As disasters are affecting millions of people around the world, humanitarian supply chains are changing to identify needs and to respond to those affected. To achieve successful humanitarian operations, humanitarian supply chains need certain capabilities to anticipate the effects of a disaster, quickly mobilise the necessary resources and provide better services through these capabilities to the people in crisis. In other words, they must be resilient while scaling up quickly to meet unpredictable demands. Thus, the primary aim of this thesis is to explore the concept of scalability and understand how scalability contributes to various outcomes, such as resilience in HSCM, through three essays. The first essay is based on a systematic literature review to deepen the understanding of theoretical approaches and concepts borrowed from other research fields in humanitarian supply chain management. It is entitled ‘Borrowing Theories in Humanitarian Supply Chain Management’. The second essay is ‘Investigating Scalability for Building Supply Chain Resilience’, and the third essay is ‘Supply Chain Scalability: The Role of Supply Chain Integration’. Both the second and the third essays are based on a single case study in a humanitarian setting. A framework of scalability is developed through the dynamic capabilities view, as humanitarian organisations are operating in one of the most turbulent environments. Furthermore, this thesis contributes not only to humanitarian organisations but also organisations that face regular turbulence because the business environment is becoming increasingly turbulent.
Scalability and Resilience in Humanitarian Supply Chains
Scalability and Resilience in Humanitarian Supply Chains

Key words: supply chain management, humanitarian supply chains, structural flexibility, integration, scalability, resilience, dynamic capabilities

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Supply chain management (SCM) and logistics have been at the core of every organisation that is striving to become more effective and efficient in terms of time, cost, and location. SCM has been defined as “the systematic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole” (Mentzer et al., 2001, p. 18). On the other hand, logistics management is a part of SCM and is defined as “that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers’ requirements” (CSCMP, 2015).

As globalisation has been increasing, both organisations and their supply chains have become exposed to risks. The streams of SCM dealing with disasters are supply chain risk management (SCRM) at the organisational level and humanitarian supply chain management (HSCM) at the beneficiary level. HSCM is the research stream of SCM and logistics management that overlaps with disaster management as well as the stream of SCRM that deals with risk arising from disasters. HSCM involves “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” (Thomas & Mizushima, 2005, p. 60).

HSCM has gained a great deal of attention both from academics and from practitioners, particularly after the 2004 Indian Ocean tsunami. The term HSCM refers not only to disaster relief operations, but also to development aid (Kovács & Spens, 2007a). In the SCM literature, disasters are studied under the SCRM stream at the commercial organisational level. SCRM looks into the ways of mitigating risks from external and internal factors. Disasters are among those external factors that affect the operations of commercial organisations all over the world. The starting point of this thesis is disaster trends. We are surrounded by different kinds of disasters or possibilities of disasters. The data from EM-DAT show that, although the number of disasters seems to fluctuate over the years, the number of people affected by them is actually increasing year by year (EMDAT, 2015).

If we look at the latest disasters, such as Typhoon Haiyan in 2013, the Nepal earthquake in 2015, or man-made disasters such as the Syrian civil war, it is understandable how logistics—with a limited amount of funding—can make a great contribution in disaster operations, as logistics activities account for 80% of HSCM operations (Van Wassenhove, 2006).

SCRM is defined as “the identification and management of risks for the supply chain, through a coordinated approach amongst supply chain members, to reduce supply chain vulnerability as a whole” (Jüttner et al., 2003, p. 201). As emphasised by this definition, supply chain integration or/and collaboration is a very important aspect of managing risk. There are tools to mitigate risks in the research field of SCRM. Supply chain resilience is one of the tools that is studied in SCRM, and building resilient supply chains is the main objective of efforts in this field (Colicchia & Strozzi, 2012). Resilience is a concept used in many different streams of science, from biology and psychology to
engineering (Pettit et al., 2010; Ponomarov & Holcomb, 2009). The concept has been adopted by commercial organisations to mitigate risks while facing supply chain disruptions caused by disasters. From an SCM perspective, resilience is defined as “the ability of a system to return to its original state or move to a new, more desirable state after being disturbed” (Christopher & Peck, 2004, p. 2). Supply chain resilience can be achieved through strategies related to collaboration, supply chain design, agility, and risk awareness (Christopher & Peck, 2004). In fact, resilience should be built into supply chain design considerations (Kamalahmadi & Parast, 2016; Melnyk, 2014). From a humanitarian organisation perspective, resilience is “the ability of an individual, a household, a community, a country or a region to withstand, cope, adapt, and quickly recover from stresses and shocks such as violence, conflict, drought and other natural disasters without compromising long-term development” (ECHO, 2013, p. 2).

The other main concept in this thesis is scalability. Scalability, or scale-matching (Baker & Refsgaard, 2007), in ecological economics refers to the ability to scale-up and scale-down in case of a disaster or “the ability to surge in response” (Baker & Refsgaard, 2007, p. 339). It has foundations in the manufacturing literature. Scalability is referred to as “surge capacity” in the healthcare sector, which highlights the expansion of healthcare services in times of crisis or disaster. More precisely, surge capacity is the “ability to manage a sudden, unexpected increase in patient volume (i.e. numbers of patients) that would otherwise severely challenge or exceed the current capacity of the health care system” (Hick et al., 2004, p. 254). Similarly, scalability in HSCM is the ability to scale up and scale down according to the scale of a disaster. HSCM operations are divided into three main phases: preparedness, immediate response, and reconstruction (Kovács & Spens, 2007a). In this thesis, the main focus is on the transition from preparedness to immediate response when the scaling up is activated.

In this thesis, supply chain scalability and resilience are discussed in the context of the Kenyan nutrition supply chain, where the supply chain is already scalable when responding to drought and other disasters. Scalability arguably contributes to supply chain resilience. In exploratory essays, supply chain scalability through structural flexibility and information sharing (Essay B) and supply chain integration (Essay C) were discussed, while an introductory essay (Essay A) aims to provide an understanding of theoretical approaches in HSCM and contributes to the development of a scalability-and-resilience framework by identifying the research gaps in HSCM. The main theoretical lens is a dynamic capabilities view (explained below). Scalability is discussed in the thesis as a proactive approach whereby certain organisational antecedents are in place before disasters happen.

Overall, this thesis aims to increase the understanding of HSCM beyond its current boundaries by contributing to the SCRM literature. The author is not seeking generalisations from a single case study approach; rather, he seeks to develop a framework and propositions that can be tested via further studies in different humanitarian and commercial settings.

1.1 Overall aim and research questions

The primary aim of this thesis is to explore the concept of scalability and understand how scalability contributes to various outcomes, such as resilience in HSCM, through three essays. A framework of scalability is developed through the dynamic capabilities view.

In Essay A, the objective is to understand the maturity of HSCM. Thus, the theoretical
approaches applied to the field are identified and evaluated using content analysis. The findings of the essay show that scalability is still at the level of proposition and hypothesis, while there is an effort to develop frameworks of supply chain resilience in the context of HSCM. Due to these findings, the findings of the general thesis were shaped towards developing a scalability framework in which supply chain resilience is the main outcome.

In Essay B, the objective is to evaluate scalability and resilience in an explorative way, and deepen our understanding of these two concepts in terms of dynamic capabilities in the Kenyan nutrition supply chain.

Essay C explores scalability through supply chain integration (process, information, and the integration of primary and supporting members of the supply chain) and how scalability can help to achieve resiliency in humanitarian supply chains in the Kenyan nutrition supply chain.

Overall, Essay A is a state-of-the-art look at HSCM, aimed at locating the research gaps in HSCM research. The findings of Essay A show that scalability and resilience in HSCM are still scant. Therefore, Essay A presents evidence that scalability and resilience in HSCM are worth studying. Essay B, on the other hand, looks at scalability through the lens of structural flexibility and information sharing and tries to see how scalability contributes to supply chain resilience. Finally, Essay C looks at supply chain integration (SCI), and at the role of SCI in building scalability.

The research questions addressed in each essay are as follows:

- RQ1: Which theories are used in HSCM? (Essay A)
- RQ2: Which disciplines does HSCM borrow theories from? (Essay A)
- RQ3: How is scalability through structural flexibility and information sharing implemented in humanitarian supply chains? (Essay B)
- RQ4: How can humanitarian supply chains be resilient through scalability? (Essay B)
- RQ5: What is supply chain integration in HSCM? (Essay C)
- RQ6: How does supply chain integration contribute to scalability in a humanitarian setting? (Essay C)

1.2 Core concepts

This thesis falls into the field of HSCM and the SCRM stream of SCM. The supply chain is the main focus of analysis in the thesis. In this section, the evolution of SCM is described, along with the characteristics of HSCM.

1.2.1 SCM and logistics management

Supply chain management appeared in the literature together with marketing, physical distribution, logistics, and distribution channels. Initially, SCM was seen as a method of improving customer service with better inventory management and overall channel performance (Ellram & Cooper, 1993). The definition and coverage of SCM has been discussed in the literature since just before the 1960s (Forrester, 1958) and dramatically gained attention among researchers in the 1980s and 1990s (Huan et al., 2004). The term was introduced and conceptualised in the early 1980s (Oliver & Webber, 1982). SCM is “the integration of all key business processes across the supply chains” (Cooper
et al., 1997, p. 2) and it involves three supply chain elements: network structure, business processes, and management components (Lambert et al., 1998). The focal organisation and its network need to be integrated to be able to compete in the market (Christopher, 1992).

The contribution of logistics to the development of SCM is evident, as logistics is one of the competitive advantages of a firm (Porter, 1980). Logistics and physical distribution emerged as a field of research in the 1960s (Arlbjorn & Halldorsson, 2002; Ballou, 2007; Bowersox, 1969). In business logistics, while the main objective is managing physical assets from a focal organisation perspective (Gripsrud et al., 2006; Ballou, 2007), the main objective of SCM is managing the key business processes in an inter-organisational context (Cooper et al., 1997; Giunipero & Brand, 1996; Gripsrud et al., 2006; Mentzer et al., 2001). On the other hand, the relationship between marketing and SCM is also evident (Gripsrud et al., 2006; Jüttner et al., 2010), as research shows that marketing could contribute to SCM and enhance the development of concepts (Gligor et al., 2016; Lambert & Cooper, 2000; Min et al., 2007).

There are four diverse perspectives (traditionalist, re-labelling, unionist, and intersectionist) that are commonly discussed regarding SCM and purchasing (Larson & Halldorsson, 2002), SCM and logistics (Larson & Halldorsson, 2004), and perspectives on SCM and logistics on the part of supply chain professionals (Larson et al., 2007). Although there are different perspectives on SCM vs logistics, SCM professionals prefer “broad, multiple function perspectives (unionist and intersectionist) to narrow, single function, logistics-based perspectives (traditionalist and re-labelling)” (Larson et al. 2007, p. 18).

1.2.2 HSCM

HSCM is an umbrella term that has been used to describe the logistics efforts in both disaster relief and development aid (Kovács & Spens, 2007a). Humanitarian supply chains involve many actors with many different logistics skills, mandates, and objectives—actors such as international relief organisations, host governments, military organisations, private sector companies, and local and regional relief organisations (Balcik et al., 2010). Coordination and collaboration among these actors takes on extreme importance during disaster relief operations (Kovács & Spens, 2007a).

The main characteristics of HSCM are its (requisite) “speed of inception and execution” and its relative “impermanence” (Tatham & Kovács, 2010, p. 36). Balcik and Beamon (2008, p. 102) listed other unique characteristics of HSCM:

- the unpredictability of demand in terms of timing, location, type, and size;
- suddenly occurring demand in very large amounts short lead times for a wide variety of supplies;
- high stakes associated with adequate and timely delivery; and
- a lack of resources (supply, people, technology, transportation capacity, and money).

The challenges of HSCM are related to the types of disasters, the phases of disaster relief, and the types of humanitarian organisations involved (Kovács & Spens, 2009). Humanitarian organisations differ, ranging from supranational aid agencies (e.g., UN agencies) and governmental organisations to non-governmental organisations (NGOs) whose staffing resources range from one-man operations to large, international associations of people with a common interest (Kovács & Spens, 2009).
The lifecycle of HSCM stems from disaster management. Generally, mitigation, preparedness, response, and recovery constitute the disaster management phases (Altay & Green, 2006). In HSCM, however, the mitigation phase is excluded due to the lack of logisticians or relatively fewer logistics activities (Cozzolino, 2012). The most common model of phases in HSCM is the three-phase model (Kovács & Spens, 2007a), consisting of preparedness, immediate response, and reconstruction (Kovács & Spens, 2007a). During preparedness, the members in the supply chain focus on warehousing and inventory management, pre-positioning the necessary items for anticipated disasters, early warning systems, and training local communities on how to react to future disasters (Van Wassenhove, 2006).

In immediate response, members in the supply chain focus on resource mobilisation, transitioning from dormancy to action, has according to a maxim of cost-efficiency vs agility (Kovács & Tatham, 2009). The reconstruction phase can have either short-term or long-term supply chain goals, depending on the perspectives of the various donors (Kovács & Spens, 2007a). On the other hand, development aid is “constantly given to a country over longer periods of time in the form of education, roads, goods, etc. in order to develop” (Abidi & Scholten, 2015, pp. 236–237). There is an argument, based on temporary vs permanent structures of disaster relief and development aid, reasoning that, while development aid is a permanent supply chain, disaster relief is a temporary supply chain (Jahre et al. 2009).

1.3 Positioning of the thesis

In this thesis, the main focus is on HSCM, along with concepts derived from SCRM. The importance of HSCM activities in disaster relief operations increased in the mid-1990s, as Long and Wood (1995) studied the logistics of famine relief. However, it was not until the second half of the 2000s decade that the field gained considerable attention from academics, following the South Asian tsunami disaster in 2004 (Kovács & Spens, 2011).

Scalability is the main concept explored in this thesis, along with resilience. The first essay, however, examines the status quo of HSCM on the basis of theories borrowed from other fields. The second and third essays explicitly explore scalability through the concepts of structural flexibility and information sharing, and supply chain integration, respectively.

Resilience has long been studied in other fields of research, such as engineering, ecological sciences, and organisational research (Pettit et al., 2010) and it has been studied in SCM via SCRM in commercial supply chains. On the other hand, scalability aims to respond to the sudden surges in demand, an activity analogous to the demand risk that SCRM customarily deals with; but it is also a feature of HSCM, which has the ability to activate temporary networks in respond to the “demand” of beneficiaries following a disaster. The cross-learning opportunities between commercial and humanitarian supply chain management are evident (van Wassenhove, 2006). Many researchers have proposed borrowing concepts from SCRM, such as resilience and other risk management concepts, for application in HSCM and explicitly state that cross-learning opportunities between SCRM and HSCM abound (Day et al., 2012). HSCM has as its objective the alleviation of human suffering and/or loss of life (Kovács & Spens, 2007a) through a myriad of humanitarian organisations as well as governments and logistics services providers; even the commercial sector is incidentally trying to mitigate such risk through the building of resilient supply chains. Recently, donor expectations
became visible in terms of integrating humanitarian supply chains along the lines of SCRM, so that SCI could be considered one of the antecedents of SCRM though collaboration and coordination. Thus, this thesis contributes to the overall SCM literature through exploration of the potential of SCRM and SCI for application in the humanitarian context of HSCM.

1.3.1 Research paradigms

SCM, as a managerial science, demonstrates a strong relationship to the natural sciences, which see reality as hard, external, and objective (Mears-Young & Jackson, 1997). In line with realist ontology—and its correlative, relativist epistemology (see below)—supply chain managers consider themselves as studying “the system of concern” and improving its design so as to achieve its goal through guidance (Mears-Young & Jackson, 1997). These authors (Mears-Young & Jackson, 1997) further state that the overall goal of SCM is to maximise performance.

As Aastrup and Halldórsson (2008, p. 748) emphasise, SCM is “a practice-oriented and solution-based discipline, and has developed under strong influence from physical sciences by making non-living phenomena its study objects.” These authors further note that human intervention or influence has been studied to a lesser extent than tangible parts of physical systems, and that SCM activities involve non-physical assets, such as “the power position of the operating equipment manufacturers in the supply chain, the conflicting positions of one [or another] supplier in multiple supply chains, and the perceptions of closer efficient consumer response collaboration” (Aastrup & Halldórsson, 2008, p. 753).

Vafidis (2007, p. 24) explained ontology as the “existence i.e. assumptions concerning claims about what exists and what it looks like, what it is made of and how the units that constitute it interact.” Näslund (2002, p. 323), defining epistemology as an element that “deals with how we perceive the world, and the relationship between the researcher and the known,” further explained that epistemological and ontological assumptions shape methodological decisions, i.e., decisions that deal with how we gain knowledge about the world. The ultimate goal of SCM is to maximise the SCM performance of services and to minimise the logistics costs; as such, the methodology used in SCM research was always positivist (Skjoett-Larsen, 1999). However, new epistemologies have emerged in SCM that are closer to more interpretivist social theory and subjectivist methodological assumptions (Solem, 2003). Epistemological assumptions depend on the researcher’s view on reality; thus, within SCM, assumptions can differ among researchers as well (Arlbjørn & Halldórsson, 2002).

According to Mangan et al. (2004), a research paradigm is the centre of all research fields and is a general notion of a scientific endeavour. The most common research paradigms in the SCM research are positivism, interpretivism, and scientific realism (Kovács & Spens, 2007b). Of these, positive approaches have been used more frequently, while interpretive and qualitative approaches are still scant (Arlbjørn & Halldórsson, 2002; Kovács & Spens, 2007b; Näslund, 2002).

In SCM research, positivism and functionalism are sometimes used synonymously (Kovács & Spens, 2007b). For example, Burgess et al. (2006) reviewed 100 randomly selected journal articles and concluded that 97 had foundations in functionalism.

This thesis falls within the critical realist paradigm. To begin with, Essay A looks into the
different theoretical approaches applied in the field of HSCM. This proves that there can be different ways of creating knowledge, which aligns with a critical realist paradigm. The other two essays examine the concept of scalability via different capabilities (e.g., structural flexibility and information sharing and SCI) through a case study approach. Critical realism is becoming one of the most common research paradigms in SCM research (Aastrup & Halldórsson, 2008; Rotaru et al., 2014) and it is an umbrella term for many approaches that lie in between positivism and interpretivism (Kovács & Spens, 2007b). Critical realism has realist ontology and relativist epistemology (Bhaskar, 1998). In SCM research, the deductive approach has been mostly positivist; however, deduction in positivism is deterministic, while the deductive approach in critical realism is probabilistic (Kovács & Spens, 2007b).

1.3.2 Research approaches

To create knowledge in SCM, theory development and theory testing have been used, and theories have been borrowed from other disciplines (Stock, 1997). Arlbjørn and Halldórsson (2002) argued for knowledge creation in SCM with a framework distinguishing three levels of abstraction: meta level (philosophy of science), discipline level (logistics), and practice level. As noted previously, the main research paradigm of this thesis is critical realism, which also affects the main methodological and ontological approaches in the thesis. Critical realism gives researchers the opportunity to look at phenomena through different theoretical lenses (Halldórsson et al., 2015).

Although critical realism is on the rise in SCM research, positivism dominated the field in the beginning. Gammelgaard (2004) classified SCM schools into three categories: systems (based on systems theory), analytical (based on positivism), and actors (based on sociological meta theories). Moreover, this author described these approaches as follows: While the analytical approach aims to provide general, time-free, and value-free explanations, since SCM is considered too complex for deriving cause-and-effect relations, the systems approach aims to derive concrete systems, such as maps and models, while the actors approach aims to demonstrate that, since the individual context varies for different organisations, SCM should be understood and implemented differently.

Kovács and Spens (2007b) discussed three research approaches in SCM: the deductive, inductive, and abductive approaches. The same authors (Kovács & Spens, 2005) argued that SCM lacks inductive and abductive approaches, while the deductive approach is dominant. Deduction follows a path from theory to empirical testing, whilst induction follows a path from empirical observation to theory (Kovács & Spens, 2007b). Abduction, however, follows partly inductive and partly deductive approaches, with iteration (Kovács & Spens, 2005). In this thesis, the deductive approach is dominant. Essay A, with content analysis, tests the propositions derived from the literature. In Essays B and C, the deductive approach is the main approach, and the theoretical framework from the literature is tested against the data.

1.3.3 Theoretical lens of the thesis

Supply chain management is criticised for not having a unified theory (Halldórsson et al., 2007); however, borrowing theories from other disciplines is common (Stock, 1997; Halldórsson et al., 2007; Halldórsson et al., 2015) and contributes to the development and conceptualisation of the field (Stock, 1997).
Defee et al. (2010) identified transaction cost economics and the resource-based view (RBV) as the most common theories applied in SCM. The RBV (Barney, 1991) argues that an organisation can have a competitive advantage by virtue of its bundle of resources and capabilities. In the world of commerce, to achieve a sustainable competitive advantage, a firm’s resource(s) should be valuable, rare, imperfectly imitable, and non-substitutable (Barney, 1991). To contribute to a sustainable competitive advantage in the humanitarian arena, however, the RBV focuses on the identification of the internal resources and skills of an organisation (Kovács et al., 2012). Grant (1991) presented four barriers to sustaining resources and capabilities: durability, transparency, transferability, and replicability. According to Grant (1991), the key to a resource-based approach is to understand the mechanisms of relationships among resources, capabilities, and competitive advantage, as well as which kinds of competitive advantage can be sustainable.

The main theoretical approach in this thesis is the dynamic capabilities view (DCV), as resilience and scalability can be considered dynamic capabilities (DCs). The DCV is an extension of the RBV, but with an evolutionary aspect (Barney, 2001; Barney et al., 2011). The main question in this approach is how firms can cope with changing environments (Barreto, 2010). DCs deal with change and changes in the environment (Helfat et al., 2007; Teece, 2007).
Figure 1 Capabilities leading to supply chain resilience and scalability

Figure 1 shows the relationship between supply chain scalability and supply chain resilience according to the DCV. As shown in Figure 1, information sharing is posited as a lower-level capability, while SCI and structural flexibility are the higher-level capabilities contributing to supply chain scalability and supply chain resilience. Resilience is considered a DC (Eltantawy, 2016; Kamalahmadi & Parast, 2016; Ponomarov & Holcomb, 2009). Ponomarov and Holcomb (2009) identify resilience as an adaptive capability. On the other hand, SCI can be considered a relational capability (RC). RCs create competitive advantage through relationships and networks (Dyer & Singh, 1998). Figure 1 also shows the focus areas of each of the essays and where they intersect.

Scalability is the ability to scale up and scale down supply chain’s capacity in order to meet the changing demands in a humanitarian context. Scalability displays the feature of adaptation, whereby humanitarian supply chains are able to increase or decrease their capacities when there is a change in demand, in other words, when a disaster strikes or subsides.
Recently, L’Hermitte et al. (2015) developed an integrated approach to agility in the humanitarian context from a DCV perspective. Similarly, in this thesis, scalability is also posited as a DC, one that provides humanitarian supply chains with adaptation through the foundations of structural flexibility (Christopher & Holweg, 2011) and information sharing amongst the actors involved, and SCI, specifically in a humanitarian supply chain with a long-term strategic focus. As stated in Teece (2007), scalability, as a DC, enables a humanitarian supply chain sensing the environmental changes (caused by a disaster) and, with them, surges in demand, to seize the opportunities and manage threats through reconfiguration of structural flexibility and information sharing (i.e., through SCI). Moreover, a DCV adopts a system view (L’Hermitte et al., 2015), which a supply chain already has.

