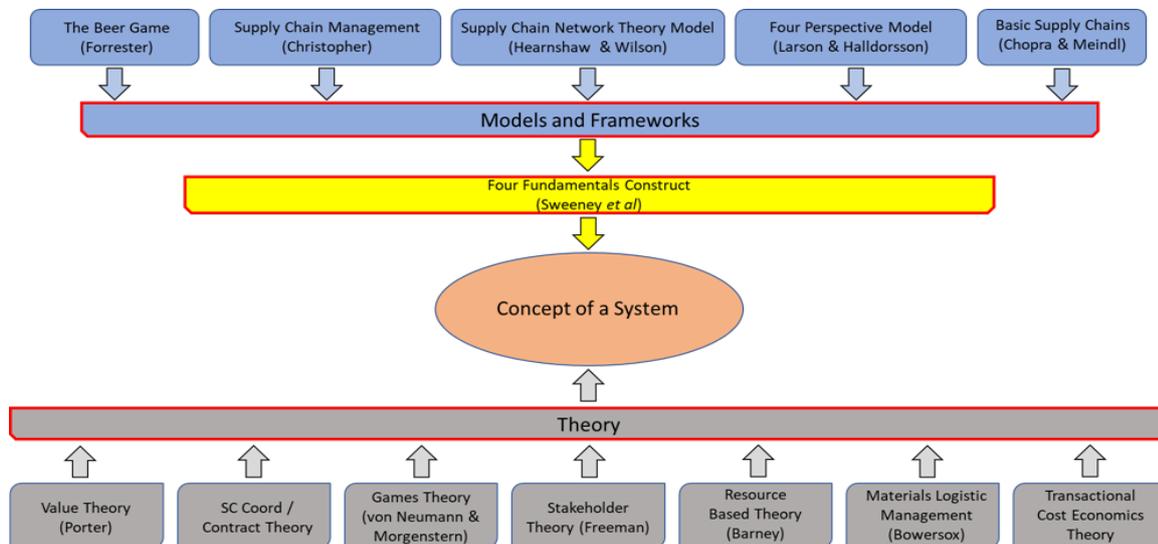


Figure 1. The contribution of theory, models and frameworks to the concept of the Humanitarian Supply Chain as a System.

## Analysis

### **Current Thinking**

Lindgreen, *et al* (2013) consider how humanitarian supply chains compare with commercial supply chains and recognise that NGOs are subject to challenges in terms of relationships and interaction which are not normally experienced in the business world. Even though they acknowledge that NGOs can be involved in both simple supply chains and complex supply networks, they do not identify any contemporary business models or frameworks that can assist the humanitarian logistician.

The models based on the five business processes of suppliers, manufacturers, distributors, retailers and customers, as introduced by Forrester (1958) and developed by Christopher (1992) and Chopra and Meindl (2010), have no relevance to the design of humanitarian supply network operations, not least because concentrating on just processes involves taking a reductionist view. However, despite the SCOR model being essentially based on these five process models, it introduces the notion of planning which implies that organisational hierarchy has a fundamental role to play in supply network activities. Firmly grounded in commerce, the SCOR model as translated by Van Wassenhove and Martinez (2012) introduces this extra dimension of decision-making, one which is articulated well by Blecken (2010) whose model comes closest to recognising the horizontal and vertical nature of the humanitarian supply network. Both the model presented by Cooper, *et al* (1997) and the one developed from it by Chen and Paulraj (2004) take a fresh view of the commercial supply chain, providing a deeper understanding by taking a more holistic approach.

However, Akhtar, *et al* (2012) fail to take a holistic view. They concentrate on the flow of material rather than the flow of information and the coordination of activities. There is little recognition of stakeholder engagement, but their model can be read as a one-dimensional map of what they refer to as a humanitarian relief chain. Duddy, *et al* (2017) make an early attempt in achieving a holistic view of the humanitarian supply network but recognition of the vertical flow of information is implied rather than specified.