1.4 Limitations

Like all other research, this thesis also has its limitations. Some limitations are due to the choice of methods (e.g., qualitative methods), while others are related to the general theoretical lens used in the thesis. For the first essay (A), generalisability can be seen as limited due to the choice of the bibliography as the sample. For Essays B and C, the limitations stem from studying a single case, from which generalisability is not possible, although this was not the aim of the thesis.

The other limitation of the thesis was that group interviews conducted with caregivers of beneficiaries were excluded from the essays, since they did not serve the aim, however, they were used for data triangulation. Nevertheless, they will be considered for future studies. The main themes that emerged during caregivers interviews were the lack of clarity as to why certain populations are targeted by the nutrition supply chain and the lack of a complaint management system.

One additional limitation here would be ignoring the argument about the foundations of development aid (see Escobar, 1995). However, the main objective here is to contribute to the understanding of how to enhance the supply chain mechanism so as to have more resilient supply chains, and as a result contribute to the sustainability of communities, so that they might sustain themselves.

This thesis is based on the DCV approach and two different streams of SCM: SCRM and HSCM. Accordingly, most of the discussions are within the boundaries of these two streams of SCM. The empirical data are from the Kenyan nutrition supply chain, which constitutes a geographical and contextual limitation. Thus, a suggestion for future research would be to test the propositions and frameworks across other contexts.

1.5 Significance of the thesis

The contribution of this thesis is to the three interrelated streams of SCM. SCI, being the core of SCM, is important to create mutual benefits among the members of the chain; it is also an important capability in that it enables members to foresee the risks in a supply chain. Moreover, SCI is a relational capability that delivers performance and operational outcomes. Supply chain resilience is the objective of SCRM, while agility, collaboration, risk awareness, and re-engineering are the essence of it.

Thus, SCI has a relation to SCRM as almost every definition of SCRM involves the coordination aspect of SCI. On the other hand, SCRM deals with changes in the environment caused by disasters. Disasters are already the focus of HSCM. On the other
hand, there has been a call by donors for better integration in humanitarian supply chains, for the reason that SCI in humanitarian supply chains is also necessary for better operational and performance outcomes for those chains.

Thus, in this thesis, the outcome contributes to the intersection of three streams of SCM. In doing so, the thesis answers the call of using risk management tools in HSCM (Day et al., 2012) and the call of donors’ expectations for better integration in HSCM (Moshtari, 2016). Also, as the supply chain has entered new era of turbulence (Christopher & Holweg, 2011), the thesis presents insights from a sector that is known to be the most dynamic (Kovács et al., 2012; Oloruntoba & Kovács, 2015). Therefore, this thesis, besides its theoretical contribution, also brings a different perspective for organisations and managers operating in this turbulent environment.

In the HSCM literature, cross-learning opportunities between commercial SCM and humanitarian SCM have been discussed. Recently, there has also been a call for adopting SCRM tools in HSCM (Day et al., 2012; Dubey et al., 2014; Tatham, 2012) and for resilience in every supply chain design (Melnyk, 2014). On the one hand, SCRM practices are vital for enabling supply chains to respond to risk coming from the external and internal environments. Therefore, this thesis develops a framework across the boundaries of two streams of SCM. On the other hand, humanitarian supply chains are considered the most agile (Oloruntoba & Gray, 2006), and thus can rapidly respond to the demand uncertainty caused by disasters. Therefore, humanitarian supply chains are scalable, with the ability to scale up and scale down following a disaster. Empirical studies on scalability in HSCM are still scant, although it has been studied in manufacturing and production literature for quite some time.

Recently Jahre et al. (2015) examined responsiveness in HSCM in terms of flexibility and cost efficiency. Scalability also contributes to responsiveness in HSCM through its ability to quickly scale up the capacity and operations in responding to demand increase following a disaster. In this sense, as stated, scalability requires anticipation and quick mobilisation of resources, which is discussed throughout this thesis in terms of SCI, structural flexibility, and information sharing.

In summary, this thesis is significant, as it contributes to SCRM through studying resilience and scalability, and contributes to HSCM through studying humanitarian contexts. Therefore, it contributes to SCM overall.

1.6 Structure of the thesis

The summary part of the thesis is organised into five chapters followed by three essays. A summary of each chapter is presented in this section as follows.

Chapter 1 presents the overall objective, the research questions, the positioning of the thesis, the research approach, the research paradigm, the key concepts, and the importance of the thesis. Chapter 2 presents the extensive literature review of SCI, supply chain resilience along with supply chain risk management, and supply chain scalability. Chapter 3 presents the research methods of the essays. The chapter goes into detail regarding the methods used in each essay and how the data analysis was conducted in each essay. Chapter 4 presents the important findings of each essay. Chapter 5 encompasses the overall discussion of the thesis and presents the methodological and theoretical insights, along with managerial implications. The chapter ends with recommendations for future studies.
1.6.1 Essays

Essay A (together with Arni Halldórsson, Gyöngyi Kovács, & Karen Spens): Borrowing theories in humanitarian supply chain management (published in *Journal of Humanitarian Logistics and Supply Chain Management*)


Essay C (together with Olivia Agutu): Supply chain scalability: The role of supply chain integration (to be submitted to *Disasters*)
2 OVERVIEW OF SCI, SUPPLY CHAIN SCALABILITY, AND SUPPLY CHAIN RESILIENCE

The objective of this theoretical chapter is to review the literature on SCI, supply chain scalability, and supply chain resilience. The review starts with capabilities in SCM and logistics, proceeds to examine SCI from a general perspective, and then focuses on SCI in humanitarian settings. The dominant view in the thesis is that SCI is the ultimate goal among the relationship types in SCM. Collaboration and coordination are seen as antecedents of SCI.

The third part of the chapter reviews the concept of scalability in general and then scalability in HSCM more specifically. The third part of the chapter reviews SCRM and the ultimate objective of SCRM, supply chain resilience.

2.1 Capabilities in SCM

Capabilities in SCM has caught the attention of researchers since the term emerged in the literature (Horvath, 2001; Tracey et al., 2005). In this thesis, resilience and scalability are proposed as the important capabilities that lead to benefits such as operational outcomes and performance outcomes in HSCM, from a DCV. In the domain of DCV literature, capabilities are differentiated into dynamic capabilities and ordinary (or static) capabilities (Defee et al. 2010) in the resource base of a firm (Laaksonen & Peltoniemi, 2016). Ordinary capabilities manage the current activities of a firm and are referred to as zero order and operational capabilities (Laasonen & Peltoniemi, 2016). Even though they have been associated with high turbulence and volatility (Christopher & Holweg, 2011; 2017 Gattorna, 2009), DCs have been overlooked both in practice and in academia for a long time (Defee et al., 2010).

2.1.1 Dynamic capabilities view

The dynamic capabilities view is defined as “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece et al., 1997, p. 516). When it comes to rapidly changing environments, the environment of humanitarian supply chains can be the most rapidly changing of all due to the unpredictability and uncertainty of demand. Markets are differentiated as moderately dynamic and high-velocity (Eisenhardt & Martin, 2000), and humanitarian supply chains also generally operate in high-velocity markets (Kovács et al. 2012). DCs are “idiosyncratic” (Eisenhardt & Martin, 2000; Winter, 2003), and the DCV aims to find commonalities and good practices (Eisenhardt & Martin, 2000). Dynamic capabilities diverge from ordinary capabilities in terms of sensing opportunities and threats, seizing opportunities, and maintaining competitiveness through reconfiguring resources and capabilities (Teece, 2007). Zollo and Winter (2002) state that DCs address the roles of experience accumulation, knowledge articulation, and knowledge codification. These authors define a dynamic capability as “a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness” (Zollo & Winter, 2002, p. 340). Dynamic capabilities foster learning in order to shape routine operations of a single entity or a chain (Zollo & Winter, 2002) and refer to the integration, adaptation, and reconfiguration of external and internal resources in order to respond to the changes in the environment (Teece & Pisano, 1994). Moreover, strong
DCs enable organisations to have good strategy and to be agile, flexible, and resilient (Lessard et al., 2016).

The literature on the Dynamic capabilities view is riven with inconsistencies and ambiguities (Barreto, 2010, Zahra et al., 2006), but there are two main features of DCs in the literature that are found in the resource base of a firm: search and selection, and deployment (Helfat et al., 2007). Barreto (2010) gave a different definition of the view in order to encapsulate the diverse definitions in one point. The author defines DCs as “the firm’s potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base.” The author claims this definition has several advantages in terms of construct, nature of the construct, and level of different DCs.

Dynamic capabilities are complex, organisation-specific, and mutual and they need time to be developed (Lessard et al., 2016), thus they enable organisations to compete in the market with a competitive advantage. Although learning has been identified as an antecedent of DCs in several studies (Eisenhardt & Martin, 2000; Zollo & Winter, 2002), it can also be considered as a DC, itself (Ambrossini et al., 2009). DCs turn resources and capabilities into products and services that bring customer value in short order (Wang & Ahmed, 2007); therefore they are difficult for competitors to imitate, which results in a sustained competitive advantage (Wang & Ahmed, 2007). Although, however, some studies, such as Zahra et al. (2006), claim that DCs do not always bring success and survival, they are considered most valuable in a rapidly changing environment or an environment that is unpredictable (Zahra et al., 2006).

There is a different frame of reference in the literature that classifies different hierarchies of DCs in an organisation (Ambrossini et al., 2009). Some studies conceptualise the constructs of DCs as in Wang and Ahmed (2007), as adaptive capability, absorptive capability, and innovative capability. Another distinction in the DCV literature is the hierarchisation of the capabilities in order to establish DCs in the business environment. Eisenhardt and Martin (2000) study DCs in terms of volatility of markets from moderately dynamic markets to high-velocity markets. Ambrossini et al. (2009) suggest incremental and renewing DCs, following Eisenhardt and Martin’s (2000) views on the ability of DCs to operate in moderately dynamic markets as well and suggest regenerative DCs based on Winter’s (2003) study. A recent review article on DCV (see Wilden et al., 2016) looked into the issues on the micro-foundations of DCV (such as routines, processes, and competitive advantage) and their outcomes (innovation, performance), multilevel nature, definitions, and methodological approaches and created a DCV framework based on enablers of sensing, seizing, and reconfiguring. In this thesis, the definitions by Teece et al. (1997) and Helfat et al. (2007) are adopted as the basis of the DCV. Similar to Teece et al.’s (1997) definition, Helfat et al. (2007, p. 4) define a DC as “the capacity of an organization to purposefully create, extend, or modify its resource base.” According to Teece (2007), a DC has the abilities of sensing, seizing and reconfiguring. Thus, a DC enable an organisation or a supply chain to sense the risk, seize the mitigation opportunity and reconfigure its resources to mitigate the risk. This framework is followed in order to explain scalability in humanitarian supply chains.

In the domain of DCV, dynamic capabilities that provide competitive advantage through relations are called relational capabilities (Dyer & Singh, 1998; Kale et al., 2000; Lorenzoni & Lipparini, 1999). Relational capabilities enable organisations by creating a basis for learning and know-how transfer (Kale et al., 2000). Relational capabilities create competitive advantage through complementary capabilities, relationship-specific assets, interfirm knowledge-sharing routines, and effective governance (Dyer & Singh,
Recently, Donada et al. (2016) combined relational capabilities and DCs in one pot as relational dynamic capabilities and define this as “the ability to integrate, build, and reconfigure a set of skills, assets, and routines that provide the basis for a firm's relational rent to address changing environments” (Donada et al., 2016, p. 3).

As noted above, capabilities in the SCM literature have caught the attention of researchers since the term “SCM” emerged (Horvath, 2001; Tracey et al., 2005). Even so, SCM is identified as a capability itself (Barney, 2012) that leads to competitive advantage. In this thesis, resilience and scalability are posited as higher-order DCs that operate on other DCs, such as structural flexibility, SCI, and information sharing. Resilience and scalability in humanitarian supply chains are proposed as important capabilities, leading to operational and performance benefits and creating best practices in the humanitarian supply chain.

Dynamic capabilities are also studied in various streams of SCM literature, however studies of DCV are still scant in that literature (Beske et al., 2014; Defee & Fugate, 2010). DCV has, however, been studied in the sustainability stream of SCM (Beske et al., 2014; Foerstl et al., 2010), as capabilities of SCM (Defee & Fugate, 2010), relationships in SCM (Fawcett et al., 2011; 2012), and agility (Blome et al., 2013; L’Hermitte et al., 2015; 2016). Agility provides quick mobilisation of resources in humanitarian supply chains (Kovács & Tatham, 2009). Arguably, structural flexibility covers dynamic flexibility (Christopher & Holweg, 2011) and dynamic flexibility is considered as an antecedent of agility (Dubey & Gunasekaran, 2016). Agility is already identified as a DC in commercial supply chains (Blome et al., 2013) as well as in humanitarian supply chains (L’Hermitte et al., 2015; 2016). In order to develop DCs in a supply chain through three interrelated supply chain capabilities, Lee and Rha (2016) suggest enhancing visibility (supply chain sensing), agility (supply chain seizing), and flexibility (supply chain reconfiguring). In SCM, DCs can be shared and utilised amongst the organisations in a supply chain and they enable the supply chain to be more responsive and adaptive and to perform better (Defee & Fugate, 2010). Gölgeci and Ponamorov (2013) use DCV in order to explain supply chain disruptions and state that supply chain resilience is a DC.

The dynamic capabilities view provides a suitable theoretical background for explaining organisations in humanitarian supply chains, as the definition of DCV can be applied to not-for-profit organisations as well, since both commercial and humanitarian organisations both can have a resource base and both can face changes in their environment (Helfat et al., 2007).

Many authors also contribute to the hierarchy of DCs in the organisational capability catalogue. Thus, Ambrossini et al. (2009) propose regenerative capabilities, following the argument by Helfat et al. (2007) on how DCs affect other DCs, as well as Winter’s (2003) discussion of zero-order, first-order, and higher-order capabilities. According to Winter (2003), zero-level capabilities are those which an organisation has in the current static situation. In other words, they are ordinary or operational capabilities. Similarly, Wang and Ahmed (2007) name DCs in the third-order among the capabilities of a firm, while resources are zero-order, capabilities are first-order, and core capabilities are second-order in the hierarchy. These authors give the example of Zara, whose core capability is responsiveness based on the integration of capabilities and resources such as information systems and just-in-time philosophy. Lessard et al. (2016) define capabilities as DCs which are difficult to imitate, complex, and need time to develop; second-order dynamic capabilities as the capabilities that combine and adjust the existing ones and lower-order capabilities as ordinary capabilities (such as routine
activities). In this thesis, following Helfat et al.’s (2007) views on DC hierarchy, there is no differentiation in the framework of scalability and resilience. Though, however, SCI is proposed as lower-order relational capability, information sharing and structural flexibility are proposed as a lower-order dynamic capability on which resilience and scalability operate.

Recently, L’Hermitte et al. (2015) developed an integrated approach to agility in the humanitarian context, using a DCV perspective. Similarly, in this thesis, scalability is posited as a DC, which provides humanitarian supply chains with adaptation through the foundations of structural flexibility (Christopher & Holweg, 2011), information sharing amongst the actors involved, and SCI, specifically in a humanitarian supply chain with a long-term strategic focus. As stated in Teece (2007), as a DC, scalability enables a humanitarian supply chain sensing the environmental changes (caused by a disaster), and thus surges in demand, to seize the opportunities and manage threats by reconfiguration resource and ordinary capabilities through structural flexibility and information sharing, or SCI. Moreover, DCV adopts a system view (L’Hermitte et al., 2015), which a supply chain already has.

Similarly, supply chain resilience is a DC, with its ability to address risk by being proactive and responding to the impact through being reactive (Gölgeci & Ponomarov, 2013; Jüttner & Maklan, 2011; Mandal et al., 2016; Ponomarov & Holcomb, 2009), since supply chain resilience has the ability to sense the risk from the different risk sources and to integrate necessary lower-level capabilities in order to be both proactive and reactive in responding. Moreover, information sharing also promotes the ability to sense and therefore enable supply chains to respond to the changes in the market; thus, it is a DC as well (Tatham, 2013).

2.2 Relationships in humanitarian supply chains

In this section, SCI were discussed through supply chain collaboration and supply chain coordination in SCM and in humanitarian setting.

2.2.1. SCI in humanitarian context

Supply chain integration is conceptualised in many ways in the literature; specifically, among other things, as collaboration, coordination, or information sharing (Nagashima et al., 2015). SCI is the process of integration and collaboration across organisations in a supply chain (Huang et al., 2014). In this thesis, we follow Flynn et al.’s (2010) definition, that integration is the process of two or more organisations working together for the same objective. In short, SCI enables a supply chain to act as a single unit by improving performance and operational outcomes (Ralston et al., 2015).

In HSCM, there has been a call for humanitarian organisation, for working together in order to use the resources more efficiently. Recent publications (see Moshtari, 2016) show that integration is the one area in the humanitarian sector that has been overlooked. In this thesis, the focus is not on SCI per se, but on a capability of SCI, i.e., its role in scalable supply chains and how it contributes to scalability in humanitarian supply chains.

The definition of SCM from one of the most cited articles is “the integration of business processes from end-user through original suppliers that provide products, services and
information that add value for customers” (Cooper et al., 1997, p. 2). Integration is the heart of SCM (Mentzer et al., 2001, Pagell, 2004). According to Flynn et al. (2010, p. 59), SCI is “the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organisation processes” or, more recently, “SCI is the scope and strength of linkages in supply chain processes across firms” (Leuschner et al., 2013, p. 34). There are diverse views of SCM with respect to collaboration and integration, which results in the terms being used synonymously (Fawcett et al., 2014) or as antecedents of each other (Jin et al., 2013; Kache & Seuring, 2014; Soosay & Hyland, 2015). In this thesis, following the views of Kache and Seuring (2014), Jin et al. (2013), and Leuschner et al. (2013), SCI is seen as the ultimate goal. Leuschner et al. (2013) claimed that supply chain collaboration and coordination are elements of SCI. Recently, Stevens and Johnson (2016, p. 22) posited the definition of SCI as “the alignment, linkage and co-ordination of people, processes, information, knowledge, and strategies across the supply chain between all points of contact and influence to facilitate the efficient and effective flows of material, money, information, and knowledge in response to customer needs,” which explains SCI profoundly. However, in this thesis, the focus is more on inter-organisational integration, as in Flynn et al. (2010).

2.2.2 Supply chain collaboration and coordination

According to Cao and Zhang (2011), information sharing, decision synchronisation, incentive alignment, resource sharing, collaborative communication, goal congruence, and joint knowledge are the antecedents that supply chain collaboration requires, hence SCI. In HSCM, the terms defining relationships among humanitarian organisations are generally used interchangeably (Balcik et al., 2010; Russell, 2005). Supply chain collaboration is defined as “a partnership process where two or more autonomous firms work closely to plan and execute supply chain operations toward common goals and mutual benefits” (Cao & Zhang, 2011, p. 166) and supply chain collaboration is defined as “the ability to define the problem or task, to make joint decisions, to properly assign roles and responsibilities to each partner, and to evaluate the collaborative performance” (Moshtari, 2016, p.5). In SCM, SCI arguably contributes to the performance in supply chains. In humanitarian settings, though, good SCI efforts improve the performance of HSCM activities in saving lives (Balcik et al., 2010). SCI in a humanitarian context is also a way of creating flexible but more stable and permanent humanitarian supply chains (Fawcett & Fawcett, 2013).

There are many barriers to coordination and collaboration in the humanitarian setting, hence the need for SCI (Kabra & Ramesh, 2015, Moshtari & Gon, 2016). These barriers could be cultural conflicts between the humanitarian organisations (Akthar et al., 2012); different mandates and objectives amongst humanitarian organisations; and being dependent on funding by donor organisations (Balcik et al., 2010). In order to eliminate these inhibiting factors of SCI in supply chains, Kabra and Ramesh (2015) identified the top three solutions as long-term focus, commitment from the actors involved, and transparency. Development aid of humanitarian supply chains, however, has a permanent structure with a long-term strategic focus as long as the development program lasts. Obviously, there are benefits of SCI in humanitarian operations in terms of responding to the needs of beneficiaries and increasing the responsiveness of operations (Kabra & Ramesh, 2015; Kovács & Spens, 2009; Moshtari, 2016). Humanitarian organisations, donors, and governments also recognise the benefits of SCI in a humanitarian context in order to enhance efficiency and effectiveness (Moshtari, 2016).
The antecedents of SCI are operationalised differently in humanitarian (as opposed to commercial) settings, due to the unique characteristics of HSCM. In humanitarian settings, information is shared during coordination meetings with the members of humanitarian supply chains who participate in those meetings (Akhtar et al., 2012; Jahre & Jensen, 2010; Kabra & Ramesh, 2015). Monitoring and evaluation can be another mechanism contributing to information sharing (Heaslip et al., 2012). In humanitarian settings, information is shared through maps, reports, and similar avenues (Van Wassenhove & Pedraza Martinez, 2012).

Inter-organisational fit refers to the organisation's compatibility (Moshtari, 2016), which refers to the degree of goal congruence (Cao & Zhang, 2011, Holcomb & Hitt, 2007; Moshtari, 2016). Goal congruence in humanitarian supply chains can be achieved with good leadership (Akhtar et al., 2012), standardisation (Balcik et al., 2010; Van Wassenhove & Pedraza Martinez, 2012), and supply chain understanding (Christopher & Peck, 2004) through coordination meetings as well as through commitment to the objectives (Pettit & Beresford, 2009). In these meetings, as well as through the cluster system (Jahre & Jensen, 2010), decision synchronisation can take place. In humanitarian settings, risk is shared among the members of the supply chain, and procurement on behalf of members can provide cost reductions (Balcik et al., 2010; Ergun et al., 2014). These can be examples of incentive alignment operationalisation in humanitarian settings, as the members in humanitarian supply chains have little or no incentive to work together (Tomasini & van Wassenhove, 2009).

Resource sharing is also an important antecedent of SCI, through sharing assets such as warehouses, fleets (Balcik et al., 2010), and human resources (Van Wassenhove & Pedraza Martinez, 2012). Resource sharing in the integration of humanitarian supply chains advances operational outcomes (Kovács & Tatham, 2009). Lastly, as coordination is one of the antecedents of SCI, it also contributes to the integration of humanitarian supply chains by paving the way for sharing information (Akhtar et al., 2012).

Figure 2 shows the relationship between coordination, collaboration and integration in supply chains.
2.3 Supply chain scalability

Scalability has been studied in information and communications technology (Tongia et al., 2005), human resource management (Dyer & Erickson, 2005), and flexible manufacturing (Koren et al., 1998). However, it is a relatively new term in HSCM. Supply chain scalability deals with surges in demand (Lee, 2004). Scalability is “the ability of business manufacturing, or technology process, to support sudden increases in demand” (Ciancimino & Cannella, 2009, p. 481) or “the flexibility of the chosen supply chain setup to handle changing volumes, both seasonal and structural” (Vanelslander et al., 2013, p. 250).

Related to disaster management, scalability from dormancy to action can be referred to as surge capacity. Surge capacity is the “ability to manage a sudden, unexpected increase in patient volume (i.e. numbers of patients) that would otherwise severely challenge or exceed the current capacity of the health care system” (Hick et al., 2004, p. 254). The term is used in the boundaries of healthcare management. As HSCM covers both disaster relief and development operations, in this thesis, scalability encompasses broader operations, including all supply chain activities, such as nutrition, health, construction, and so on.

In humanitarian settings, scalability refers to the scaling up of disaster relief operations in the case of a disaster and also scaling down with an exit strategy in disaster relief supply chains through anticipation (Merminod et al., 2014) and quick resource mobilisation (Kovács & Tatham, 2009). In other words, it is the ability to move from the dormant phase to the action phase (Kovács & Tatham, 2009) during disaster relief operations and to move back to normal during the transition to the recovery stage. In addition, scalability takes place through the clusters, as the cluster system is scaled up during international disaster relief operations (Jahre & Jensen, 2010).

Humanitarian supply chains are scalable, as they increase and decrease their capacity according to the demand fluctuations during and after relief operations. Thus, from preparedness to the immediate response stage, operations are scaled up, and from preparedness to reconstruction relief, operations are scaled down and are handed over to local actors as the reconstruction supply chain takes over (Matopoulos et al., 2014).

In development aid supply chains, especially where development aid and disaster relief are integrated (Day et al., 2012), the disaster relief chain is activated from development aid supply chains in the case of a rapid-onset disaster (Day et al., 2012; Jahre et al., 2009); this can also be called buttressing supply chains (Sodhi & Tang, 2014). During the scale-down, the disaster relief supply chain is transformed into the reconstruction supply chain as the disaster relief project (Jahre & Heigh, 2008) or lifecycle (Melnyk et al., 2014) ends. In countries where disaster relief and development programs are integrated, supply chains reduce their capacity to the base demand level after scaling down. The scaling down of operations can be followed by an exit strategy, which is “strategic change to assure long-term continuity of aid and development” (Sohn, 2013).

Overall, the main argument here is that humanitarian supply chains are scalable since they are structurally flexible (Christopher & Holweg, 2011; Kovács et al., 2012) and agile (Oloruntoba & Gray, 2006). Scalability is discussed here from a proactive approach perspective: a humanitarian supply chain requires necessary capabilities that form scalability during the preparedness stage in order to activate them during immediate response.
2.4 Structural flexibility and dynamic flexibility

In turbulent environments, structural flexibility enables supply chains to respond rapidly to demand fluctuations. It is defined as “the ability of the supply chain to adapt to fundamental changes in the business environment” (Christopher & Holweg, 2011, p. 70). The main objective of structural flexibility, therefore, is to enable supply chains to be more adaptable in the face of turbulence (Christopher & Holweg, 2011).

On the other hand, dynamic flexibility is a concept “which allows firms to cope with certain shifts in demand and technology, but only within the set structure of their existing supply chain design” (Christopher & Holweg, 2011, p. 64). Thus, it deals with more operational situations or “single quest” scenarios (Christopher & Holweg, 2011) in order to cope with surges in demand, and it refers to the activation of temporary networks from the existing structure or scaling up the capacity in order to meet the demand. In the literature, dynamic flexibility is the essence of building agility while structural flexibility is the essence of building adaptation (Dubey & Gunasekaran, 2016). Thus, structural flexibility is a supply chain design approach that has flexible options such as dynamic flexibility; and dynamic flexibility leads to agility in humanitarian supply chains in order to respond to the demands quickly (Dubey & Gunasekaran, 2016) (see Figure 3).

Moreover, structural flexibility and dynamic flexibility contribute to adaptability and agility in sustainable humanitarian supply chains, respectively (Dubey & Gunasekaran, 2016). Structural flexibility can be achieved through strategies such as dual sourcing, asset sharing, separating the base demand from the surge demand, postponement, flexible labour arrangements, rapid manufacturing, and outsourcing (Christopher & Holweg, 2011).

Dual sourcing is operationalised in HSCM in various ways. Dual sourcing or multiple sourcing is an action that has been used to mitigate risk in supply chains generally (Tang, 2006b; Yu et al., 2009; Wang et al., 2010). Dual sourcing might have higher setup costs, but in longer-term development activities it is advantageous in terms of time as well as cost (Iakovou et al., 2014). Asset sharing refers to sharing physical assets among the supply chain members (Christopher & Holweg, 2011). In the humanitarian context, where there is a limited budget, asset sharing takes place through sharing trucks, human resources (van Wassenhove & Pedraza Martinez, 2012), or facilities such as warehouses.

Separating base demand from surge demand fluctuations and unknown demands is a major characteristic of humanitarian supply chains. Separating base demand from surge
demand is related to demand forecasting in order to anticipate demand fluctuations. In SCM, demand surges are overcome by “information sharing” (Lee et al., 2000) or postponement. Sudden-onset humanitarian operations are characterised by demand surges and unpredictability. Postponement, therefore, is a way of handling surges in demand and a SCM best practice adopted by humanitarian organisations (van Wassenhove & Pedraza Martinez, 2012). In humanitarian settings, postponement of ownership includes pre-positioning (Jahre & Heigh, 2008; Kovács & Tatham, 2009), creating a pool of resources until they are needed (Kovács & Tatham, 2009), and optimising the de-coupling point before dispatching commodities to the beneficiaries (Chandes & Pache, 2010). Flexible labour arrangements in humanitarian settings in order to meet surge demand requires mobilising emergency personnel where they are needed (Kovács & Tatham, 2009). In humanitarian supply chains, outsourcing is also used for handing over transportation and warehousing activities to logistics service providers (Balcik et al., 2010). In summary, supply chain scalability is observed in humanitarian supply chains, as they are also structurally flexible.

Moreover, SCI is posited as one of the antecedent capabilities to build scalability in a supply chain. In order to anticipate surges in demand and to quickly mobilise resources to beneficiaries, information sharing is one of the capabilities that leads to SCI. Information sharing contributes to visibility throughout the chain. In this thesis, scalability is addressed from dormancy to action when operations transform from lean to agile (Kovács & Tatham, 2009), in other words, during the activation of temporary networks from permanent structures.

2.5 SCRM and resilience

In this section, SCRM and supply chain resilience were discussed in SCM.

2.5.1 SCRM

Risk management is “the process whereby decisions are made to accept a known or assessed risk and/or the implementation of actions to reduce the consequences or probability of occurrence” (Norrman & Jansson, 2004, p. 438). SCRM is an approach to cope with risks those organisations and supply chains are exposed to. Supply chains have become more vulnerable in dealing with risk since they have gone global. There are trends adopted by supply chains that expose them to risks, such as becoming lean (Christopher & Lee, 2004; Christopher & Peck, 2004), which causes an increase in supply chain vulnerability. Supply chain vulnerability is defined as “an exposure to serious disturbance arising from supply chain risks and affecting the supply chain’s ability to effectively serve the end customer market” (Jüttner, 2005, p. 124).

Before discussing SCRM, the related terms should be defined. Risk is differentiated in the SCM literature into various categories, mainly focusing on disruptions rather than on the triggers born of uncertainties (Trkman & McCormack, 2009). Risk could be the outcome of strategies that are adopted by organisations; or, in fact, supply chain risk can be any event that is unpredictable (Jüttner, 2005). Supply chains have also adopted the business continuity management approach as a tool of SCRM (Zsidisin et al., 2005). Although most supply chains can run their operations in a stable environment, not many achieve operational success in turbulent environments (Trkman & McCormick, 2009), where more disruptions may occur. Thus, SCRM is closely related to four basic constructs, as presented by Jüttner et al., (2003). These are supply chain risk sources,
risk consequences, risk drivers, and risk mitigation strategies. Therefore, SCRM is defined as “the identification and management of risks for the supply chain, through a co-ordinated approach amongst supply chain members, to reduce supply chain vulnerability as a whole” (Jüttner et al., 2003, p. 201) or “the management of supply chain risks through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity” (Tang, 2006a, p. 453).

Disasters are among the risks under natural or social uncertainties along with political ones, and are grouped under “environmental” and external (Jüttner, 2005) or exogenous uncertainty (Trkman & McCormick, 2009). Resilience is a new concept, involving the ability to be proactive and reactive in responding to disruptions in supply chains (Christopher & Peck, 2004; Rice & Caniato, 2003). Robust strategies that enable supply chains to be more resilient are considered a way of dealing with risk (Tang, 2006a). Further, Tang (2006b) presented six areas of research to manage disruptions and reduce the impact of risk, such as demand, information, supply, product management strategies with objective functions, and demand and supply processes, which eventually helped the development of supply chain resilience as an SCRM tool. In fact, in humanitarian settings, risk management is associated with disaster risk reduction (DRR). However, SCRM was identified as a research field that should be focused on by HSCM (Day et al., 2012).

As Day et al. (2012) stated, there are still opportunities for HSCM to learn from SCRM, such as resilience and other related risk-reduction strategies. One of the DRR strategies is to strengthen local communities, as they are the first responders to any disaster (Kabra & Ramesh, 2015). DRR may also enable sustainability in HSCM (Kunz & Gold, 2015). Thus, supply chain resilience can be a way to decrease a disaster’s impact and enable sustainability in HSCM as a tool for DRR. Risk and need assessment, coordination and collaboration, and agile supply chains are indicated as critical success factors in reducing the impact of the risks in HSCM (Yadav & Barve, 2015), which are the principles of supply chain resilience. In HSCM, a sustainability approach can be a way of managing risk; as the supply chains become sustainable, they can be more resilient in facing disruptions, since preparedness is crucial to development programmes, as well as to all humanitarian organisations (Haavisto & Kovács, 2014). Thus, supply chain resilience is an emerging concept and needs to be discussed further in humanitarian settings (Tatham, 2012).

2.5.2 Supply chain resilience

Resilience has long been studied in other fields of research, such as engineering, ecological sciences, and organisational research (Pettit et al., 2010). However, supply chain resilience is a relatively new field of research in SCRM. The term has been defined many times, and there have been state-of-the-art articles published recently (see Hohenstein et al., 2015; Kamalahmadi & Parast, 2016), which proves that the concept has been developed. In the boundaries of SCM, the term was first defined by Rice and Caniato (2003). Christopher and Peck (2004, p. 2) defined the concept as “the ability of a system to return to its original state or move to a new, more desirable state after being disturbed.”

From a capability perspective, Ponomarlov and Holcomb (2009, p. 131) defined the concept as “the adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function.” This definition has been characterised as the most profound definition of the concept
There are studies suggesting the capabilities and strategies that can be used to build resilient supply chains (Kamalahmadi & Parast, 2016). Four capabilities—supply chain re-engineering, collaboration, agility, and risk management culture—are the most common capability models in the literature (Christopher & Peck, 2004; Kamalahmadi & Parast, 2016; Scholten et al., 2014). Scholten et al. (2014) consider knowledge management one of the capabilities that can form resilience in supply chains.

Supply chain design principles, supply chain understanding, and supply base strategies (Christopher & Peck, 2004) are considered supply chain re-engineering strategies. Redundancy strategies, such as multiple sourcing and safety stock, are also considered in this category (Hohenstein et al., 2015; Sheffi, 2005; Sheffi & Rice, 2005). The trade-off between redundancy and efficiency should also be taken into consideration (Christopher & Peck, 2004).

Collaboration enables supply chains to increase their intelligence, which helps them to mitigate risk (Christopher & Peck, 2004). Collaboration also contributes to visibility by information sharing and knowledge sharing (Faisal, 2006), and it improves operational efficiency and effectiveness with quality in customer service (Scholten et al., 2014).

Agility is related to the rapid mobilisation of resources (Kovács & Tatham, 2009), and thus is critical in dealing with fluctuations in demand. The concept is defined as “a firm’s ability to quickly adjust tactics and operations within its supply chain to respond or adapt to changes, opportunities, or threats in its environment” (Gligor et al., 2013, p. 95). Although agility is sometimes used synonymously with flexibility (Braunscheidel & Suresh, 2009), flexibility is the one of the antecedents of agility (Gligor et al., 2013; Swafford et al., 2008).

Risk management in a company or in a supply chain creates awareness about the risks it is facing. It is important to have a risk management team that regularly updates risk and reports it to the board on a quarterly basis, at a minimum (Christopher & Peck, 2004). Human resource management (Hohenstein et al., 2015) and knowledge management (Scholten et al., 2014) can also be considered under risk awareness.

### 2.6 Summary of the review

In this chapter, main concepts were reviewed in relation to scalability and resilience in supply chains. The main argument is to build scalability through SCI, structural flexibility, and information sharing. Information sharing is one of the antecedent capabilities of SCI. According to the literature review, coordination and collaboration are the capabilities that lead to SCI. In SCM literature, coordination may lead to collaboration and SCI. However, SCI is the tightest relationship in a supply chain. Thus, it is posited that SCI is one of the ways of building scalability in humanitarian supply chains, as SCI is called for in the humanitarian sector (Moshtari, 2016).

Information sharing, on the other hand, is referred to as one of the antecedents of SCI, collaboration, and coordination. Information sharing, therefore, is vital for scaling up the operations during immediate response by aligning the members of the supply chain (Wong et al., 2012). Thus, information sharing is considered one of the important capabilities leading to scalability, along with SCI and structural flexibility.
Information sharing enables demand anticipation before activating the disaster relief which is the key for separating base demand from surge demand in disaster relief operations. For this reason, when humanitarian organisations adopt structural flexibility, they also need to consider sharing quality information in order to scale up in a timely way during disaster relief operations. In order to scale up the operations, quick mobilisation of resources (Kovács & Tatham, 2009) and anticipation of the event (Merminod et al., 2014) are required.

Humanitarian supply chains, specifically development aid supply chains, adopt the lean principle during the preparedness phase or during their regular development activities, as they are trying to keep minimum inventory and use postponement strategy (Scholten et al., 2010). However, they are agile as they transform into immediate response phase when a disaster happens. Thus, they adopt leagility as they also try to reduce waste and try to avoid using more funding (Scholten et al., 2010).

In Figure 4, the relationships of the concepts reviewed are shown. Information sharing is the central capability of the three types of relationships—coordination, collaboration, and integration. The arrows denote contributions of concepts to each other.
3 RESEARCH DESIGN

In this chapter, the research design of the thesis is presented. Since this is a composite thesis consisting of essays, the research methods differ from essay to essay. Although the thesis is a collection of essays and has a rather pluralistic approach, all the essays have a deductive approach in nature, but, since a new concept is introduced to the HSCM literature, in other words, the aim is theory elaboration, so Essay B and Essay C each take a partly inductive approach.

The dominant research paradigm is critical realism. Proponents of critical realism, in line with positivism, agree that there is an external reality outside of human knowledge; however, they suggest that the understanding of reality is socially constructed (Eriksson & Kovalainen, 2008). Critical realism “seeks to understand the generative structures and mechanisms that underlie events” (Aastrup & Halldórsson, 2008) and defines reality as relative to our knowledge and as a theory-dependent approach (Aastrup & Halldórsson, 2008).

Critical realism is a paradigm that allows researchers to build a bridge between empirical and theoretical knowledge, and therefore enables theory testing and theory building in SCM (Rotaru et al., 2014). The main objective of this thesis is to further the understanding of HSCM and contribute to knowledge creation in HSCM with the foundation of a critical realist view. This thesis focuses on scalability from the DCV and through different capabilities. Essay A explores different theoretical approaches in HSCM, and the other two essays examine scalability through information sharing, structural flexibility, and supply chain integration. Thus, this shows that there can be multiple approaches to knowledge creation in SCM. In this thesis, the critical realist paradigm enables us to look at the phenomena of scalability and resilience from different angles. A critical realist view supports the idea of seeing reality in different ways. Essay A looks into different theoretical approaches used in HSCM research. A case study approach also supports the critical realist view by combining various methods or data sources (Adamides et al., 2012).

In a critical realist paradigm, supply chains are regarded as two-dimensional constructions where the first dimension involves products and services and the second dimension involves the triggers to producing products and/or services (Adamides et al., 2012). In other words, in the HSCM context, one can explain relief commodities and services as first dimension and disasters as second dimension which cause surges in demand.

The first essay is a systematic and topical review of articles on theories borrowed from other fields in HSCM. Essay A, a broader view on HSCM and how it can be explained, explains from different borrowed theories that, although the real world exists, the phenomena can be looked at through different lenses. This is in line with acritical realism paradigm, as it explains there is a real world existing independently of social constructs made by humans. Supply chain, itself, is a human-made construct (Adamides et al., 2012). Essay A shows that theoretical approaches used in HSCM have roots in operations research, development studies, political science, and disaster management and, as such, proves that a critical realism paradigm is a suitable paradigm by which to examine phenomena in HSCM.

The second and third essays are based on a single-case-study approach with a critical realist paradigm. The concept under investigation is scalability and resilience. These essays (B and C) look into scalability through different concepts, namely, structural
flexibility, SCI, and information sharing. From the critical realist point of view, the interview guide used for the study was deductively created.

Table 1: Research methods across the essays

<table>
<thead>
<tr>
<th>Essay</th>
<th>Research Method</th>
<th>Data</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Content analysis</td>
<td>Secondary/279 articles published between 1995–2014</td>
<td>Content analysis</td>
</tr>
<tr>
<td>B</td>
<td>Case study</td>
<td>Primary and secondary</td>
<td>Template analysis</td>
</tr>
<tr>
<td>C</td>
<td>Case study</td>
<td>Primary and secondary</td>
<td>Template analysis</td>
</tr>
</tbody>
</table>

3.1 Content analysis

Content analysis refers to “a class of methods within empirical social science that can be applied both in a quantitative and qualitative way” (Seuring & Gold, 2012, p. 546). Krippendorff (2004, p. 18) defined content analysis as “a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use.” To analyse the diversified qualitative data collected through interviews and web-based documentary, content analysis is an appropriate method (Seuring & Gold, 2012).

The content analysis approach has been used in the SCM and HSCM literature (Haavisto & Kovács, 2014; Seuring & Gold, 2012). It is possible to find examples in the diverse field of SCM and logistics: HSCM (Haavisto & Kovács, 2014; Kovács et al., 2012; Kunz & Reiner, 2012) sustainable SCM (Srivastava, 2007; Seuring & Müller, 2008), corporate social responsibility in SCM (Tate et al., 2010), and transportation (Cullinane & Toy, 2000).

There are two levels of analysis in conducting content analysis: first, the statistical analysis that shows the content of the documents; and second, the interpretation of the concepts and arguments in the latent content (Seuring & Gold, 2012). The steps of content analysis are as follows: material collection, descriptive analysis, category selection, and material evaluation (Seuring & Gold, 2012).

Thus, the articles published between 1995 and 2014 are analysed through the theoretical approaches used. This is in line with the assumptions of the critical realism that more than one theoretical lens is used in order to examine research problems in SCM (Halldórsson et al., 2015).
3.1.1 Data collection

The state-of-the-art articles are important, as they can demonstrate where the research stands (Seuring & Gold, 2012). The first essay, Essay A, is a literature review article, where the relevant articles are reviewed in order to identify and evaluate the use of theoretical approaches in HSCM research.

The data in Essay A consists of scientific journal articles published between 1995 and 2014. The articles are filtered from the well-known HSCM bibliography created by Peter Tatham (2015). The bibliography itself was created through keyword searches and going through references of the articles that came up from keyword searches. The bibliography consists of various articles, conference papers, and book chapters published in diverse research fields, such as development studies, political science, operations research, and so on. This proves that HSCM is an interdisciplinary research field.

The criteria followed in filtering the articles involved two steps. First, well-known academic journals were chosen, and articles with a practitioner’s point of view were excluded. Second, we chose articles that follow an academic article style, with a research method section. The total of 279 articles was included in our data collection. Descriptive statistics were created in terms of journal names, the number of articles in each journal, and the number of articles published in each year for the period 1995–2014.

3.1.2 Data analysis

In Essay A, content analysis was conducted to determine which theories were used in the field of HSCM and which fields HSCM borrowed theories from. The foundation of the analysis was to evaluate latent and explicit content. All of the articles were read carefully and categorised in terms of research methods, level of theory, type of disaster, phases of disaster relief, and the name of the model/framework/theory. Arlbjørn and Halldórsson’s (2002) framework was followed, as articles were assigned levels 0 to 4. Level 0 was articles with no theory; Level 1 was those presenting hypotheses and propositions; Level 2, models and frameworks; Level 3, middle-range theories, such as RBV and DC; and Level 4 was grand theories, such as complexity theory and chaos theory. In the essay, although some of the Level 3 and Level 4 articles also developed models and frameworks based on middle-range theories or grand theories, these were still assigned to the highest-level category.

3.2 Case study approach

The case study approach is used to analyse a phenomenon in depth. The case study approach is suitable for “how” questions (Eisenhardt, 1989; Voss et al., 2002; Yin, 2009). Essays B and C used the same research methodology, a single embedded case study approach (Yin, 2009). Case studies are important, as they “allow direct observation of the field, which would be particularly suitable for approaching several stages of a supply chain” (Seuring, 2008, p. 128). In Essays B and C, a single embedded case study design was adopted with multiple units of analysis, which are organisations and individual respondents as well as development aid supply chain which provides basic nutrition services and disaster relief chain which provide emergency nutrition services. The case study is explorative (Voss et al., 2002) and aims to achieve theory elaboration (Ketoviki & Choi, 2014) through examining supply chain scalability and resilience. There are five important components (Yin, 2009, p. 27) of a case study design:

1. a study’s questions;
2. its propositions, if any;
3. its unit(s) of analysis;
the logic linking the data to the propositions; and the criteria for interpreting the findings.

A single-case-study approach does not offer generalisations; rather, it aims to illustrate a theory, and motivate or inspire other researchers to conduct further studies on the subject under investigation (Siggelkow, 2007). With the case study approach, the main objective is to illustrate theoretical findings and motivate other researchers to further explore the phenomenon of scalability and resilience in humanitarian supply chain management.

### 3.2.1 Kenya’s nutrition-related healthcare system

Food security and nutrition activities are primarily the responsibility of the Ministry of Health, but at the same time, this is a multi-sectorial effort with the help of other governmental bodies, such as the Ministry of Agriculture (food distribution) and Ministry of Education (school meals). There are 47 counties in Kenya. According to the World Food Programme report (WFP, 2015), it is classified as a “lower-middle-income but food deficit” country. Arid and semi-arid lands (ASAL) cover 80% of the country, with limited agriculture potential. Thus, the country is hit by drought frequently; however, agriculture is one of the most important economic drivers of the country. According to the WFP report (2015), in those ASAL areas, global acute malnutrition among children under 5 years of age generally surpasses 15%, and many households cannot provide a nutritious diet. As a result, approximately 1.8 million children are chronically malnourished, with high levels of stunting (35%). To solve these issues, a process of devolution took place that handed over responsibilities to county governments.