Clearly, early modelling of supply chains concentrated on the business processes involved in forging raw materials into products and getting these products to the customer. As sharper definition was given to supply chain management and logistics (Howden (2009) and Chandes and Paché (2010)), the business processes were largely taken as read, and focus switched to the supply chain management functions such as those expressed by Cooper, *et al* (1997). This set the scene for an in-depth examination of supply chain enablers such as technology and the role of stakeholders and other actors. The importance of the flow of information is evident in these original models but not necessarily understood by later iterations of the original source model, but the multi-dimensional nature of information tends to typify the humanitarian supply chain more than its commercial counterpart. It is clear that the early work of Christopher (1992) is the genus of Blecken (2010)'s model, while the Van Wassenhove and Martinez (2010) model bears all the hallmarks of the SCOR model.

<b>Model</b>	<b>Relevance</b>	<b>Limitations</b>	<b>Humanitarian Applicability</b>
Forrester (1958)	Reflects the management processes	Developed for commercial business	None; already developed by Van Wassenhove and Martinez (2010)
Christopher (1992)	Reflects the management processes	Developed for commercial business	None; already developed into an HSC applicable form
SCOR Model (c.1996)	Easily translated into an HSC form. Rich in process support detail	Only focuses on strategic processes	Some; requires translating by an experienced HSC manager
Cooper, <i>et al</i> (1997)	Gives depth of detail and acknowledges information flows	Commercially focused; significant relabelling required	Limited in its current form but a sound basis if relabelled
Chen and Paulraj (2004b) – External	Takes account of other stakeholders and could be developed to cover supply networks	Doesn't deal with vertical and horizontal information flows	Good starting point from which to develop a multi-dimensional model
Chopra and Meindl (2010)	Reflects the management processes	Developed from Christopher as a foundation for other detailed commercial processes	None
Blecken (2010)	Multi-dimensional and includes an embryonic consideration of information flow. Captures the three levels of operations	Lack of management process detail	Excellent basis from which to develop a model which covers the complexity of the management aspects of the supply chain
Van Wassenhove and Martinez (2010)	Effectively the HSC version of SCOR; evidence that it has been adopted by NGOs	Doesn't deal with vertical and horizontal information flows	Good starting point from which to develop a multi-dimensional model
Akhtar, <i>et al</i> (2012)	Recognises diversity in supply sources and the need for information flows	No recognition of coordination or stakeholder engagement	A basis for demonstrating material flows but little else
Duddy, <i>et al</i> (2017)	Captures complexity and the three levels of operations	Implies, but doesn't specifically address information flows	Good starting point from which to develop a multi-dimensional model

Table 1. Existing Model Applicability to the Humanitarian Supply Chain: A Comparison.

While each of the models above contribute much to commercial supply chain thinking, none of them can be applied to the humanitarian environment without alteration or adaptation. Therefore, in the absence of a bespoke humanitarian model and the limited applicability of commercial models, a theoretical gap exists.

### **Complexities and Conflicts**

It is without question that some commercial supply chains can be exceedingly complex, as Sarpong (2014) describes in his research into the food supply chain at the heart of the UK horse meat scandal of 2013. However, even with their level of complexity, commercial supply chains are more controllable because of the business need to be transparent and accountable, where a loss of either can have a detrimental effect on a company's bottom line. The complexities both induced and inherent in a humanitarian supply network are more pronounced and nuanced. Ergun, *et al* (2014) note that the first level of complexity occurs when more than one relief organisation becomes involved in a single relief operation 'because many organizations operate according to their own systems and objectives while at the same time working to contribute to the overall humanitarian cause' (p.1002). Each organisation may introduce a separate, distinct supply chain tailored to its own specific goals and needs.

With multiple supply chains supporting one operation, a supply network arises, and Ergun, *et al* (2014) make the connection between this additional complexity and the need for robust coordination. Van Wassenhove and Pedraza Martinez (2012) discern that the operating conditions faced by humanitarian logistics are distinctly complex and include supply and demand uncertainty and a high degree of decentralisation. Such is the level of complexity in the humanitarian supply network that they propose using operational research (OR) to find solutions to the complex problems faced by humanitarian aid agencies.