To improve the nutrition situation in Kenya, the Food and Nutrition Security Policy (FNSP) has developed a nutrition strategy, the Food and Nutrition Security Strategy (FNSS). The 2012–2017 National Nutrition Action Plan (NNAP) is based on these. 11 strategic objectives are identified in the Kenyan nutrition sector (NNAP, p. 9):

- To improve the nutritional status of women of reproductive age (15–49 years)
- To improve the nutritional status of children under 5 years of age
- To reduce the prevalence of micronutrient deficiencies in the population
- To prevent the deterioration of nutritional status and save the lives of vulnerable groups in emergencies
- To improve access to quality curative nutrition services
- To improve the prevention, management and control of diet-related NCDs
- To improve nutrition in schools, public and private institutions
- To improve nutrition knowledge attitudes and practices among the population
- To strengthen the nutrition surveillance, monitoring and evaluation systems
- To enhance evidence-based decision-making through research
- To strengthen coordination and partnerships among the key nutrition actors and mobilise them

### 3.2.2 Data collection

The nutrition supply chain case in Kenya was identified as the best case practice by the experts in the nutrition sector, the Food Security and Nutrition Working Group (FSNWG) as a part of the Academy of Finland’s “Resilience in disaster relief and
development supply chains – managing challenges of climate change, urbanization and security” project. The first paper from the data collection was published in NOFOMA Conference 2014 proceedings on critical success factors in the Kenyan nutrition supply chain based on field notes only.

The first step was the case selection; the nutrition situation in Kenya shows frequent surges in demand and calls for scalability. The Kenyan nutrition supply chain is scalable in responding to sudden surges in demand during disasters; therefore, FSNWG identified it as the best case for combining development and risk reduction. The nutrition supply chain consists of various members: NGOs, aid agencies, donors, and the Government of Kenya, represented by the Ministry of Health. The system works based on the funding system. In the case of a disaster, when the surge goes up, the supporting members of the supply chain, such as NGOs, aid agencies, and county governments, apply to donors, such as USAID, DFID, UNICEF, the World Bank, and ECHO, for additional funding to respond to surges. During the scale-up, the organisations increase the number of target beneficiaries with resource mobilisation and increase the human resources at the counties’ healthcare and outreach facilities. UNICEF acts as a procurement agency on behalf of NGOs and other organisations for nutrition commodities. The data collection excludes the manufacturing side of nutrition commodities, where there is only one major global manufacturer of therapeutic food, in France, Nutriset (Komrska et al., 2013) and manufacturing is not in the scope of HSCM.

The second step was stakeholder mapping. The data collection started with theoretical sampling (Eisenhardt, 1989) and purposive sampling (Patton, 2005), and the research team attempted to reach as many respondents as possible during the limited period of time in Kenya. This was done prior to the trip to Kenya with UNICEF Kenya and FSNWG. During the stay in Kenya, snowball sampling (Creswell, 1998) was applied through asking interviewees, for further identification of stakeholders. Data collection was carried out in the first quarter of 2014. In the scope of data collection, the next step was county selection; the possibilities were discussed with the UNICEF Kenya nutrition group and Isiolo and Turkana counties were identified. While Isiolo suffered from moderate acute malnutrition cases, Turkana suffered from severe acute malnutrition; therefore, these two counties were visited, and stakeholder mapping was done with UNOPS representatives in these counties. Further identification of respondents was done using snowball sampling. To identify group interviewees, healthcare centres were visited.

![Image of data collection process](image-url)
The interview guide consisted of questions about the background and the role of organisations in the nutrition sector, intervention, scale-up, scale-down, and the success of the operation from the supply chain point of view. All interviews were recorded and transcribed, and field notes were taken during all interviews. In total, 52 semi-structured interviews were conducted with representatives of aid agencies, NGOs, government bodies, and donor agencies that were part of the nutrition supply chain. The respondents were nutrition managers, program managers, and logistics managers from the supporting members (NGOs), Ministry of Health, aid agencies (UNICEF and WFP), and donors at both the national and county levels. Some interviews involved two or more respondents at a time. The interviews lasted an average of 45–60 minutes. Additionally, in Isiolo and Turkana, healthcare centres and villages were visited, and group interviews were conducted with community health workers and caregivers of beneficiaries (downstream supply chain). In total, 16 group interviews were conducted with pastoralist and fisher communities in Isiolo and Turkana, respectively. The group interviews were conducted with local languages with the help of a translator. One challenge of group interviews was to find a translator of the local language in order to transcribe. Thus, only the English part of the group interviews was transcribed and field notes were used for the rest.

3.2.3 Data analysis

The analysis began with transcribing. Although some interviews were transcribed by the outsourced transcriber, the author read and checked all the transcripts to prevent any misunderstanding. The rest of the interviews were transcribed by the author from scratch. The interview guide was created deductively, and the deductive approach was used to extract themes from the transcripts. The transcripts were coded with Nvivo software, which is a very useful tool for analysing qualitative data. The coding process was done according to the research questions, and each framework was adapted from the literature in the essays. The data collection process was set up deductively, and interviews were conducted by a research team of four, with which the author was involved. For the paper, the data analysis focused on the scaling-up of the operations. The data was analysed using the template analysis method (King, 2012). The template analysis is “a style of thematic analysis that balances a relatively high degree of structure in the process of analysing textual data with the flexibility to adapt it to the needs of a particular study” (King, 2012, p. 426). Templates were developed separately for the purposes of Essay B and C, and they were used with the steps (data reduction, data display, and conclusion) proposed by Miles and Huberman (1994) in order to code and analyse the data. Codes are referred to as “tags or labels” for assigning units of meaning to the descriptive or inferential information compiled during a study. Codes are usually attached to “chunks: of varying size — words, phrases, sentences or whole paragraphs” (Miles & Huberman, 1994, p. 56). The data were analysed at the organisational level and group interviews were used in order to deepen the understanding for conceptual and triangulation purposes.

3.3 Trustworthiness

In Essay A, to ensure the reliability of the findings, the “discursive alignment of interpretation” was used to resolve uncertainties in the latent content (Seuring & Gold, 2012, p. 547). Moreover, all articles were assessed by at least two researchers. Although the bibliography has many diverse articles from different fields of research
related to HSCM, it can still limit the findings of Essay A, since some articles might be overlooked when updating the bibliography.

Triangulation is a common approach in order to improve the trustworthiness of the case study approach (Eisenhardt, 1989; Voss et al., 2002; Yin, 2009). To prevent data manipulation and increase trustworthiness, triangulation was used. Triangulation is “an approach to research that uses a combination of more than one research strategy in a single investigation” (Streubert & Carpenter, 2011, p. 349), and it has types of data triangulation, investigator triangulation, method triangulation, and theoretical triangulation (Denzin, 1989).

In Essays B and C, data triangulation (documents, field notes, transcripts) is primarily used. Moreover, in order to avoid any factual mistakes, all essays were cross-checked with a nutrition expert from the case organisation. Investigator triangulation were used in Essay A. At least two authors were checked the results of data analysis. This enabled increasing the reliability and validity of the data by comparing the responses from both parties.

Data triangulation was used by combining different data sources, including interviews, group interviews with caregivers of beneficiaries, documents gathered from organisations, observations through visiting health facilities in rural areas in Isiolo and Turkana, and field notes. Moreover, expert opinions were used in order to avoid factual mistakes by sending out the essay B and C to the UNICEF nutrition section. Further, one of the nutrition experts co-authored Essay C.

The templates were created separately for Essays B and C, based on different concepts with the help of an interview guide. Then, templates were imported into Nvivo 10 and 11 software, where all data can be seen as a whole. Coding was also done through Nvivo, which also increases the validity of the findings.
4 FINDINGS FROM THE ESSAYS

This chapter describes the findings from each essay, starting with the contribution to the dynamic capabilities view.

4.1 Contributions to dynamic capabilities view

The dynamic capabilities view (DCV) is the main theoretical view in this thesis. It is an extension of the RBV (Barney, 2001; Barney et al., 2011). While the RBV argues that organisations compete in a heterogeneous environment in terms of their resources and capabilities and claims that a firm’s resources should be valuable, rare, imperfectly imitable, and non-substitutable (Barney, 1991), the DCV approaches the market from an evolutionary perspective and claims that firms compete in a rapidly changing environment (Teece, 1994; Teece et al., 1997), which is also referred to as moderately dynamic and high-velocity markets (Eisenhardt & Martin, 2000; Winter, 2003). Over time, the definition of the DCV has also changed (Wilden et al., 2016). One of the first profound definitions posited in the second half of the 1990s was “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece et al., 1997, p. 516).

Humanitarian supply chains and the humanitarian environments in which organisations operate are already identified as volatile (Kovács et al., 2012) due to their uncertainty and unpredictability. Thus, the DCV is the most suitable approach to explain resilience and scalability in humanitarian supply chains. Resilience is already considered a DC in the context of SCM (Eltantawy, 2016; Gölgeci & Ponomarov, 2013; Kamalahmadi & Parast, 2016; Ponomarov & Holcomb, 2009). In this thesis, scalability is also posited as a DC. In humanitarian environments, although the main objective is to alleviate the suffering of beneficiaries (Thomas & Mizushima, 2005), there is still competition among humanitarian organisations, specifically in the development stream of HSCM, in which organisations compete for funding. However, the general understanding in HSCM is to create and transfer good practices as a learning mechanism; therefore, the main contribution of this thesis to the DCV is that it argues that scalability and resilience are good practices that should be transferred to future studies and practices. HSCM generally borrows good practices from SCM, which is evident in the HSCM literature (van Wassenhove & Pedraza Martinez, 2012). In Essay A, the DCV is not the main theoretical view. Rather, the essay is a topical review of theoretical approaches used in HSCM over the course of 20 years. However, the essay is important, as it allows the gaps in the HSCM literature to be identified.

In Essay B, the DCV is used to explain scalability and resilience in HSCM. The supply chain resilience framework is adapted based on Christopher and Peck (2004), Scholten et al. (2014), and Kamalahmadi and Parast (2016). From the DCV perspective, the essay argues that scalability and resilience in supply chains are DCs. DCs can operate on DCs (Helfat et al., 2007); thus, there is a distinction between lower-level and higher-level capabilities. Supply chain resilience is a DC, as it integrates lower-level formative capabilities to sense threats and seize opportunities and reconfigures or shapes resources and capabilities in order to respond to and mitigate the impacts of risks (Teece, 2007; Teece et al., 1997). While scalability is a lower-order capability compared to supply chain resilience, supply chain scalability is proposed as a DC which acts as a mediating capability that contributes to supply chain resilience in HSCM.

Structural flexibility (Christopher & Holweg, 2011) and information sharing (Christopher & Holweg, 2017) are proposed as antecedents to building scalability in a supply chain.
Both structural flexibility and information sharing are proposed as DCs. First, structural flexibility has an adaptation feature and is a foundation of an adaptive supply chain (Christopher & Holweg, 2011). Information sharing is a DC, as it enables members of a supply chain to exchange information back and forth regarding when to activate disaster relief operations and increase their capacities. These two antecedents configure scalability as a DC, and scalability contributes to building resilience in a supply chain. Scalability also enhances service levels in humanitarian supply chains by sensing increase in demand and seizing the right time to respond in order to mitigate the impact of risks and addressing the gaps in a supply chain. Thus, it allows members to shape resources and capabilities collectively in order to respond to the impact of disasters quickly by scaling up operations. Thus, scalability is able to sense emergencies through information sharing because the latter increases supply chain visibility (Fu et al., 2017; Kembro et al., 2017; Lee & Rha, 2016; Maghsoudi & Pazirandeh, 2015); therefore, members of a supply chain can anticipate surges in demand. After sensing, scalability enables seizing through coordination meetings, during which members decide on the appropriate time to scale up the intervention operations or scale down the operations. In order to do so, structural flexibility enables members to shape resources and capabilities in order to adapt to new environments in times of disaster or emergency.

Along with scalability, agility, risk awareness, collaboration, and supply chain re-engineering are lower-order capabilities that form supply chain resilience. The more of these independent variables a supply chain has, the more resilient it is. Humanitarian supply chains are known for their agility capability (Oloruntoba & Gray, 2006), as well as for their flexibility (Gattorna, 2006, 2009). Flexibility is an important capability for agile organisations (Christopher & Towill) and is an antecedent of agility (Swafford et al., 2008). In addition, humanitarian organisations have started adopting structural flexibility as their strategy (Kovács et al., 2012). Therefore, exploring structural flexibility as an antecedent capability of scalability in a humanitarian context contributes to advancing the discussion on scalability from the DCV perspective.

In Essay C, the main argument is the role of SCI in scalable supply chains. The main argument is based on the foundation of coordination and collaboration as the antecedents of SCI and is focused mainly on inter-organisational integration. In the essay, along with the DCV, the relational view (RV) is exploited. The RV has foundations in supply chain relationships. Relational capabilities (RCs) are the source of creating competitive advantages based on the relationships among the members of a supply chain (Dyer & Singh, 1998). RCs are also considered to be related to resilience (Blackhurst et al., 2011). Thus, SCI is highlighted as one of the RCs in the SCM literature. The discussion in Essay C in general is that scalability as a DC is achieved through an SCI that is considered an RC.

4.2 Findings from Essay A

The first essay is not related to the main topic of the thesis, but it is important to examine the current state of HSCM. Therefore, it contributes to the main topic by identifying the research gap in HSCM. The essay examined the theoretical approaches in HSCM by identifying the theoretical contributions of the articles published in the HSCM domain. Peter Tatham’s well-known HSCM bibliography (2015) is used as a sample, and journal articles published between 1995 and 2014 are filtered for the analysis.

According to the analysis, most articles in HSCM were published in the Journal of Humanitarian Logistics and Supply Chain Management, Disaster Prevention and
Management, and the International Journal of Physical Distribution and Logistics Management. Two research questions are addressed in the essay. The first question is the following: Which theories are used in HSCM?

In order to address this question, Arbjorn and Halldórsson’s (2002) framework of knowledge creation is used. The framework consists of five levels, ranging from 0 to 4. The conceptual articles are assigned a 0; articles contributing at the proposition or hypothesis level are assigned a 1; articles that develop models or frameworks are assigned a 3; articles that use middle-range theories, such as the RBV or DC, are assigned a 3; and articles that use grand theories are assigned a 4.

Our sample consisted of 279 journal articles, of which 57 used middle-range theories. The most common borrowed theory is the inventory control theory, followed by the systems theory, the stakeholder theory, and varieties of the resource-based view. There is an upward trend in the use of theories from those published in 1995, which proves that HSCM is maturing. Most of the frameworks and models in disaster management focused on preparedness and response. One article applied development theories in the response phase. Most of the articles used OR-related theories in the preparedness and response phases, while only one article used OR-related theories on reconstruction and response together. Only one article used a grand theory—the complexity theory. The second question addressed is the following: From which disciplines does HSCM borrow theories?

The journal preferences and borrowed theories showed that HSCM is an interdisciplinary research field. According to the findings, some articles were published in diverse journals that are not related to SCM or HSCM, such as Development and Change and International Affairs. In addition, some of the middle-range theories that were used, such as the cultural bias theory, originated from political science. However, as the majority of the articles were published mostly in three journals, this shows that there are still more to research on different approaches in HSCM.

Overall, the findings of this essay showed the state of the art of HSCM. It is important to understand that scalability and resilience in HSCM are still scant, although there are some studies on agility and resilience at the framework level. It is important to note that there are also articles that have examined facility location models, postponement, and other concepts related to scalability. For instance, the facility location model is the most studied model in the HSCM literature, according to the findings. However, the main objective of the thesis is to contribute holistically to the understanding of scalability and resilience in HSCM. Thus, Essays B and C contribute to filling this gap, and the thesis as a whole contributes to the discussion on scalability and resilience by developing a framework.

4.3 Findings from Essay B

Essay B looks into scalability through information sharing and structural flexibility. Structural flexibility is a concept that supply chains have started to adopt, as they are facing demand fluctuations and market volatility. Humanitarian environments are considered the most volatile; thus, humanitarian organisations are adopting structural flexibility. Moreover, humanitarian supply chains are scalable, as they are able to quickly respond to changes because they are agile and flexible. In Essay B, scalability is explored through structural flexibility and information sharing in HSCM. The first research question under scrutiny is the following: How is scalability through structural flexibility
and information sharing implemented in humanitarian supply chains? The research question is addressed by analysing the data through the antecedents of structural flexibility. However, the findings also show that information sharing is an important capability for building scalability, as it is one of the enablers of supply chain alignment (Wong et al., 2012).

Extensive literature review has also shown that scalability can contribute to, and can be one of the capabilities of, supply chain resilience. Therefore, the second research question investigated is the following: How can humanitarian supply chains be resilient through scalability? Based on the work of Christopher and Peck (2004), Kamalahmadi and Parast (2016), and Scholten et al. (2014), the resilience and scalability framework in HSCM is developed.

The data collected from the Kenyan nutrition supply chain case is analysed through the framework. The concept of scalability has been practised in the healthcare sector. The Kenyan nutrition supply chain is the integration of a basic public healthcare supply chain and a disaster relief chain. The supply chain is scaled up in times of disaster by activating the disaster relief chain. Thus, the case is worth studying, as it was also identified as the best case by the Food Security and Nutrition Working Group in East Africa. The template for analysing the data is based on the framework and interview guide.

The findings show that scalability can be achieved through structural flexibility and information sharing in HSCM. Therefore, the argument is that, to be more scalable, the supply chain needs to be structurally flexible and must entail information sharing; thus, the essay proposes the following:

- **P1:** Scalability requires structural flexibility
- **P2:** Scalability requires information sharing

Collaboration is a formative capability for supply chain resilience (Christopher and Peck, 2004). Information sharing is one of the keys in the Kenyan nutrition supply chain and is realised through coordination meetings; therefore, it enables the supply chain to be more scalable. At the same time, coordination and information sharing contribute to supply chain resilience. Thus,

- **P3:** Scalability contributes to collaboration through information sharing
- **P4:** Scalability contributes to collaboration through structural flexibility

Information sharing is required for agility, as well as for quickly mobilising resources in the response phase. Agility and flexibility are closely related to each other, and flexibility can be a capability of agility (Gligor et al., 2013; Hohenstein et al., 2015), thus,

- **P5:** Scalability contributes to agility through information sharing,
- **P6:** Scalability contributes to agility through structural flexibility

Therefore, structural flexibility contributes to supply chain re-engineering. Sourcing decisions are highly relevant to the supply chain re-engineering capability of supply chain resilience (Christopher & Peck, 2004). Structural flexibility requires dual sourcing and outsourcing to be in place; therefore, it contributes to supply chain re-engineering in terms of sourcing decisions as well as flexibility. Moreover, in order to create knowledge amongst the member of a supply chain, information sharing is crucial (Scholten et al., 2014). Thus, the essay proposes the following:
P7. Scalability through structural flexibility contributes to supply chain re-engineering.
P8. Scalability through information sharing contributes to knowledge management/risk awareness.

As the data show, the Kenyan nutrition supply chain is resilient, as all the capabilities required for resilience are evident during the activation of scaling up. Thus, the essay proposes the following:

P9. Scalability is an antecedent capability of supply chain resilience

4.4 Findings from Essay C

Based on Essay B, the following research question is addressed in Essay C: How can supply chain integration be operationalised in HSCM? The first research question is addressed through the conceptualisation and operationalisation of SCI in the HSCM context. As a result of the literature review on SCI, the framework is developed in order to create the template for analysing the data. Thus, how does supply chain integration contribute to scalability?

Thus, Essay C examined scalability through SCI. In the essay, SCI is considered the highest-level relationship amongst the members of the supply chain; therefore, collaboration aspects and coordination are considered resources for forming supply chain integration. Information sharing is an important capability for SCI and enables the supply chain to be scalable, as it also allows members of the supply chain to have the anticipation capability (Merminod et al., 2014) and quick resource mobilisation (Kovács & Tatham, 2009). Moreover, information sharing through coordination meetings enables the duplication and overlap of efforts to be avoided. Information sharing enables SCI, and SCI enables humanitarian supply chains to be more agile (Oloruntoba & Gray, 2006), as the findings prove. Thus, the essay proposes the following:

P1. Scalability requires SCI
P2. SCI yields more agility in scalable supply chains

As the data show, through the lens of DCV, SCI is an important capability for building scalability in a supply chain. Because collaboration is one of the capabilities of building resilience in supply chains, along with agility, risk awareness, and supply chain re-engineering (Christopher & Peck, 2004; Hohenstein et al., 2015; Kamalahmadi & Parast, 2016; Ponomarov & Holcomb, 2009; Scholten et al., 2014; Scholten & Schilder, 2015), and as evident from the data, resilience can also be built through scalability (through supply chain integration). Thus, the essay proposes the following:

P3. Scalability through SCI contributes to supply chain resilience.
5 CONCLUSIONS AND IMPLICATIONS

The research focus of this thesis is to study scalability and resilience in humanitarian supply-chain management (HSCM). Explorations of the research problem were divided into three essays to examine the concepts more thoroughly. This chapter elaborates on the concluding remarks from these essays, the managerial and methodological implications, the contributions to theory and literature, the research limitations and the potential directions for future research.

5.1 Concluding remarks

First, it is important to state that volatility and turbulence are not rare within the business environment; instead, they have become the reality of such environments (Christopher & Holweg, 2011, 2017; Gattorna, 2009). For this reason, there are more cross-learning opportunities to explore across the humanitarian and business settings (Van Wassenhove, 2006).

The first essay, Essay A, is a research paper on the theoretical approaches in HSCM. Essay A is not directly related to the concept of scalability but focused on identifying the gaps and maturity of the research field itself. It also proposed avenues for reasoning and theorising in the field. The other two essays examined scalability from different angles. Although this thesis primarily explores scalability, resilience is considered an outcome of scalability; thus, scalability is the means, and resilience is the end. The overarching aim of this thesis is to deepen the understanding of scalability in supply chains and how this leads to supply chain resilience.

Essays B and C are based on a case study of the Kenyan nutrition supply chain. Both essays explored the scalability of the Kenyan nutrition supply chain through when it’s built through structural flexibility and information sharing, and SCI. Structural flexibility was introduced as a capability for building a supply chain in volatile markets (Christopher & Holweg, 2011). Humanitarian supply chains are already structurally flexible (Kovács et al., 2012), as humanitarian organisations operate in volatile environments. The dynamic capabilities view (DCV) served as the main theoretical lens in both articles, as DCs describe an organisation’s ability to survive in volatile environments (Teece et al., 1997).

These findings are aligned with previous studies in that, according to the DCV, scalability and resilience are posited as DCs because they enable organisations to sense threats, seize opportunities and survive in volatile environments by reconfiguring their resources and capabilities (Teece et al., 1997; Teece, 2007). According to Helfat et al. (2007), who explained that DCs can operate on DCs, the antecedents of scalability (i.e. SCI, structural flexibility and information sharing) are also considered lower-level DCs. SCI and information sharing are considered relational capabilities (RCs) since they create competitive advantages between members of a supply chain (Dyer & Singh, 1998).

5.1.1 The maturity of HSCM research

Essay A aimed to further the understanding of theoretical approaches used in HSCM research, as there are claims that both supply chain management (SCM) and HSCM lack their own theories, instead borrowing them from other fields of research. As HSCM research is a relatively young field, compared to SCM, this essay examined its
borrowed theories. At the framework and model levels, HSCM borrowed more theories from operations research and SCM than from other disciplines, such as disaster management. At the framework, model and middle-range-theory levels, there is an increasing trend that shows HSCM is reaching maturity as a discipline. Another finding revealed that there is a lack of theories cited in studies assessing the reconstruction phase at all levels. For the response phase, middle-range theories are also absent in research on flexibility and agility.

To increase knowledge in SCM, both SCM and HSCM research should borrow theories that are most suitable to these fields rather than benchmarking their implementation of concepts, such as flexibility and agility, against their counterparts. However, the main contribution of Essay A is that it identified where scalability and resilience stand in HSCM, as the findings show that there is still little understanding of these concepts.

5.1.2 Supply chain scalability through structural flexibility and information sharing

Essay B advanced the discussion on supply chain scalability and resilience, and how scalability contributes to resilience in the Kenyan nutrition supply chain, as this supply chain is scalable in terms of its ability to respond to surges in demand. This essay also addressed the call for resilience in the literature on HSCM (see Day et al., 2012; Dubey et al., 2014; Tatham, 2012) and SCM (see Kamalahmadi & Parast, 2016; Melnyk et al., 2014). Resilience in supply chains is built through re-engineering, collaboration, agility, and risk awareness/knowledge management (Christopher & Peck, 2004; Scholten et al., 2014). Essay B analysed the Kenyan nutrition supply chain for resilience through these capabilities, and analysed the supply chain through structural flexibility and information sharing (Christopher & Holweg, 2011; Kovács et al., 2012) for scalability. From the DCV, resilience is inherently DC because it allows an organisation to cope with turbulent environments. Essay B highlighted that scalability is also a dynamic capability that contributes to supply chain resilience.

The essay’s findings can also be interpreted as recommendations for both humanitarian and commercial organisations operating in moderately dynamic, high-velocity markets, in terms of configuring resources to gain sustainable competitive advantages or best practices. There are always cross-learning opportunities between humanitarian and commercial supply chains (Van Wassenhove, 2006). Commercial organisations facing demand fluctuations caused by seasonality or supply-chain disruptions can learn from the scalability practices of the humanitarian sector. Regarding theory and practice, the present paper represents the first step towards a deeper understanding of scalability in the supply chain and its contribution to supply-chain resilience.

5.1.3 Supply chain scalability through SCI

An alternative method for achieving scalability is to integrate the primary and supporting members into the supply chain, as it is important to work collectively and scale up quickly to meet surges in demand. In Essay C, scalability was analysed through SCI. SCI is the highest level of the relationship amongst the members of a supply chain, and therefore carries the role of fostering collaboration and coordination within the supply chain. In this essay, the aspects of collaboration, proposed by Cao and Zhang (2011), and coordination were used to develop the theoretical framework.
Information sharing is the most important aspect of the collaboration and coordination activities that enable SCI; and all the other aspects of collaboration, as well as integration of the primary and supporting members, were observed in the data on the Kenyan nutrition supply chain. SCI is important because it enables the humanitarian supply chain to be agile (Oluruntoba & Gray, 2006); this contributes to scalability, since humanitarian supply chains scale up quickly.

The main theoretical lens in Essay C is the DCV. Supply-chain integration is posited as a RC and is regarded as a capability that activates scalability and contributes to another DC (i.e. supply chain resilience). The main objective in both Essays B and C was to elaborate on the concepts in HSCM by developing a theoretical framework (Ketokivi & Choi, 2014) for supply chain scalability and resilience for HSCM through the DCV.

5.2 Managerial implications

From a managerial point of view, the findings of Essays B and C are important for managers working in both the humanitarian and commercial sectors, as these sectors face demand fluctuations and lacking of capacity in everyday business due to seasonality and other uncertainties. The findings demonstrate the usefulness of supply-chain integration and scalability practices.

Scalability has long been practiced in commercial supply chains and manufacturing settings to avoid the bullwhip effect (Lee et al., 1997). However, due to seasonality, demand can be predictable in the commercial sector, while humanitarian operations are defined by unpredictable demand. Scalability practices in humanitarian operations are therefore more challenging, as humanitarian organisations work against time when mobilising resources to meet the needs of their beneficiaries in disaster-affected areas. Humanitarian organisations clearly operate in turbulent environments and their supply chains are therefore scalable, as they scale up and down according to their beneficiaries’ needs.

Due to the trends of globalisation and cost reduction, commercial organisations are exposed to risks and operate in turbulent environments. SCRM practices have thus been developed to cope with risk while running business. Both structural flexibility and SCI provide humanitarian organisations with the abilities to anticipate need and quickly mobilise commodities to affected areas. Commercial organisations can learn from these scalability practices, as humanitarian organisations operate in the most turbulent environments (Kovács et al., 2012).

The antecedents of scalability are also practiced in commercial supply chains, as is supply chain resilience. The main objective of SCRM is to build resilience (Grötsch et al., 2013). In the context of HSCM, the present findings demonstrate scalability practices that may lead to supply chain resilience. Therefore, along with Christopher and Holweg (2011), the present thesis contributes to advancing the survival of commercial supply chains in turbulent environments. Information sharing is also identified as the key capability contributing to both SCI (Cao and Zhang, 2011) and structural flexibility (Christopher and Holweg, 2017). Therefore, the present findings are useful for managers in both the business and humanitarian settings.
5.3 Contributions to theory and literature

The overall findings contribute to both theory and literature on DCV, HSCM, SCRM, and commercial SCM. Scalability has long been studied in SCM and manufacturing literature, as managers must deal with sudden surges in demand. In HSCM, however, there is still a lack of understanding of concept of scalability, although scalability has increased in practice. Thus, the present objective of elaborating on this concept is sound and logical. Resilience, on the other hand, has been widely adopted by commercial organisations and studied in SCM literature since 2003 (Hohenstein et al., 2015).

Essay A contributes to these bodies of knowledge through its examination of the HSCM research theories. This essay also identified the gaps in HSCM literature, such as studies on resilience and scalability. Essay A serves as the backbone of the present thesis and provides opportunities for future research in this field.

Following the literature review in Essay A, Essay B considered the conceptualisation of scalability and resilience in HSCM, developing a theoretical framework based on the DCV, then analysing this framework by applying it to the Kenyan nutrition supply chain. This essay proposed that scalability is a DC as it can help organisations sense threats, seize opportunities and shape their resources and capabilities in response to humanitarian emergencies (Teece, 2007). Apart from examining conceptualisation, this essay also contributes to the DCV through its elaborations on the capabilities that lead to resilience and scalability in HSCM. Information sharing and structural flexibility have been described as complementary towards efforts to increase scalability, and scalability has been identified as a mediating force in building supply chain resilience. Christopher and Holweg (2017) recently suggested that information sharing is also key for enabling structural flexibility in supply chains, granting them a better chance of survival in highly volatile environments.

Information sharing is also considered an important capability for SCI. Using this theory as a starting point, Essay C examined the role of SCI in scalable supply chains. First, SCI was conceptualised and operationalised through the coordination and collaboration in HSCM, as HSCM does not make a clear distinction between relationship types (Balcik et al., 2010). Coordination and collaboration are considered the antecedents of SCI (Leuschner et al., 2013); thus, a theoretical framework was developed. While scalability was identified as a DC, SCI was identified as an RC. SCI during times of preparation is more of a strategic approach; however, for disaster relief, especially during immediate response, SCI is more of an ad-hoc approach that is often referred to as episodic (see Moshtari, 2016; Zacharia et al., 2011) or transient (see Day et al., 2012), as it lasts for a certain period or phase. Therefore, many authors have recently suggested that humanitarian supply chains should have a more permanently structured SCI (Fawcett & Fawcett, 2013). In the Kenyan nutrition supply chain, since it is a development aid programme, SCI represents a strategic decision made by the GoK and other humanitarian organisations.

The present thesis provides a melting pot of the SCRM, HSCM, and SCI in SCM domains. Although SCRM approaches were developed for the commercial setting, it has been suggested that there are cross-learning opportunities between HSCM and commercial SCM and, further, that HSCM should borrow from SCRM approaches (Day et al., 2012; Jahre, 2017; Tatham, 2012; van Wassenhove, 2006). SCI is one such approach that can mitigate risks, having been implemented by humanitarian organisations to manage the risks they face (Chang et al., 2015; Jahre, 2017; Tang, 2006a;2006b). Thus, the interplay amongst SCI, SCRM and HSCM is evident in the literature as well as in practice.
Building supply chain scalability enables supply chains to anticipate needs and quickly mobilise resources (Kovács & Tatham, 2009; Merminod et al., 2014). The data supports the theory that SCI, structural flexibility and information sharing can help achieve this. Moreover, resilience in humanitarian supply chains requires advanced abilities in anticipating needs (Merminod et al., 2014); thus, scalability also contributes to resilience in HSCM.

From the DCV perspective, resilience is considered a DC as it enables supply chains to sense threats, seize opportunities and adapt to volatile environments (Ponomarov & Holcomb, 2009). Similarly, scalability enables the supply chain to increase and decrease capacity to meet the customer’s demands. These findings are aligned with Gattorna’s (2006) framework for customer segmentation. Gattorna (2006) proposed that agile supply chains can provide a solution for demand surges and fully flexible supply chains (i.e. humanitarian supply chains) can provide a solution for cavitation demand and emergencies. The present thesis proposes that scalability can be used to mitigate surges in demand, including cavitation flows.

Figure 6 displays the framework and related capabilities required to activate scalability during the transition from preparedness to immediate response. In this framework, the dashed arrows denote the propositions made in the three essays, which are supported by the data collected from the Kenyan nutrition supply chain. These propositions can be further tested in the future studies.
5.4 Research limitations

The main limitation of this thesis may be its limited generalisability. The research objective did not include generalising the findings, instead focusing on expanding the knowledge for future studies, and the reasons for this limitation can thus be observed in each essay.

In Essay A, the sample articles were sourced from Tatham’s (2012) bibliography, which is the main reason for the limited generalisability of the present thesis. Although this
bibliography is well known in the humanitarian community and updated regularly, there might be some missing publications. The bibliography lists journal articles, conference papers, book chapters, practitioner essays, and other works from many diverse research fields, such as development studies and political science; however, Essay A only sourced its academic journal articles.

For Essays B and C, the single-case study approach was used. Results from this approach have been criticised as being relatively non-generalisable; but again, this is not the main objective of the present thesis. Rather, the single-case study approach was used to illustrate the conceptual findings and to motivate researchers to further examine the phenomenon under investigation (Siggelkow, 2007). Regardless, this may be considered a research limitation.

5.5 Future research

One possible direction for future research, following the topic of the present thesis, is to test the proposed framework and propositions for scalability and resilience in different contexts. The prevailing argument is that each disaster presents a unique environment for humanitarian operations; thus, it is difficult to generalise any findings but possible to transfer knowledge. In the present thesis, scalability was discussed through the lens of both slow and rapid-onset disaster operations. Still, every country has diverse capacities and regulations related to disaster management.

Supply chain resilience, on the other hand, is built on more concrete pillars. As recent studies have shown, collaboration, agility, risk awareness and supply chain re-engineering contribute to resilience; however, there is a lack of empirical studies within the literature on supply chain resilience (Bhamra et al., 2011). SCRM practices are also lacking in HSCM (Day et al., 2012) although there are cross-learning opportunities between humanitarian and commercial settings.

Although the DCV complements and explains the main concepts quite well, there are different approaches for examining these concepts and contributing to the discussion of SCM. One such approach is the complex adaptive system Choi et al. (2001), which aims to delineate the complexities in systems where its micro structures create the macro structure. This is similar to the supply chain, as its members compose the supply chain itself. Another potential approach is the contingency theory (see Lawrence & Lorsch, 1967), which claims that there are many dependent variables in the humanitarian environment and they are all unique (Balcik & Beamon, 2008; Kovács & Spens, 2007a; Kunz & Gold, 2015).

Regarding the DCV, since it is the evolution of the resource-based view (RBV), the longitudinal study approach can be applied to humanitarian cases to better understand scalability, resilience and their antecedents from the lens of an enhanced RBV. Within a firm or a supply chain, a longitudinal study could also offer a good opportunity to observe the development of DCs over time. Thus, it is recommended that a longitudinal study examining the phenomenon under investigation be conducted in the future.

Sustainability in HSCM has gained much attention, as sustainability is one of the most desired outcomes in both disaster relief and development aid (Dubey & Gunasekaran, 2016; Kunz & Gold, 2015). Supply chain scalability can arguably contribute to sustainability in humanitarian operations as well as sustainability in the community-at-large. Scalability originated from the manufacturing sector; therefore, it is also useful to
discuss scalability in commercial supply chains. Seasonality and demand fluctuations can be more effectively handled through better integration and more flexible options, as well as sectorial clusters.

Another possible direction for future studies regarding scalability is to consider the humanitarian cluster system, which was introduced in 2005 following the Kashmir earthquake in Pakistan (see Jahre & Jensen, 2010). The cluster system contributes to humanitarian supply chains and enables them to rapidly scale up in response to a disaster. The focus of the cluster system is to strengthen coordination amongst clusters (i.e. humanitarian organisations in a humanitarian-aid network) by scaling up their intervention activities (Jahre & Jensen, 2010). Theoretically, this function could also contribute to supply chain resilience. So far, the cluster system has had a positive effect on the scaling up of relief operations. Although the cluster system has improved information management and helped integrate members of the supply chain, there is still little understanding of the cluster system amongst organisational partners.

In the present thesis, there are no differentiations made between surge demand and cavitation demand (Gattorna, 2006). Gattorna (2006) classified four types of customer-segmentation strategies: continuous replenishment, lean, agile and fully flexible. Out of these strategies, both the agile and fully flexible strategies deal with demand surge and cavitation demand in supply chains. Segmentation has become an important strategy in supply chain management (Godsell et al., 2006; Jüttner et al., 2010). Demand is a key driver of segmentation (Godsell et al., 2011) and surges in the humanitarian supply chain can be managed through beneficiary segmentation, which is one of the objectives of supply chain scalability. In the humanitarian sector, the term ‘surge’ is commonly used to express spikes in demand. There is an opportunity for future research to differentiate between demand surge and cavitation demand in humanitarian supply chains, using a multiple-case study design across a variety of countries.

Recently, Gligor et al. (2016) studied agility through a combined market and supply chain orientation. Similarly, future studies on supply chain scalability and resilience can combine both orientations into humanitarian research and practices, as different beneficiary segmentations are needed for the development-aid and disaster-relief supply chains.

Finally, although one of the essays of this thesis examined the role of SCI in supply chain scalability, it considered inter-organisational integration and excluded beneficiary integration in the context of humanitarian operations. As evidenced by Heaslip (2013), marketing approaches in HSCM research are still scant; therefore, scalability in HSCM can be studied from the marketing perspective, such as servitisation and service management, as well as to deepen the understanding of beneficiary integration.
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Borrowing theories in humanitarian supply chain management

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Abstract
Purpose – Within the emerging research field of humanitarian supply chain management (HSCM) the use of existing theoretical concepts and frameworks to provide explanation and understanding of the phenomena under scrutiny is not yet well understood. There is still a lack of research on which theoretical approaches are used in this field, and to what extent this emerging field “borrows” theories from other disciplines. The purpose of this paper is therefore to deepen the understanding of HSCM from a theoretical point of view by identifying and evaluating the use of theories in HSCM literature.

Design/methodology/approach – A literature review is conducted based on academic journal articles included in a well-recognised and publicly available bibliography on HSCM articles (Tatham, 2015). A content analysis is applied to the articles in terms of level of theory, research methodology, disaster management stages, disaster types, and disaster name/region.

Findings – A trend towards using more established, "middle-range" theories, is evident. However, the use of theoretical approaches is not evenly spread between the different phases of disaster relief. A strong emphasis on SCM as a background discipline is also mirrored in the choice of theories used, which indicates the solidification of humanitarian logistics as a primarily supply chain discipline. The lack of use of other theoretical perspectives and grand theories is, however, still evident, which provides an interesting research agenda for future research.

Research limitations/implications – The use of the bibliography limits the generalisation of the findings although some trends are evident.

Originality/value – This is a first review of theories used in HSCM. It provides an overview of the state of the art of HSCM research but contributes to the maturation of research in this field. The paper concludes with a research agenda.

Keywords Theory, Humanitarian supply chain management, Disaster relief, Borrowing theories

Paper type Research paper

1. Introduction

Humanitarian supply chain management (HSCM) is an emerging field within supply chain management (Kovács and Spens, 2007a) that marks a development of principles and practices for at least three reasons. First, as an object of study, humanitarian aid, in a broad sense, allows for the exploration of contextual factors that shape the conditions for an effective flow of goods and materials, and that are distinct to circumstances in other...
industries, e.g. automotive, retail, and transportation. An openness to the context of research – here particular disasters and disruptive events – has been called for in the recent methodological debate in logistics, e.g. the opportunities in action-oriented research (Näslund, 2002), classification of research schools (Gammelgaard, 2004), abductive reasoning (Kovács and Spens, 2005), and an overall calling for approaches that allow for theory development rather than theory testing (Arlbjørn and Halldórsson, 2002). Second, research on HSCM has increased the understanding of social and even political issues from a supply chain management (SCM) point of view. The role of principles such as postponement and speculation in inventory management is not limited to commercial purposes only; the ability and efficiency of material flows can be related to wider functions of society such as people’s well-being and the availability of basic needs such as food, water, and medicine for survival. Third, as Stock (1997) emphasises, borrowing and applying theories from other disciplines to advance knowledge and understanding is important for the development of logistics and SCM as discipline. Logistics management has borrowed theories from a variety of disciplines ranging from economics to psychology, mathematics to political science (Stock, 1997). More recently, the use of theory in SCM research has been further emphasised in a series of recent papers (e.g. Halldórsson et al., 2007; Defee et al., 2010; Chicksand et al., 2012; Kembro et al., 2014; Spina et al., sine anno). Common to these papers is a rather broad view on SCM, with a commercial focus as an underlying assumption.

Although there is ample literature in the field of HSCM, with a clear boom in volume of publications since 2009 (Kunz and Reiner, 2012), the area has been criticised for a lack of a theoretical base (Jahre et al., 2009). In particular, it is not well understood which theoretical concepts and frameworks are currently used to provide explanation and understanding of the phenomena, and even which disciplines HSCM “borrows” its theories from. Such an overview would provide a perspective of both the theoretical foundation on which HSCM builds, and the potential future direction of the field. Against this backdrop, the aim of this paper is to deepen the understanding of HSCM from a theoretical point of view by identifying and discussing the use of theories in humanitarian supply chain literature. Based upon a review of extant literature, this study is guided by the following two research questions:

**RQ1.** Which theories are used in HSCM?

**RQ2.** Which disciplines does HSCM borrow theories from?

The contribution of the paper is twofold. First, it provides a structured review of the use of theories in recent literature within the field of HSCM. In order to do so, content analysis was applied to identify the theories, as well as the various levels of theories used in this field. Content analysis is considered appropriate for conducting literature reviews in SCM (Seuring and Gold, 2012; Kache and Seuring, 2014). Relevant literature was identified and sampled through the use of Peter Tatham’s bibliography of HSCM (version January 2015; Tatham, 2015).

Second, the paper identifies the disciplines whence HSCM researchers have borrowed theories from. This does not only show the current state of the art and the current state of (theoretical) maturity of the field, but also possible related disciplines that impact on the development of HSCM. Importantly, this analysis indicates similarities but also differences between mainstream commercial SCM and HSCM research.

The paper is structured as follows. Section 2 revisits insights from prior literature in SCM and more specifically in HSCM. Based on this, a set of three propositions is
developed. A methods section, Section 3, explains how content analysis was used for this literature review. Section 4 presents the findings, and the paper concludes in Section 5 with implications and suggestions for further research.

2. Theories in HSCM
Theories play an important role in helping us “to make sense of the complex environment in which we live and work” (Chicksand et al., 2012, p. 456). As said, HSCM has been criticised for a lack of a theoretical base, which would though be needed for the maturing of the discipline (Jahre et al., 2009). Both the application and modification of existing theories and the building of new ones are important for knowledge creation in SCM (Arlbjørn and Halldórsson, 2002). Knowledge creation in SCM has been shaped by different theoretical as well as methodological initiatives in the field: Abductive reasoning (Kovács and Spens, 2005), and overview of research approaches (Spens and Kovács, 2006), theory building (Kovács and Spens, 2007b; Randall and Mello, 2012), research schools (Gammelgaard, 2004), and theories used in SCM and logistics (Defee et al., 2010; Chicksand et al., 2012; Kembro et al., 2014).

Emerging fields often push the boundaries of the discipline, as is the case with HSCM in light of SCM. Yet it is not necessarily self-evident, which disciplines, and which streams of research HSCM is expanding on. “Humanitarian logistics” as well as “humanitarian operations” have been used as umbrella terms for a variety of streams in research, originating from various research traditions. For example, a strong tradition of SCM research originates from business logistics and even marketing (Gripsrud et al., 2006), whereas other traditions such as operations research and their views on SCM also inform HSCM. For the sake of clarity between the various traditions and to be able to trace the origins of HSCM, in this paper we distinguish between “SCM” as pertaining to the business logistics/logistics management tradition, and “OR” as pertaining to the operations research one.

Similar to SCM, that has grown out of related fields (Larson and Halldórsson, 2002: discuss purchasing vs SCM; Larson and Halldórsson, 2004: discuss logistics vs SCM), some of the earlier reviews of HSCM literature were focused on particular streams. For example, Altay and Green (2006) explicitly focus on OR articles, whereas Kovács and Spens (2008) have SCM as their focal point of reference. In combination, these research traditions inform the fundamental underpinnings of HSCM. By suggesting this, we imply that albeit performance and key objectives of HSCM may differ from the more traditional view of SCM, the former shares some fundamental assumptions of the latter, including the three key components identified by Cooper et al. (1997) and Lambert et al. (1998, p. 15): supply chain network structure; supply chain business processes; and management components. OR has since the very beginning of the emergence of HSCM been an influential perspective with its focus on application of analytical methods to improve decision making. Albeit it might overlap with operations management, it stands out by providing tools to explain the potential of maximum (such as profit, performance, or yield) or minimum (such as loss, risk, or cost) (INFORMS, 2015). In particular, OR supports the allocation of limited resources in HSCM (Van Wassenhove and Pedraza Martinez, 2012).

The fact that researchers from different research traditions have contributed to HSCM implies a broad range of methodological approaches along with a variety of theoretical backgrounds being prevalent and also impacting on research in this context. In addition, HSCM can include activities ranging from disaster management to development aid to even health care operations in emergencies and public sector management. Just as in other, more interdisciplinary research, one would expect
these other disciplines to contribute to the richness of theories used in HSCM – in this case, theories that originate from, or are commonly used in development studies to peace research to health care.