Olorundoba and Kovacs (2015) see environmental instability as a significant distinction between humanitarian and commercial supply chains while Bharosa, *et al* (2010) refer to the dynamic nature of the humanitarian environment and recognise that deciding and acting in a disaster response situation is a 'challenging process for each individual, because everyone is faced with severe time-pressure and a flood of information that may be inaccurate or out-dated by the time a decision or action takes place. Such a complex, intense and information-rich environment can easily result in cognitive overload at an individual level' (p.51).

Altay and LaBonte (2014) associate complexity with the chaotic nature of damage, and in addition to discrimination, corruption and ethnic bias, suggest the factors below as being key to contributing to humanitarian supply network complexity:

- Supply chain issues: uncertainty in demand and supply;
- Funding issues: donors with specific targets;
- Needs assessment and procurement: accuracy and timeliness;
- Management of information: information systems and connectivity;
- Coordination issues: supply chain ownership, control and management;
- Infrastructure and network design: enabling the supply network through available infrastructure;
- Standardisation issues: lack of conformity and modular solutions;
- Operational issues: resource availability and consignment-specific issues;
- Personnel issues: qualification, experience and turn-over.



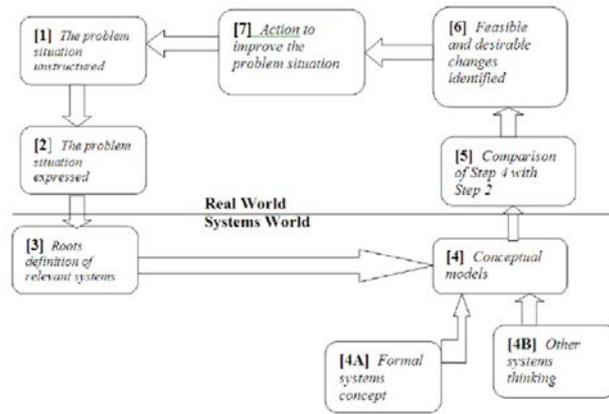


Figure 3. Soft Systems Methodology, Checkland (2000).

SSM can be adapted to deliver this flexibility because it is based on the principle of deriving a root definition for a problem using six established crucial characteristics, described by Checkland (1981) as CATWOE, but for the humanitarian paradigm, this mnemonic would have to be adapted. As a problem-solving tool, SSM comprises seven distinct steps; however, of the purposes of this research, it will only be necessary to follow the process to Step 4. This research considers the Real-World problem and express the problem situation, but the model development occurs within the Systems Thinking domain, culminating with the definition of domain specific knowledge guidelines. The development of a method to derive root definition for problems in the humanitarian supply network that represents a significant contributions to knowledge.

### **Conclusion**

All research is underpinned by a conceptual basis but the research currently being undertaken in the field of humanitarian supply network management suffers from a lack of applicable models and frameworks. The theories underpinning current work are drawn from commercial supply chain thinking and adapted to specific challenges and issues arising during humanitarian operations. This leads to a reductionist view of the challenges and issues because they are viewed in isolation, as either supply chain processes or functions; not holistically as part of a much greater and more complex paradigm.

Systems Thinking offers a robust conceptual model in the form of VSM because, in a similar way to Blecken (2010), it can be applied to a multi-layered supply chain organisation operating at strategic, operational and tactical levels but it can also handle the complexities of multiple supply chains coming together in a supply network. However, while VSM provides a sound conceptual base, it does not have the flexibility of coping with issues that have hitherto not be captured by commercial supply chain models. Should such issues arise, SSM becomes a valuable tool because by deriving a root definition of the system from the problem situation, a conceptual model can be developed using an array of other Systems Thinking tools, taking into consideration such factors as the customer, end beneficiary and donor; all the stakeholders; the owners of the system; environmental constraints; the desired transformation process to resolve the problem; and the world view (Weltanschauung) that makes this transformation meaningful within the context of the whole system.

By taking a systems approach to research and using VSM as the initial conceptual basis, issues within the humanitarian supply network can be identified, examined and analysed in a holistic manner with a full understanding of the impact that a localised solution would have on the greater system. Where problems become difficult to resolve within VSM, SSM offers a fully flexible, holistic solution by providing a CATWOE-type framework from which to derive a bespoke conceptual model through the determination of a problem situation specific root definition.

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