2.1 Disciplines informing the use of theories in HSCM
Which is thus the “mother discipline” in HSCM when it comes to the use of theories? When it comes to the definition of “humanitarian logistics”, it is clearly based on the SCM research tradition in that the most commonly used definition of it by Thomas and Mizushima (2005) adapts the Council of Supply Chain Management Professionals’ (CSCMP) definition of logistics management to the humanitarian context:

Humanitarian logistics is 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 (Thomas and Mizushima, 2005, p. 60).

In fact, Thomas and Mizushima (2005) have merely replaced “end customer” with “end beneficiary” in their adaptation of the CSCMP definition of logistics management. Though small, this replacement bears many important implications. In any case, the wide acceptance of the Thomas and Mizushima (2005) definition would indicate the following of the research tradition of SCM. Hence we suggest that it is SCM rather than other disciplines (such as disaster prevention and management, development studies, etc.) that forms the backbone to HSCM research. Taking this one step further, one would expect the theories used in SCM research to be the ones dominating in HSCM as well. Our first proposition is thus:

P1. HSCM research is dominated by theories that are used in the SCM research tradition.

An obvious next question is which those theories would be. In the SCM research tradition itself, there have been various attempts to trace the origins of the discipline, and the origins of theories used in the discipline (Stock, 1997). Yet, the use of some theories has been emphasised over others. For example, Halldórsson et al. (2007) discuss agency theory (AT), transaction cost economics (TCE), (industrial) network theory (INT), and the resource-based view (RBV) as the typical theories used in SCM research. Hitt (2011) identify RBV, TCE, organisational learning theory, and social capital theory as the ones typically borrowed from strategic management to SCM, whereas Defee et al. (2010) identify TCE and RBV as most frequently used theories in SCM. But the disciplines from which theories are borrowed also depend on the studied subject area. For example, albeit focusing on organisational theory overall, Sarkis et al. (2011) highlight that green SCM has equally benefited from theories that stem from a variety of natural sciences and inform the ecological aspect of green SCM.

In light of P1, HSCM research should reflect the traditions of borrowing theories in SCM, including in choices of theories. That said, there are important differences to be acknowledged between the “humanitarian” and “commercial” contexts. These include the urgency (Beamon, 2004) and agility emphasis of HSCM (Oloruntoba and Gray, 2006), social development and equity considerations instead of profitability aims (Thomas and Mizushima, 2005; Huang et al., 2012), and the role as a public service in between donors, tax payers, and beneficiaries who do not typically pay for the service themselves (Jahre and Heigh, 2008; Choi et al., 2010). Given these differences we want to further investigate the distribution of theories currently used in HSCM. What is more, prior
research has paid much attention to differences in the phases of disaster relief, and even suggested there to be differences in the principles followed in supply chain design across these phases. Next, we will therefore delve deeper into the various phases of disaster relief and the use and usability of different theories and research traditions in these phases.

Phases in disaster relief and the use of theories in HSCM. A number of literature reviews have been published in HSCM, which categorise publications either in terms of the phase of disaster relief (Kovács and Spens, 2007a, 2008; Natarajarathinam et al., 2009; Overstreet et al., 2011) or types of disasters they focus on (Kovács and Spens, 2011), or both (Altay and Green, 2006; Galindo and Batta, 2013; Kunz and Reiner, 2012; Leiras et al., 2014). Others are topical reviews on, e.g. game theory applications in HSCM (Muggy and Stamm, 2014), and optimisation models (Caunhye et al., 2012). Another stream of research seems to be structured around “phase models” in disaster management.

In terms of phases in disaster relief, there is a common distinction between preparedness and immediate response (the relief itself), to which reconstruction phase afterwards has been added (Kovács and Spens, 2007a). Preparedness refers to the necessary preparation when anticipating disasters. Preparedness is important from a supply chain perspective, as it includes activities such as warehousing and inventory management in pre-positioning stock for disasters (Kovács and Spens, 2007a; Chandes and Pache, 2010; Apte, 2010), as well as preparing for disasters in terms of evacuation and distribution plans and early warning systems and trainings (Van Wassenhove, 2006). Parallel to preparedness, mitigation may also take place, but as those are the responsibility of government, Cozzolino (2012) excludes it from an HSCM focus. Immediate response, on the other hand, refers to relief activities in the immediate aftermath of a disaster, though after search and rescue operations. Finally, reconstruction includes long-term rehabilitation and restoration, and can even be linked to development activities. Apart from phase models, another important taxonomy in disaster relief distinguishes between natural vs man-made disasters, and potentially more importantly from an SCM perspective, between their warning times for their onset (cf. Van Wassenhove, 2006).

Importantly, different supply chain principles may be applied in the different phases. Although Oloruntoba and Gray (2006) argue for an agility maxim in HSCM, and Charles et al. (2010) highlight the various levels of agility in humanitarian organisations, Taylor and Pettit (2009) distinguish between agile response and lean reconstruction. The reconstruction phase is a turn from the emergency aspect of relief towards more developmental considerations. Therefore we propose that, complementary to the theories that are borrowed from SCM:

P2a. Disaster management research informs the choice of theories in HSCM when studying the immediate response phase.

P2b. Development studies inform the choice of theories in HSCM when studying the reconstruction phase.

In a meta-analysis of HSCM literature, Kunz and Reiner (2012) found a clear focus of prior studies on the (immediate) response phase, mostly related to sudden-onset natural disasters, followed by articles in preparedness and last, reconstruction. There is though another distinction implied in this literature: sudden-onset disasters are characterised by surges of demand, short lead times for a wide array of supplies, a lack of resources, and high stakes associated with adequate and timely delivery (Balci and Beamon, 2008). All this is combined with an overall lack of data in the first days of response
Analytical models often focus on the preparedness phase instead where data are available – or are conceptual in nature. The development of new technologies is expected to improve the possibilities to collect as well as compute quantitative data during response (Kovács and Spens, 2011; IFRC, 2013), but until then perspectives that rely upon OR are expected to focus more on preparedness problems, whereas research with a more managerial SCM background is used to focus on immediate response. Hence we formulate the following proposition:

P3. OR informs the choice of theories in HSCM when studying preparedness.

Figure 1 positions these three propositions in a framework that illustrates the different phases of disaster relief and the speed of the onset of a disaster. The distinction between sudden-onset and slow-onset disasters becomes blurry during reconstruction where the cause of the disaster is less of essence, and activities are akin development aid.

3. Research methods
3.1 Sampling and data collection
Data for our study was comprised of scientific journal articles that have been written in the context of HSCM. Peter Tatham’s (2015) bibliography of HSCM formed the basis of our sample. The sampling for the bibliography itself follows a combination of keyword searches together with snow-balling through the references in the articles that are found. It can therefore be attested to be very comprehensive, even more so than any of the literature reviews published in this field so far. The bibliography extends to not only scientific research but also white papers and practitioner-oriented publications, and includes peer-reviewed journal articles as well as book chapter and even papers from various conference proceedings.

Due to the focus on the use of theories, we only included articles from scientific journals in our sample. The criteria to identify these were as follows: we extracted articles that were published in scientific journals first. Next, we excluded viewpoints, editorials, and other non-reviewed articles from the sample. On the other hand, articles from a 2014 special issue in Production and Operations Management that focused on humanitarian operations were missing from the bibliography but added to our sample. Altogether, this resulted in 279 articles that were published in scientific journals during the period of 1995-2014.

3.2 Data analysis
Content analysis was applied as a systematic method to analyse the articles in the sample. Seuring and Gold (2012) review a number of different methods that have been used for systematic literature reviews in SCM and highlight content analysis as one of the most structured and systematic approaches with the clear steps of

Figure 1.
Disciplines
HSCM borrows theories from
material collection, descriptive analysis, category selection, material evaluation, and assessing the quality of the study. Krippendorff (2004, p. 18) defines content analysis as “a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use”.

Content analysis can be applied qualitatively for evaluating latent content, or quantitatively for word counts, or counting instances something is mentioned in a text. Both ways of using content analysis have been applied in SCM research before (Seuring and Gold, 2012), as well as in HSCM (Haavisto and Kovács, 2014; Kovács et al., 2012). In this study, the content analysis needed to evaluate both explicit and latent content, as, e.g. the term “theory” could be mentioned in just phrases such as “in theory”, not denoting the use of any theory in particular. Also, many articles mentioned what other authors had used as the theoretical frameworks of their research, without applying these in their own study. Thus, eventually, we reviewed not just keywords but read all the articles carefully, and discussed ambiguous uses of terminology among several coders. We used a discursive alignment of interpretation to resolve ambiguities as a way to address the reliability of the study, foremost used when primarily latent content is being assessed (Seuring and Gold, 2012). All articles were assessed by at least two coders.

To deepen the understanding of the use of theories in SCM, the categorisation of theories that were used was broken down to various levels. Following Arlbjørn and Haldórsson’s (2002) approach, we assigned level 0 to articles that did not mention nor use any theory, level 1 to those presenting hypotheses and propositions, level 2 to models and frameworks, level 3 to “middle-range theories” such as RBV, TCE, etc., and level 4 to “grand theories” such as chaos theory, complexity theory, and even philosophy of science perspectives. We further assessed the articles in terms of the phase of disaster relief.

4. Findings from the content analysis

To date, a large number of articles have been published in the Journal of Humanitarian Logistics and Supply Chain Management, which is dominantly dedicated to humanitarian research in logistics and SCM. The second and third journals with most articles in HSCM are the Disaster Prevention and Management and the International Journal of Physical Distribution and Logistics Management (see Table AI), mostly due to various dedicated special issues published in these journals. Special issues in various journals further explain the peaks in number of publications in Figure 2.

The resultant sample included articles from a number of academic disciplines, which indicates that HSCM is of interest to several research traditions and audiences. However, 45 of the journals HSCM research could be identified in had only published one article pertaining to HSCM. These journals ranged from Benchmarking: An International Journal, to Development and Change, from Gender and Development to Social Studies of Science, or from International Affairs to Health Policy. This dispersion of HSCM over wide range of academic journals suggests that HSCM has a strong profile as an interdisciplinary field of research.

4.1 An inventory of theories in HSCM

A vast range of theories could be found in HSCM, though only one article used a grand theory (in this case complexity theory). A total of 57 articles made use of a middle-range theory, and an additional three used a grounded theory approach to develop theory. In the subsequent analysis, we exclude grounded theory from middle-range theories since it is a methodological approach for theory development. Amongst middle-range
theories, with ten instances, the most frequent one was inventory control theory, which could be found in various OR-related journals such as the *International Journal of Production Economics, Journal of the Operational Research Society, OR Spectrum*, and *Computers & Operations Research* (see Table I), closely followed by systems theory, stakeholder theory, and varieties of the RBV. Table I lists the grand, and middle-range theories that were identified in the sample.

OR-related middle-range theories included inventory control theory, ant colony optimisation, queuing theory, graph theory, fuzzy set theory, Bayes’ theorem, game theory, oscillation physics theory, and auction theory. The frequency of their application in HSCM varies, some middle-range theories are used more frequently, some of them are used only once in our sample. Similar spread has been identified in the SCM literature; some theoretical perspectives that are borrowed from other disciplines seem to have gained a distinct role relative to SCM whereas other perspectives are used less frequently (see, e.g. Defee et al., 2010; Chicksand et al., 2012). Most theories that were identified could be associated with SCM (30 articles, representing 51.7 per cent of those using a grand or middle-range theory but only 10.8 per cent of all articles) compared to 21 articles (36.2/7.5 per cent) pertaining to OR. Interestingly, however, if including also frameworks and models, the distribution between OR and SCM is reversed, with a total of 91 articles using frameworks, models, middle-range theories, and grand theories following the OR research tradition, compared to 62 from the SCM research tradition (see Table II). Overall, thus, *P1* could not be supported, and our findings do not indicate one clear tradition HSCM follows but two: OR and SCM.

Only few theories could be identified in HSCM that would not be commonly used in OR nor SCM. Of these, one article refers to “various development theories”, others discuss “cultural bias theory” or “structural theory” – the latter two originating from political science. Interestingly, we could not identify any middle-range theories used in HSCM that would clearly originate from disaster management. The contribution of
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<th>Theory</th>
<th>Number of articles</th>
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<td>Ant colony optimisation</td>
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<td>Industrial network theory</td>
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**Table I.**

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**Notes:** DPM, disaster prevention and management; DS, development studies; SCM, supply chain management; OR, operations research; OT, organisational theories; PA, public administration; PS, political science; P, preparedness; R, response; Rc, reconstruction. First numbers indicate middle-range theories and grand theories only, numbers in brackets include also frameworks and models.

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disaster management is more visible on the level of frameworks and models, such as the disaster response model or disaster crisis pyramid. (A list of all frameworks and models that were identified can be found in Table AII). As for development studies, we found only one article (McEntire, 2004) that used various development theories. To conclude, it is SCM and OR that informs HSCM in the choice of theories. More is borrowed from other disciplines on the level of frameworks and models, but by large, HSCM has developed a rather coherent focus on SCM and OR, with relatively little influence from other disciplines.

4.2 The maturity of HSCM research

The number of HSCM studies using theories is steadily on the rise. Looking at the 20 year time span of our analysis (1995-2014), there is a clear downwards trend of articles lacking a clear theoretical foundation, from representing 67 per cent of articles published between 1995 and 1999 down to 27 per cent of those published between 2010 and 2014. The use of various frameworks and models has risen steadily during the same time, from 17 per cent in 1995-1999 to 51 per cent in 2010-2014. The use of frameworks and models starts to appear by 1997, but middle-range theories only come in by 1999 (see Figure 2). Thus, our findings show that HSCM as a discipline has been maturing over the years, answering Jahre et al.’s (2009) call.

From a different angle, we also looked at the spread of theoretical levels across journals. Not surprisingly, the Journal of Humanitarian Logistics and Supply Chain Management sticks out not only in total number of articles – this being the dedicated journal to HSCM – but also in the spread across various theoretical levels. The sample per journal is too small to clearly state which journals would prefer which level of theory, however, though there was a stronger attribution between research following the OR research tradition and being published in journals dedicated to OR.

4.3 Theoretical lenses to study different phases of disaster relief

For a further analysis across the various phases of disaster relief, we cross-tabulated the results with the phase(s) of disaster relief an article focused on, noting also studies that focused on more than one phase, on all phases, or that did not discuss their actual focus from this perspective. Due to the paucity of middle-range theories from other disciplines being prevalent in HSCM, in this analysis, we included also frameworks and models from other disciplines (see Table II).

Findings indicate that frameworks and models in disaster management are used in preparedness and response, though not in studies focusing on the reconstruction phase of disaster relief. The one article that actually borrows from development studies applies these theories to the response phase. Notwithstanding these results, the subsamples of these articles are too small to draw any further conclusions for the propositions P2a and P2b. Theories borrowed from public administration and political science are used in response, or in “all phases”, i.e. where authors do not distinguish between phases of disaster relief, but again, there are too few of these in the sample for attributing these results any significance.

Investigating P3 yielded very interesting results. Theories from the OR research tradition were used in all phases but the reconstruction phase (one article in response and reconstruction together). Whilst their prevalence in preparedness is in line with Kovács and Spens’ (2011) suggestion of the availability of data in preparedness
prompting the development of more OR models in this phase, their frequency in response, where data are still difficult to obtain, is surprising. However, a closer analysis of these articles revealed that only three of them used any primary data in their model development or testing, others were conceptual-analytical in nature or used secondary data only. The same usage pattern appears for theories that were leaning on the SCM research tradition, with articles focusing exclusively on the reconstruction phase not using any middle-range theories or frameworks. In conclusion, we could not find any support for P3.

5. Conclusions
The aim of this paper was to deepen the understanding of HSCM from a theoretical point of view by identifying and evaluating the use of theories in HSCM literature. SCM has been criticised for a lack of theories, leading to both a discussion on how to borrow them from other disciplines and apply them in this field (Stock, 1997), as well as to an endeavour to develop an own logistics theory (Mentzer et al., 2004). As HSCM is emerging as a stream of research, its positioning is less clear. This paper therefore provides a perspective on the current state by identifying the borrowed theories to the field and disciplines that the field borrows theories from. Interestingly, HSCM has made use of both the OR and SCM research traditions, but of only few frameworks and models that would not typically be used in these. Whilst this may help in delineating the boundaries of HSCM, research in this field could in fact benefit from looking more into other related disciplines from public health to crisis management, disaster management, etc. After all, HSCM has many traits also in common with these fields, from a not-for-profit aim to considerations of equity as performance criteria. There would be ample room for HSCM to learn from other, related disciplines. HSCM research would gain from embracing interdisciplinarity, both to benefit from but also to contribute to related disciplines, and to contribute back to SCM research overall.

Generally, there is a trend towards using more middle-range theories in HSCM, and towards using various frameworks and models. This development shows that HSCM is gaining in maturity as a discipline. Our results show that there is a lack of theoretical approaches (on all levels) when it comes to the reconstruction phase of disaster relief, in spite of this phase being the most comparable to steady, lean supply chains – though whilst claiming this, Taylor and Pettit (2009) in fact discuss the applicability of value chain analysis in all phases of disaster relief. Similarly to their article, much of the extant HSCM literature proposes the application of various concepts and frameworks from other disciplines but remains on a conceptual level in doing so. In conclusion, more empirical research would be needed in HSCM to move from suggesting the use of various theories to actually testing and/or developing them.

A different problem with the response phase may be its emphasis on speed, agility, and flexibility, which are difficult to encapsulate in any of the rather “static” middle-range theories that are used in both the OR and SCM research traditions. Some supply chain decisions such as outsourcing, postponement, and speculation, are based upon comparative analysis of two or more alternatives, but these remain static in the sense that they provide little guidelines as regards to “how” to get there. These decisions are more typical in preparedness, however, whereas response focuses on the how and when of activities. Instead, the response phase calls for more procedural approaches, and theories that allow for procedural analysis in terms of
the flow of events, chronologies, and mechanisms, in which process is defined as “a sequence of individual and collective events, actions, and activities unfolding over time in context” (Pettigrew, 1997, p. 338).

In this sense, theories and frameworks that enhance the further understanding of response would not be bound to SCM in general, but more specifically to those SCM concepts and frameworks that imply a “process vocabulary”. It seems that current HSCM research is locked in a vocabulary of static states when trying to explain and work with response. Instead, it would be important to develop concepts that inherently share the assumptions of the process of response in order to increase our understanding of this phase of disaster relief. Further research should therefore focus on the development of suitable, procedural theories for response, and most importantly, theories that are borrowed should fit with the purpose of the research, and the research topic at hand. Similarly, as commercial supply chains look at humanitarian ones as benchmarks of flexibility and agility, also commercial SCM research would benefit from embracing more procedural theories in being able to more accurately capture flexibility and ultimately, devise concrete ways for supply chains to become more flexible.

References


Apte, A. (2010), Humanitarian Logistics: A New Field of Research and Action, Now Publishers, Hanover, MA.


(The Appendix follows overleaf.)
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Table AI.

Borrowing theories in HSCM

297
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Table AII. Frameworks and models used in HSCM (continued)
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Table AII.

**Corresponding author**
Tunca Tabaklar can be contacted at: tunca.tabaklar@hanken.fi

299
Investigating Scalability for Building Supply Chain Resilience

Tunca Tabaklar
Department of Marketing, Hanken School of Economics, Helsinki, Finland

Structured Abstract

**Purpose** – The aim of this study is to explore the link between supply chain scalability and supply chain resilience in the Kenyan nutrition supply chain and to understand how scalability supports supply chain resilience in this context.

**Design/methodology/approach** – A single embedded case study design is adopted for this study. Semi-structured interviews are the main data sources and group interviews and documents from humanitarian organisations in the supply are used for data triangulation.

**Findings** – Supply chain scalability can be achieved through structural flexibility and information sharing. The findings show that scalability is a dynamic capability, which leads to supply chain resilience and is a capability of building resilient supply chains in humanitarian settings.

**Research limitations/implications** – This study focuses on the transition from a dormant condition to action in a humanitarian supply chain. However, single case study approach limits the generalisability of the findings.

**Practical implications** - There are cross-learning opportunities between humanitarian and business supply chains, thus scalability practices can be transferred to other industries facing demand fluctuations.

**Originality/value** - Scalability is little understood in the supply chain management literature. If scalability is built through structural flexibility then it can enable or redesign the supply chain in a way that contributes to supply chain resilience; thus, it is a dynamic capability.

**Keywords:** humanitarian logistics, supply chain resilience, dynamic capabilities, flexibility, agility.
1. Introduction

After more than a decade of study, there is still more to explore when it comes to the relationship between humanitarian logistics and supply chain management. The emerging stream of literature on supply chain management has gained a lot of attention, especially after the South Asian Tsunami in 2005 (Kovács and Spens, 2011a), but now it is in the maturity phase (Kovács, 2014). Humanitarian logistics or humanitarian supply chain management are umbrella terms for development aid and disaster relief operations (Kovács and Spens, 2007). This study looks into the Kenyan nutrition supply chain, which integrates a development aid supply chain that provides basic public healthcare service and a disaster relief supply chain. This integrated supply chain has the capability to alter its capacity in case of a disaster, which is known as supply chain scalability.

Increasingly, humanitarian organisations are implementing structural flexibility into their supply chains. Humanitarian supply chains are scalable because they are set up quickly in order to immediately respond to the effect of disasters and they are quick to transit from preparedness to immediate response. Thus, it could be the case that structural flexibility can enable humanitarian supply chains to be scalable. Therefore, the first research question is:

- How is scalability through structural flexibility and information sharing implemented in humanitarian supply chains?

To cope with a surge in demand, scalable supply chains respond by scaling up and then later, return to their original state by scaling down with an exit strategy. Arguably, as suggested by Annala et al., (2014), supply chain scalability requires structural flexibility (Christopher and Holweg, 2011) and supply chain integration. In this study, scalability is conceptualized and operationalized through structural flexibility and information exchange (Lee et al., 2000), thus, the investigation is on the flexibility aspect of supply chain scalability.

Humanitarian supply chain management has three phases that are commonly used: preparedness, immediate response and reconstruction (Kovács and Spens, 2007). These are derived from a four-phase disaster management cycle that includes mitigation, preparedness, response and recovery (Altay and Green, 2006). The mitigation phase of disaster management is generally overlooked in humanitarian logistics literature, since it has fewer practices related to supply chain management and logistics (Cozzolino, 2012). This study focuses on the dormant phase to the action phase, in other words, the transition from preparedness to immediate response. During the transition, the baseline demand goes up to surge demand. Disasters are classified into two groups according to their sources; man-made and natural, as well as according to their occurrence speed, slow-onset and sudden-onset (Van Wassenhove, 2006). The Kenyan nutrition supply chain faces drought, which are classified as a slow-onset
natural disaster, as well as floods which are classified as sudden-onset natural disasters. The Kenyan nutrition supply chain, under the leadership of the Ministry of Health (MOH) Kenya with the collaboration of UNICEF Kenya, was identified as a best practice case in East Africa. It combines risk reduction and development by the Food Security and Nutrition Working Group (FSNWG). Scalability enables Kenyan nutrition supply chains to scale up during times of drought in order to respond in increased needs caused by higher malnutrition rates and scale down when the nutrition situation improves.

Therefore, this study aims to understand how supply chain scalability contributes to the capabilities of supply chain resilience from dormancy to action. In order to cope with turbulence and volatility in a supply chain, Christopher and Holweg (2011) suggest structural flexibility, which is defined as the “ability of the supply chain to adapt fundamental changes in the business environment” (Christopher and Holweg, 2011, 70).

Additionally, supply chain resilience is an important concept for commercial organisations as well as humanitarian organisations. It is defined as “the ability of a system to return to its original state or move to a new, more desirable state after being disturbed” (Christopher and Peck, 2004, p. 2). Researchers state that resilient humanitarian supply chains can save many lives (Merminod et al., 2014) and supply chain resilience should be discussed further in a humanitarian context (Tatham, 2012). Although, there are many studies on supply resilience from a business perspective (Hohenstein et al., 2015), attention is still lacking from a humanitarian supply chain perspective (Dubey et al., 2014). Recently, Scholten et al. (2014) developed an integrated framework of resilience for disaster management. This study differs from previous ones, as it looks into the resilience in a supply chain where development aid and disaster relief are integrated. Thus, this study is exploratory in looking at humanitarian supply chain resilience through scalability. Therefore, the second research question is:

- How can humanitarian supply chains be resilient through scalability?

With the questions under investigation, this study examines resiliency in scalable nutrition supply chain in Kenya aligned with capabilities models of supply chain resilience (Christopher and Peck, 2004; Scholten et al., 2014, Hohenstein et al., 2015) drawing from a theoretical lens based on dynamic capabilities (DC) (Teece and Pisano, 1994). DC can be used to explain a highly dynamic environment, such as humanitarian environment (Kovács et al., 2012). There is an increasing attention to the supply chain resilience in the literature for turbulent and dynamic environments (Kamalahmadi and Parast, 2016). The contribution of this study is twofold. First, scalability and supply chain resilience have little evidence in the context of humanitarian supply chain management, although the concepts have been practiced in the field; therefore, this study fills this gap by contributing to that particular stream of supply chain management. Second, the case study in this research is an integration of two supply chains (development aid and disaster relief), which are streamlined during regular times and in the case of a disaster. It is important to highlight resilience in
humanitarian supply chains where development aid and disaster relief are integrated. Since disasters may disrupt development aid or surge the demand and development aid may reduce or increase the next disaster’s impact (Day et al., 2012). Thus, resilience plays an important role in reducing the impact. Further, there is interplay between humanitarian and commercial supply chains; therefore, the managerial implications would be useful for managers working in both areas.

Although the humanitarian sector focuses generally on resilience of communities, the supply chain perspective on resilience in humanitarian supply chains is still scant from an academic perspective. This study employs an in-depth single case study approach (Yin, 2009) exploiting observation, semi-structured interviews and documents available publicly and gathered through organisations. As a part of the discussion, propositions are developed from the findings to be tested in further studies.

The rest of this paper is structured as follows: First, literature on humanitarian settings and supply chain resilience are reviewed, followed by a conceptual framework of supply chain resilience capabilities with regard to DC. Next, the research design is presented for a single case study approach along with data collection, analysis and trustworthiness of this study. Findings and discussion with testable propositions follow, before the conclusion with theoretical contribution and managerial implications.

2. Theoretical Background
2.1 Theoretical Foundations in the Light of Dynamic Capabilities

Capabilities are referred to in supply chain management as “central to creating and maintaining competitive advantage” (Defee and Fugate, 2010, 180). DC focus on capabilities and resources and how these capabilities can be developed in order to have a competitive advantage in a rapidly changing environment (Teece and Pisano, 1994) or is defined “the firm’s processes that use resources specifically the processes to integrate, reconfigure, gain and release resources to match and even create market change” Eisenhardt and Martin (2000, 1107). Further, they enable business enterprises to “create, deploy and protect the intangible assets that support superior long-run business performance” (Teece 2007, 1319). The concept of DC is derived from the resource-based view (RBV) of the firm, however it has an evolutionary aspect (Barney 2001; Barney et al., 2011).

The environment of humanitarian supply chains and humanitarian organisations can be very volatile. Unpredictability of demands, unanticipated timing of disasters, uniqueness of geography and the diversity of infrastructure of different regions are some of the reasons for this changing or unstable environment. Moreover, changing risks and climate change makes this environment even more difficult.

Recent examples of DC can be seen in supply chain management (Cheng et al., 2014) and supply chain resilience (Pereira et al., 2014). The examples of DC application can
be found in humanitarian logistics literature as well. In (Kovács et al., 2012), the authors positioned logistics skills and capabilities according to DC and RBV.

Eisenhardt and Martin (2000) differentiate markets as moderately dynamic markets and high-velocity markets. The humanitarian environment is considered to be the latter (Kovács et al., 2012). DC are considered “idiosyncratic” according to Eisenhardt and Martin (2000) and Winter (2003). In this context, it may be argued that operational and tactical routines form dynamic capabilities like resilience and scalability in the supply chain. Capabilities are highlighted in the literature by many authors. Supply chain innovative capability (Chen et al., 2009), sourcing (Ramsay, 2001; Hunt and Davis, 2008; Wu and Pullman, 2015), integration capabilities (Vanpoucke et al., 2014) are highlighted as supply chain capabilities. In a humanitarian setting, emergency response capability has been discussed (Tatham and Houghton, 2011) and further logistics can be considered as dynamic capability in such an environment (Kovács et al., 2012). The main point of a dynamic capability view (DCV) is to have the ability to sense threats and opportunities, to seize the opportunities and to reconfigure current resources and capabilities in order to compete in a turbulent environment (Teece, 2007).

Although resilience is considered a dynamic capability itself (Ponomarav and Holcomb, 2009; Kamalahmadi and Parast, 2016; Eltantawy, 2016), it also plays a key role in blending dynamic capabilities, as highlighted in the work of Helfat et al. (2007), such as agility (Gligor et al., 2015) and sustainability (Ponomarav and Holcomb, 2009). Thus, scalability and resilience are conceptualised as dynamic capabilities, due to their nature of seizing, shaping and transforming resources to have a competitive advantage or good practices in a non-profit environment.

2.2 Supply Chain Resilience

Supply chain resilience is a relatively young field of research; it was first defined from organisational perspective in the context of supply chain management in 2003 (Hohenstein et al., 2015), although it has been studied in other fields for considerably longer, such as engineering, ecological sciences and organisational research (Pettit et al., 2010). Ponomarav and Holcomb (2009, p. 131) define the concept as “the adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function” This is identified as the most profound definition of supply chain resilience (Hohenstein et al., 2015), although there is still no common definition of the concept (Hohenstein et al., 2015). Recently, new studies have emerged that discuss more thoroughly the role of procurement (Pereira et al., 2014) and the role of collaboration (Scholten and Schilder, 2015) in supply chain resilience.

To be able to build resilient supply chains, there are diverse capabilities that need to be in place. Christopher and Peck (2004) presented capabilities of supply chain resilience under four main classification form the systems theory perspective as follows: supply
chain re-engineering, agility, collaboration and risk awareness. Following that classification of capabilities, Scholten et al. (2014) point out that knowledge management is one of the capabilities of supply chain resilience and should be considered with risk awareness. Information sharing is an important enabler of knowledge management (Scholtern et al. 2014). Supply chain re-engineering refers to many attributes of a supply chain, such as supply chain design principles, supply chain understanding and supply base strategy (Christopher and Peck, 2004). Considering the supply chain design principles, redundancy is one of the most important capabilities for building resilient supply chains (Sheffi, 2005; Hohenstein et al., 2015). Redundancy strategies refer to ensuring multiple suppliers and safety stocks (Hohenstein et al., 2015, Sheffi and Rice, 2005) and in this sense, they are similar to the dual sourcing attribute of structural flexibility (Christopher and Holweg, 2011).

The other important antecedent of supply chain design principles is efficiency (Christopher and Peck, 2004). In terms of supply base strategy in regard to building resilient supply chain, it is vital to work with a supplier with a risk awareness culture (Christopher and Peck, 2004), such as working with a supplier headquartered in a less disaster-risky area. From the point of supply chain understanding, organisations should know their supply chain well to be able to map out who is doing what (Christopher and Peck, 2004).

Collaboration is one the capabilities that is required in building resilient supply chains. A high level of collaboration, which provides collaborative planning and increased supply chain intelligence, helps to mitigate the risk of disruption (Christopher and Peck, 2004). By sharing information and knowledge amongst the members, collaboration is considered to increase visibility (Faisal et al., 2006); operational efficiency and effectiveness; and customer service quality (Scholten et al., 2014). Coordination and cooperation are among the assets that are required in achieving collaboration (Hohenstein et al., 2015). Recently, Scholten and Schilder (2015) discuss how collaborative actions contribute to visibility, velocity and flexibility. Agility is critical to respond to sudden changes in demand rapidly and cost efficiently (Lee, 2004). Agility is defined as “a firm’s ability to quickly adjust tactics and operations within its supply chain to respond or adapt to changes, opportunities, or threats in its environment” (Gligor et al., 2013, p. 95). Alertness, accessibility, decisiveness, swiftness and flexibility are presented as dimensions of agility (Gligor et al., 2013). Flexibility is sometimes referred to as one of the standalone capabilities of supply chain resilience (Hohenstein et al., 2015). Agility and flexibility can be used synonymously (Braunscheidel and Suresh, 2009); however, they are different in nature.

Flexibility is the key element of agile organisations. Its origin comes from flexible manufacturing system (Christopher, 2000). Morlok (2003) defines flexibility as “the ability of a system to adapt to external changes, while maintaining satisfactory system performance”. Christopher and Peck (2004) presented visibility and velocity as the resources of agility, although they are both can be seen standalone capabilities of supply chain resilience in the literature (Hohenstein et al., 2015). Risk awareness or creating a risk management culture refers to knowing the risks that supply chains can
face. Therefore, it is highly recommended to form a risk management team to be in charge of “regularly updating the supply chain risk register and to report to the Board through the supply chain director on at least a quarterly basis” (Christopher and Peck, 2004, p. 11). Human resource management is presented as one of the capabilities in Hohenstein et al. (2015) and can be considered under the risk awareness/knowledge management capability as a one of the first-order capabilities. Scholten et al. (2014) stated that knowledge management, similar to risk management, is a capability of supply chain resilience. As Ponomarov and Holcomb (2009) state, there should be a feedback loop of the system so managers can learn from the past experiences to respond better to future incidents.

2.3 Scalability in a Humanitarian Setting

Humanitarian logistics is defined 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” (Thomas and Mizushima, 2005, 60). Humanitarian supply chains involve many actors with many different focuses, skills and mandates, including relief organisations, host governments, military organisations, private sector companies and local and regional relief organisations (Balcik et al., 2010). The range of actors is of extreme importance when it comes to coordinating all these actors during disaster relief operations (Kovács and Spens, 2007).

The challenges of humanitarian logistics are classified according to the types of disasters, the phases of disaster relief and the type of humanitarian organisation (Kovács and Spens, 2009). The unpredictability of demand and surges in demand with limited resources are the main characteristics of humanitarian setting (Balcik and Beamon, 2008). Humanitarian logistics follows phases derived from disaster management literature. The most common model is 3-phase model (Kovács and Spens, 2007).

Scalability in humanitarian setting is conceptualized through the phases of the operations. Since humanitarian supply chains are agile during the response phase, they rapidly scale up operations by transforming from a lean preparedness phase and later, scale down by transforming back to a lean stage in the reconstruction phase. The 3-phase model consists of preparedness, immediate response and reconstruction (Kovács and Spens, 2007). During preparation, the actors in the supply chain focus on warehousing and inventory management to pre-position the necessary items for anticipated disaster, early warning systems and training the local community on how to react to the future disasters (Van Wassenhove, 2006).

In immediate response, actors in the supply chain focus on resource mobilization by evolving from dormancy to action, which has a maxim of cost efficiency vs. agility (Kovács and Tatham, 2009). The reconstruction phase can have either short-term or long-term supply chain goals, depending on the donors’ perspective (Kovács and Spens, 2007).
Although, there is a growing stream of literature on disaster relief supply chains, the development stream of humanitarian logistics is still scant (Kovács and Spens, 2011b; Oloruntoba and Gray, 2006; Balcik et al., 2010). Development aid is “constantly given to a country over longer periods of time in the form of education, roads, goods etc. in order to develop” (Abidi and Scholten, 2015, 236-237). The debate of development aid and disaster relief is based on the temporariness and permanentness (Jahre et al., 2009). In terms of DCV, a humanitarian setting is one of the most suitable settings, as uncertainty and unpredictability generate a high volatile environment. As a consequence, humanitarian supply chains are regarded as the “most agile” (Oloruntoba and Gray, 2006) and “fully flexible” (Gattorna, 2006) and even humanitarian organisations have adopted structural flexibility (Christopher and Holweg, 2011; Kovács et al., 2012) in an environment that is evidently dynamic (Kovács et al., 2012).

Scalability has been studied in human resource management (Dyer and Ericksen, 2005) and flexible manufacturing (Koren et al., 1998). However, it is a relatively new term in supply chain management. Supply chain scalability deals with surges in demand (Lee, 2004). Scalability is “the ability of business manufacturing, or technology process, to support sudden increases in demand” (Ciancimino and Cannella, 2009, 481) or “the flexibility of the chosen supply chain set-up to handle changing volumes, both seasonal and structural” (Vanelslander et al., 2013, 250).

Since humanitarian supply chains are structurally flexible (Christopher and Holweg, 2011; Kovács et al., 2012), scalability in humanitarian requires structural flexibility and information sharing in order deal with demand fluctuations (Lee et al., 2000). Structural flexibility is defined as “ability of the supply chain to adapt to fundamental changes in the business environment” (Christopher and Holweg, 2011, 70). Structural flexibility can be achieved through dual sourcing, asset sharing, separating ‘base’ from demand, postponement, flexible labour arrangements, rapid manufacture and outsourcing” (Christopher and Holweg, 2011). On the other hand, dynamic flexibility is also a way to cope with surges in demand (Christopher and Holweg, 2011). Notably, the main difference between structural flexibility and dynamic flexibility is that structural flexibility is a supply chain design principle, which yields dynamic flexibility, whereas dynamic flexibility is a temporary solution (Christopher and Holweg, 2011). In a recent study, Trkman et al. (2015) propose changing to adapt to the changes in the environment and state that supply chains lack the ability to do so, since efficiency is preferred over flexibility.

Humanitarian supply chains are scalable because they increase and decrease their capacity according to the demand fluctuations during the relief operations. Thus, from preparedness to the immediate response stage, operations are scaled up and from preparedness to reconstruction relief operations are scaled down as operations are handed over to local actors and the reconstruction supply chain takes over (Matopoulos et al., 2014).
In development aid supply chains, especially where development aid and disaster relief are integrated (Day et al., 2012), a disaster relief chain is activated from the development aid supply chains in case of a rapid-onset disaster (Jahre et al., 2009; Day et al., 2012). This can also be called buttressing supply chains (Sodhi and Tang, 2014). During the scale down, the disaster relief supply chain is transformed into a reconstruction supply chain (Jahre and Heigh, 2008). In countries where disaster relief and development programs are integrated, supply chains decrease their capacity to the base demand level after scaling down. Scaling down of operations can be followed by an exit strategy, which is “strategic change to assure long-term continuity of aid and development” (Sohn, 2013).

Figure 1 Humanitarian supply chain resilience framework (Adapted from Christopher and Peck, 2004; Scholten et al., 2014; Kamalahmadi and Parast, 2016)
Figure 1 is conceptual framework of humanitarian supply chain resilience based on the work of Christopher and Peck, (2004), Scholten et al. (2014), and Kamalahmadi and Parast, (2016). It shows the relationship between scalability and resilience in a supply chain. According to the framework, scalability is considered one of the capabilities for building supply chain resilience.

3. Research Design

A single embedded case study design (Yin, 2009) is adopted with multiple unit of analysis, which are organisations and individual respondents. The case is an occurrence of a natural disaster and the response of a development aid supply to this disaster. A single case study may have many objectives; this case is explorative and revelatory (Yin, 2009). It represents a base practice case regarding a disaster risk reduction strategy in fighting malnutrition in Kenya. Case study research is considered a suitable method for supply chain management (Seuring, 2008), since it allows researchers in the field to access “supply chains at various stages and with a range of data gathering techniques” (Seuring 2008, p. 135). A single case study design has many objectives for researchers; they could be motivational, inspirational or illustrative (Siggelkow, 2007) In this study, the case study aims to illustrate what is conceptualised and to motivate other researchers to study further testable propositions. For the case study design, there are five important components (Yin, 2009, 27):

- the study’s questions
- its propositions, if any
- its unit (s) of analysis
- the logic linking the data to the propositions; and
- the criteria for interpreting the findings.

This study begins with a research question on resilience and scalability concepts, which elaborate using a case study on Kenyan nutrition supply chains. In this section, the sample and data collection, data analysis and trustworthiness of the study are elaborated. The propositions are developed in the discussion section for examination in future studies.

The case study focus on basic public health and nutrition services provided to end users. The main members of the supply chain are the government of Kenya (GOK) and the technical partner is UNICEF Kenya, which provides support to the GOK. Therefore, the unit of analysis is two supply chains; the first is the development aid supply chain that provides basic nutrition services to beneficiaries due to malnutrition and the second is a disaster relief supply chain, which is activated during a nutrition emergency and which also provides nutrition services to a greater amount of beneficiaries.
It is interesting to note that, there are different groups of stakeholders in the supply chains; these are also studied as sub-units of the analysis. These organisations mainly are the government, UN agencies and non-governmental organisations (NGOs) that serve as implementation partners. Also, the supply chain as a whole and the interactions between the members of the supply chain contribute to the supply chain scalability.

3.1. Sample and Data Collection

The nutrition supply chain case in Kenya was identified as best case practice by the experts in nutrition sector (FSNWG). Figure 2 shows the data collection process.

The first step was the case selection. The nutrition situation in Kenya shows frequent surges in demand and calls for scalability. The Kenyan nutrition supply chain is scalable in response to sudden surges in demand during disasters; therefore, FSNWG identified it as a best representative case of combining development and risk reduction. The nutrition supply chain consists of various members; NGOs, aid agencies, donors and Government of Kenya (GOK) represented by the MOH. The system works based on funding system. In case of a disaster, when surge goes up, the supporting members of the supply chain such as NGOs, aid agencies and county governments apply to donors such as the UK’s Department for International Development (DFID), UNICEF, the World Bank and the European Civil Protection and Humanitarian Aid Operations (ECHO) for additional funding in order to respond to surges. During a scale up, these organisations increase the number of beneficiaries with resource mobilization and by increasing the human resources at the local county healthcare facilities as well as outreach facilities. The data collection excludes the manufacturing side of nutrition commodities as manufacturing is not the focus of humanitarian supply chains, where there is one major global manufacturer of therapeutic food, in France, Nutriset (UNC, 2009) and a local producer INSTA in Kenya.

The second step was stakeholder mapping. This step was done prior to the trip to Kenya with UNICEF Kenya and FSNWG then possible interviewees were selected through purposive sampling (Patton, 2005) which allowed the research team to identify important representatives from Kenyan nutrition supply chain members. During the
stay in Kenya, snowballing sampling (Creswell, 1998) was applied for further identification of stakeholders. Data collection was carried out in the first quarter of 2014. In the scope of data collection, the next step was county selection. The possibilities were discussed with the UNICEF Kenya nutrition group and the counties of Isiolo and Turkana were identified. Isiolo had fewer caseloads of acute malnutrition while Turkana had the highest caseloads for acute malnutrition. Therefore, these two counties were visited and stakeholder mapping was done with United Nations Office for Project Services (UNOPS) representatives in the counties. Further identification of respondents was done using snowball sampling. In order to identify group interviewees, the health centres were visited.

<table>
<thead>
<tr>
<th>Code</th>
<th>County</th>
<th>Organisation</th>
<th>Respondent (s) Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>Nairobi</td>
<td>MOH</td>
<td>Assistant Chief Nutritionist Officer</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>MOH</td>
<td>Program Officer (Division of Nutrition)</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>NASCOP, under MOH</td>
<td>Nutritionist and Program Officer</td>
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<tr>
<td>4</td>
<td></td>
<td>KEMSA, Procurement agency</td>
<td>Resource Mobilization Advisor and Procurement Manager</td>
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<td>5</td>
<td></td>
<td>CONCERN Worldwide, NGO</td>
<td>Country Director</td>
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<tr>
<td>6</td>
<td></td>
<td>Kenya Red Cross (KRC), Red Cross chapter</td>
<td>Nutrition Specialist</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>*Merlin / Save the Children, NGO</td>
<td>Nutrition Co-ordinator</td>
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<tr>
<td>8</td>
<td></td>
<td>Save the Children, NGO</td>
<td>Nutrition M&amp;E Specialist and Procurement Officer</td>
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<tr>
<td>9</td>
<td></td>
<td>UNICEF, Aid agency</td>
<td>Supply and Procurement Manager</td>
</tr>
<tr>
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<td></td>
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<td>Specialist, IYCN and HIV/AIDS</td>
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<td></td>
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</tr>
<tr>
<td>12</td>
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<td>Chief Emergency and Field Operations</td>
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<td></td>
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<tr>
<td>15</td>
<td></td>
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<td>Logistics Assistant</td>
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<td>16</td>
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<td>17</td>
<td></td>
<td>WFP, Aid agency</td>
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<td></td>
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<tr>
<td>19</td>
<td></td>
<td>World Vision, NGO</td>
<td>Nutrition Manager</td>
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<tr>
<td>20</td>
<td></td>
<td>World Vision, NGO</td>
<td>Nutrition Program officer</td>
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<tr>
<td>21</td>
<td>Action Against Hunger (ACF), NGO</td>
<td>Logistics specialist, Head of Nutrition</td>
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<tr>
<td>22</td>
<td>International Medical Corps (IMC), NGO</td>
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<tr>
<td>23</td>
<td>Mercy USA, NGO</td>
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<td>24</td>
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<td>26</td>
<td>World Bank, Donor</td>
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<td>27</td>
<td>ECHO, Donor</td>
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<td>28</td>
<td>FAO, UN agency</td>
<td>Regional Food Security Advisor</td>
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<td>29</td>
<td>Kimetrica, Information management consultant</td>
<td>M&amp;E and Survey Expert</td>
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<td>30</td>
<td>Deloitte, Supply chain consultant</td>
<td>Director, Senior Consultant</td>
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<tr>
<td>31</td>
<td>Kuehne and Nagel, Logistics service provider</td>
<td>Sub-regional Manager and Emergency &amp; Relief Logistics</td>
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<td>32</td>
<td>MOH</td>
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<tr>
<td>33</td>
<td>Isiolo District Hospital</td>
<td>Interim County Health Director</td>
<td></td>
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<tr>
<td>34*</td>
<td>Kenya Red Cross, Red Cross chapter</td>
<td>Regional Nutritionist</td>
<td></td>
</tr>
<tr>
<td>35**</td>
<td>UNOPS, NGO</td>
<td>Substitute Nutrition Support Officer</td>
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<td>Assistant Program Manager</td>
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<td>Nutrition Specialists</td>
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<td>39</td>
<td>IMC, NGO</td>
<td>Health and Nutrition Programme Manager</td>
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<td>40</td>
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<td>Turkana County Nutrition Officer</td>
<td></td>
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<tr>
<td>41</td>
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<td>Sub-county Nutrition Officer / Turkana West</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>MOH</td>
<td>Sub-county Medical Officer / Turkana Central sub-county</td>
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<tr>
<td>43</td>
<td>NDMA</td>
<td>County Drought Information Officer / Turkana</td>
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<td>44</td>
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<td>Nurses</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Nadoto health dispensary</td>
<td>Assistant Nurse</td>
<td></td>
</tr>
</tbody>
</table>
In total, 52 semi-structured interviews were conducted with representatives of aid agencies, NGOs, and government bodies that were part of the nutrition supply chain and contributed to this healthcare and nutrition system (see Table 1 for a list of interviewees). The respondents were nutrition managers, program managers and logistics managers from the supporting members (NGOs), the MOH, aid agencies (UNICEF & WFP) and donors. Some interviews involved two or more respondents at a time. The interviews last an average of 45-60 minutes. Additionally, the researchers visited health centres in Isiolo and Turkana, and conducted group interviews were conducted with caregivers of beneficiaries. In total, 16 group interviews were conducted with pastoralist and fisher communities in Isiolo and Turkana.

The interview guide (Appendix 1) consisted of questions about the background and the role of the respondent’s organisation in the nutrition sector, intervention, scale-up, scale-down processes and the success of the operations from a supply chain point of view. All interviews were recorded and transcribed, and field notes were taken during all of the interviews.

**3.2. Data Analysis and Trustworthiness**

The analysis began with transcribing. Although some interviews were transcribed by an outsourced transcriber, the author read and checked all the transcripts to prevent any misunderstandings. The remaining interviews were transcribed by the author. The interview guide was made deductively and the deductive approach was used in order to extract themes from the transcripts. The transcripts were coded with NVivo software, which is a very useful tool for analysing qualitative data. The coding process was done according to the research question and objective and the framework deduced from the literature on scalability and resilience in supply chain management. The data collection process was set up deductively and interviews were conducted by research teams of four, which the author was a part of. For this study, the data analysis focused on scale up of operations.

The template (King, 2012) was developed based on the supply chain capabilities (Christopher and Peck, 2004; Scholten et al., 2014; Kamalahmadi and Parast, 2016)
(Appendix 2). Then, the three steps (data reduction, data display and conclusion) proposed by Miles and Huberman (1994) were used for coding and analysing the data based on the template. In order to prevent data manipulation and increase the trustworthiness, triangulation was used. Triangulation is “an approach to research that uses a combination of more than one research strategy in a single investigation” (Streubert and Carpenter, 2011, 349) and it has various types: data triangulation, investigator triangulation, method triangulation and theoretical triangulation (Streubert and Carpenter, 2011, p. 352). In this study, data triangulation was used through observation, expert opinion, documents collected from humanitarian organisations and focus groups interviews, as well as field notes taken during interviews. Observation was used to increase the understanding of the context in Kenya regarding malnutrition. Specifically, observations of dry weather conditions and the livelihood of people in villages and signs of malnutrition in beneficiaries enabled the researcher to gain a fuller picture of the problem in Kenya as well as how to respond to it. Moreover, focus group interviews showed how aid is delivered and how communities are being monitored. Documents collected from various NGOs and UNICEF Kenya as well as expert opinion enables validity through avoiding factual mistakes and ensuring the data is current.

4. Findings

4.1 Scalability in the Kenyan Nutrition Supply Chain

Supply chain scalability consists of activities such as scaling up and scaling down. The Kenyan nutrition supply chain is a good example of a scalable supply chain that activates a temporary supply chain in case of a disaster (e.g. drought). Scalability in the supply chain requires both structural flexibility and information sharing. The nutrition commodities that flow through the supply chain are ready-to-use therapeutic food (RUTF) (also known as Plumpy’Nut) ready-to-use-supplementary food (RUSF) (also known as Plumpy Sup) and therapeutic milk. While therapeutic milk is used in facility treatment, RUSF and RUTF are used for home treatment for a child until the child fully recovers which is about 8 weeks or less. RUTF is used for treatment of severe acute malnutrition (SAM) while RUSF is used for treatment of moderate acute malnutrition (MAM).

4.1.1 Structural flexibility in the Kenyan Nutrition Supply Chain

Humanitarian supply chains are structurally flexible (Christopher and Holweg, 2011; Kovács et al., 2012). The antecedents of structural flexibility along with information sharing were observed, according to the accounts of the interviewees.

In the Kenyan nutrition supply chain, procurement of supplies for treatment of SAM is under the responsibility of UNICEF, while supplies for treatment of MAM is under WFP. The procurement, is done centrally by the supply division at UNICEF in Copenhagen. Procuring health commodities centrally and globally can provide advantages in quality and cost reduction for humanitarian organisations. Thus, dual
sourcing takes place in the supply chain for RUTF; however, different UN agencies support Ministry of Health for different nutrition programme components. UNICEF supports the implementation of High Impact Nutrition Interventions (HINI). WFP supports treatment of MAM, which is one of the HINI interventions component. Thus, from the programme perspective, this supports the dual sourcing antecedent of structural flexibility in the nutrition supply chain.

Postponement is generally operationalized through pre-positioning in the humanitarian setting. The commodities are pre-positioned in strategically located warehouses and distribution is postponed until they are needed. However, for some commodities, the shelf life can be short; thus, information sharing is vital in order to anticipate demand. Especially for emergency situations, humanitarian organisations pre-position the commodities, Kenya Red Cross, act as first respondent to emergencies; thus, they handle pre-positioning.

‘...what we are now looking at is prepositioning within the Kenya Red Cross warehouses, especially contingency stock in case of emergencies.’

Humanitarian organisations share their warehouses in the supply chain, which is another example of asset sharing. For instance, in Turkana, the MOH uses Kenya Red Cross’ warehouse. Outsourcing takes place for transportation and warehouse management activities. UNICEF Kenya collaborates with the logistics service provider (LSP) Kühne+Nagel and it outsources the warehouse management to Kühne+Nagel in Nairobi. The LSP is responsible for storing nutrition commodities in the warehouse and for updating the level of inventory. Thus, UNICEF Kenya is kept up to date with the stock level in warehouse. Outsourcing also is used in distribution of the commodities, especially at the country level. For instance, Child Fund in Turkana and Action Aid International in Isiolo are responsible for distributing the commodities to outreach facilities and in within the counties on behalf of the partners. In the supply chains, especially when the intervention is scaled-up, human resources can be moved to outreach facilities where they are mostly needed. This is highly related to flexible labour arrangements. Moreover, human resources can be shared amongst the organisations in the supply chain as well as other assets.

Separating base from surge demand is another important antecedent of structural flexibility, as it provides the members of the supply chain with the anticipation of when to scale up and scale down the nutrition intervention. In this aspect of structural flexibility, information sharing is vital, as it enables the supply chain members to manage demand fluctuations rapidly (Lee et al., 2000). Base demand represents the vulnerable population that needs to receive nutrition services; this is the minimum level that the supply chain needs to provide. However, when a disaster strikes the country, such as a drought, there are more vulnerable people that need to receive nutrition services. Surge demand represents the peak of the demand due to malnourishment. Surge demand initiates the partners to activate disaster relief by scaling up the capacity of the supply chain.
4.1.2 Information sharing in the Kenyan nutrition supply chain

Information sharing is one of the important antecedents that provides information flow into the supply chain. Information sharing enables the partners to review base demand and surge demand and helps the supply chain scale up and down due to meet the demand changes in the country. There are members in the supply chains who are responsible for the continuation of the information flow and coordination meetings take place amongst the members under the leadership of the MoH, Kenya.

‘There is a lot of coordination and there is a lot of communication. We normally share all this information.’ [49]

The coordination meetings are called the Nutrition Technical Forum (NTF), where all the partners share information about what they are doing and where they are conducting nutrition activities. There are also coordination meetings held at the counties level, where the same information is shared.

‘...we coordinate nutrition activities through county nutrition technical forum and this is a forum that brings on board all the partners implementing nutrition and nutrition related activities so all those partners attend this particular forum and in this forum we meet every month and this is the forum where most of the nutrition activities in the county are coordinated...’ [32]

In these meetings, information on when to scale up the intervention and when to scale down the intervention are discussed, related to nutrition activities. Generally, the coordination meetings are held once a month; however, if there is an emergency, the frequency of the meetings can be up to a daily basis to monitor the situation closely. Another body of information sharing is the National Drought Management Authority (NDMA). This organisation is responsible for drought surveillance in Kenya and responsible for providing information regarding drought to the partners.

4.2. Supply Chain Resilience in the Kenyan Nutrition Supply Chain

4.2.1. Supply chain re-engineering

Supply chain re-engineering is an important capability of supply chain resilience in configuration of a supply chain. It has assets such as supply chain understanding, predefined decision plans including contingency plan and communication plans. In the Kenyan nutrition supply chain, organisations have contingency plans. They have enough nutrition commodities stocks, which is related to redundancy, demonstrating both proactive and reactive capability of supply chain resilience as well as inventory management.
In addition, there is an understanding of the supply chain in the Kenyan nutrition supply chain amongst its members. Mapping the supply chain in terms of the responsibility of the members is highly valuable. As it can be seen from the following statement, there is a division of responsibility amongst the partners:

‘...and, basically, not to be dividing responsibility because it is already clear who is doing what, where.’[14]

Members also have contingency plans on how to react to emergencies. In Turkana, they have contingency plan based on the reports from NDMA. The respondent from MOH in Turkana explains it as follows:

‘as a county we decided now let's go out and look at how the situation is, how the information of the report and this will assist in coming up with plan B which is contingency plan. And how we are supposed to respond.’
[40]

Supply chain re-engineering is also highly relevant to supplier development and sourcing decisions. There are global (Nutriset) and local suppliers (INSTA) of RUTF, and, there is two-pipeline distribution in the supply chain. UNICEF Kenya and WFP distribute both RUTF and RUSF, but mainly focus on RUTF and RUSF, respectively. This is in line with dual sourcing (structural flexibility) and multiple sourcing (redundancy).

4.2.2. Collaboration

Coordination is seen as one of the most important asset to achieve collaboration in the supply chain along with cooperation, joint decision-making, knowledge sharing, supplier certification and supplier development. Supplier development, at the same time, is an important capability for supply chain re-engineering. Coordination is the backbone of the Kenyan nutrition supply chains: there are monthly meetings with the partners in regular time and in case of a disaster, these monthly meetings can be on everyday basis even:

‘...during emergency when you are scaling up there is very regular and intense meeting so when you are scaling down, the meetings are also, they remain regular but like on a monthly basis as supposed to if you meet almost every day to review the situation when there is an emergency’[32]

Coordination meeting are the places that partners also share knowledge:

There is a lot of coordination and there is a lot of communication. We normally share all this information.’[49]
Thus, the coordination in the supply chain is working as described by the respondent at the county level. The coordination meeting is called the County Nutrition Technical Forum, where the nutrition partners meet and share activities and update information.

‘...we coordinate nutrition activities through county nutrition technical forum and this is a forum that brings on board all the partners implementing nutrition and nutrition related activities so all those partners attend this particular forum and in this forum we meet every month and this is the forum where most of the nutrition activities in the county are coordinated...’[32]

Coordination is one the key antecedents of collaboration capability of supply chain resilience. In Kenya, meetings take place monthly and in these meetings, the nutrition situation in Kenya is discussed among the members of the supply chain. The meetings are under the leadership of the MoH, Kenya.. Joint decision-making also takes place in the Kenyan nutrition supply chain in many ways. One of them is joint rapid assessment, which is key for scaling up activities.

4.2.3. Agility

Agility is critical in responding to surges in demand. It requires antecedents, such as visibility and velocity and is a capability in building resilience in supply chains. In the Kenyan nutrition supply chains, monthly coordination meetings are held for discussing the current situations and for future activities in order to be ready for emergencies. The NDMA is responsible for early warning system and collecting data regarding Mid-Upper Arm Circumference (MUAC) screening:

‘NDMA is responsible for performing this early warning system, we’ll need to, well they are already in contact with the MOH of course and now what we are trying to do with, while nutrition partners are on the ground, is to train as well NDMA staff for them to able to take MUAC...’[27]

As the one of the donors stated, the early warning system is under the responsibility of NDMA and MUAC screening is a part of community surveillance, as well. After reviewing early warning data gathered through the system, the system can be activated to scale up. At the county level, for instance in Isiolo, NDMA is also big part of early warning. It monitors the indicators that show the situation is getting worse:

‘We have early warning systems and we have a surveillance ... we do mass screening, normally when we look at the admission... admission trends that gives us a signal that perhaps the situation is worsening or deteriorating or improving ...’[32]

At the county level, the county governments conduct mass screening and examine the admissions to the health facilities and the NDMA is responsible for forecasting related to drought situations.
In summary, the cross-sectorial monthly meeting is the place where members get data from the ground and NDMA and discuss the situation. If the situation gets worse, the participants conduct an additional, rapid assessment in these meetings. The rapid assessment has the aspects of velocity and visibility aspects of agility. Thus, members act with agility to emergencies. Rapid assessment is also important for the transition from a proactive agile approach to a reactive approach.

‘Rapid assessment, like the one just we have just completed is informed by the prevailing situation at the time. As the term has it, rapid means that you must have information as fast as you can. And information that is presented to you, or rather, should provide a picture of the current situation.’ [40]

As part of the contingency plan, contingency funding is important to activate the scale up in the Kenyan nutrition supply chain. It is an important asset for acting quickly and to be agile as stated in Oloruntoba and Kovács (2015):

‘What I mean by contingency fund is whereby an organisation, or even the Ministry and the counties, are able to set aside some fund, which can be used in case of an emergency. So, that if an emergency occurs, we just make use of that fund. Or, even the commodities.’ [34]

Overall, agility is an important capability for building resilience in a supply chain. The data from the Kenyan nutrition supply chain shows that agility can be observed in the supply chain. Flexibility is one the assets for agility, there scalability supply chain supports agility in that particular area, which has structural flexibility aspects.

4.2.4. Risk awareness/knowledge management

Risk awareness, or risk management culture, is another important asset of building resilient supply chains. This requires assets such as leadership and board level responsibility to be defined as well as well-managed human resources. Knowledge management is another asset for supply chain resilience proposed in Scholten et al., (2014). Supply chain understanding in terms of information and physical assets including human resources important for knowledge management (Scholten et al., 2014). Similar to supply chain re-engineering capability, supply chain understanding is also highlighted as an asset in risk awareness/knowledge management capabilities. One of the respondents from an NGO at the national level states that there is a high-level of supply chain understanding among the members of Kenyan nutrition supply chain:

‘Because with all the NGOs on the ground...they do the partner mapping, they know partner so-and-so is here, so we can't send you there, because they're doing the same thing, so instead we'll send you here. So, in the event that you have some supplies that you need to give to government,'
during the coordination meetings, such information is passed, that we have this kind of logistics, so-and-so has this kind of logistics.’ [23]

The partners share a lot of information in the monthly coordination meeting regarding the lesson learned, gaps and share knowledge:

‘We have the Nutrition Technical Forum that is held on a monthly basis whereby partners from the entire county meet to discuss issues on nutrition so that we have people identify any gaps...’ [38]

Employee training is another important asset for creating a risk management culture. In the nutrition supply chain, there are many training sessions ongoing on different fields in logistics and supply chain management skills as well as in monitoring and evaluation.

‘We do give the trainings to both field monitors and the communities. But, in joint partnership with several organisations within the county. Just a few days ago, we did the Kenya Red Cross. The other three months, we did the Catholic Relief Services.’ [43]

NGOs also provide trainings for MOH personnel on many different aspects:

‘...we are training the MOH, the Ministry of Health guys on the key indicators, the key indicators of the high impact nutrition interventions. And also doing proper reporting on machine, screening, inferring, and being dependent on themselves in case the partners are away, so they can be able to rely on themselves.’ [37]

Leadership is an important asset in risk management and in the nutrition supply chain, MOH leads the coordination on behalf of the GOK.

‘The ministry is coordinating, and the policy has been that when the partner [inaudible] every partner who goes to the ground has to work with the county health management teams... ‘ [2]

The leadership of MOH is considered a strong one and it directs all the necessary nutrition activities that needs to be prioritized as one of the respondent state:

‘There has been a lot of leadership from the Ministry of Health, so they already have the priority activities that will be on the ticket. So, for all the partners, sort of, we do something similar, because there are laid down priority areas that you have to work towards.’ [22]

Overall, supply chain understanding and human resource management are the important assets to create risk awareness and a risk management culture as well as knowledge management. In order to achieve scalability in the nutrition supply chains,
the assets, resources and capabilities that contributes to scalability also contributes to capabilities of supply chain resilience, as it is clearly demonstrated in this case, especially to risk awareness and knowledge management.

5. Discussion and Development of Propositions

The propositions (see Figure 3) are aligned with the foundation of scalability as a dynamic capability for a supply chain. Scalability not only allows a system to integrate capabilities for building supply chain resilience, it also activates dynamic flexibility, which is an antecedent of agility in a supply chain.

Considering the two unit of analysis, a dormant regular basic health and nutrition supply chain (development aid) and an active disaster relief supply chain, the development aid supply chain is the process where the dynamic capabilities are developed in order to expand the target beneficiaries in time of a disaster. During the regular development aid supply chain, humanitarian organisations are in the process of building scalability through structural flexibility (Christopher and Holweg, 2011) and information sharing (Christopher and Holweg, 2017). The necessary lower-order capabilities for building supply chain resilience are observed from the data. From the scalability perspective, in theory, these requirements are met with the ability to scale up and structural flexibility, as well as through information sharing.

Scalability can be achieved through structural flexibility in humanitarian supply chain management with the contribution of information sharing capability. Therefore, it can be argued that in order to be more scalable, a supply chain needs to be structurally flexible. Moreover, information capability is important in order to deal with demand fluctuations (Lee et al., 2000). As a dynamic capability, scalability has the ability of sensing the threats in the environment that supply chain runs its business. In this sense, information capability is the key in order to anticipate surges in demand. On the other hand, structural flexibility enables a supply chain to sense through information sharing amongst the members of the supply chains to seize through scaling up and scaling down to meet demand. Structural flexibility enables supply chain to shape its resources to be able to scale-up or down. Thus, this study proposes:

\[ P1: \text{Scalability requires structural flexibility.} \]
\[ P2: \text{Scalability requires information sharing.} \]

Structural flexibility (Christopher and Holweg, 2011) means having flexible options for a temporary (Merminod et al., 2014) or a permanent supply chain. Thus, agility and flexibility are closely related to each other; however, flexibility is the antecedent of agility (Hohenstein et al., 2015). Considering the aspects of structural flexibility such as asset sharing and information sharing, it can be concluded that to some extent, partners need to work collaboratively in order build structurally flexible supply chains because information sharing and asset sharing is an important aspect of supply chain collaboration (Cao and Zhang, 2011). Thus, this study proposes;
P3. Scalability contributes to collaboration through information sharing
P4. Scalability contributes to collaboration through structural flexibility

Asset sharing of structural flexibility is also a way to increase agility in humanitarian supply chains (Maghsoudi and Pazirandeh, 2015) and it is one of the antecedents of the coordination of humanitarian actors (Kovacs and Tatham, 2009; Maghsoudi and Pazirandeh, 2015). Structural flexibility can also activates dynamic flexibility (Christopher and Holweg, 2011), which is an antecedent of humanitarian supply chain agility (Dubey and Gunesakaran, 2016) Moreover, agility requires visibility (Christopher and Peck, 2004) and visibility contributes to flexibility in humanitarian supply chains (Maghsoudi and Pazirandeh, 2015) Thus, this study proposes:

P5: Scalability contributes to agility through information sharing,
P6: Scalability contributes to agility through structural flexibility

Structural flexibility also contributes to supply chain re-engineering. Sourcing decisions are highly relevant to the supply chain re-engineering capability of supply chain resilience (Christopher and Peck, 2004) and structural flexibility aims supply chains to adapt fundamental changes in order to cope with high turbulence (Christopher and Holweg, 2011; 2017) Scalability through structural flexibility requires dual sourcing and outsourcing to be in place; therefore it contributes to supply chain re-engineering in terms of sourcing decisions. The data support that there is a positive relationship showing that scalability contributes to capabilities of supply chain re-engineering, thus this study proposes:

P7. Scalability through structural flexibility contributes to supply chain re-engineering.

Figure 3 Conceptual framework and testable propositions
The data show that scalability contributes to the creation risk awareness and knowledge management with its information sharing aspect. As information exchange contributes to knowledge creation amongst supply chain members. Therefore, scalability can be considered as one of the antecedent capabilities of supply chain resilience in such a context. Scalability in humanitarian supply chains also encourages members working collaboratively through information sharing. Information sharing took place mainly in coordination meetings where all stakeholders are present in Kenyan nutrition supply chain. Moreover, scalability through structural flexibility enables supply chain members. Thus, this study proposes:

P8. Scalability through information sharing contributes to knowledge management/risk awareness.

The Kenyan nutrition supply chain is a resilient supply chain. The data indicate that all the capabilities required for building a resilient supply chain are observed from the dormant to the action phase. Scalability through structural flexibility (Christopher and Holweg, 2011) and information sharing (Christopher and Holweg, 2017) contributes to the capabilities of supply chain resilience as scalability has a mediating effect of reconfiguring the antecedent capability of supply chain resilience.

P9. Scalability is an antecedent capability of supply chain resilience.

6. Conclusions

This study discusses the supply chain scalability and supply chain resilience in the Kenyan nutrition supply chain context. In answering the research questions, this study also posits propositions that are generated from the analysis and findings from the case study to be elaborated in the further studies. The findings from literature review and the framework are also parallel with the findings of case study. As the previous studies suggested (Christopher and Holweg, 2011; Kovacs and Tatham, 2009; Kovacs et al., 2012), structural flexibility is a strategy that can change supply chains fundamentally as well as enable them to achieve scalability in order to address swings in demand.

The contribution of this study is twofold. First, this study deepens the understanding on supply chain resilience in a humanitarian context through scalability. Second, it looks into scalability as a capability in building resilient humanitarian supply chains. Therefore, this study also answers the call for studying resilience in humanitarian supply chains (Day et al., 2012; Tatham, 2012; Dubey et al., 2014) and supply chains in general (Melnyk et al., 2014; Kamalahmadi and Parast, 2016).

Resilient supply chains are dependent on capabilities such as collaboration, supply chain re-engineering, agility and risk awareness/knowledge management (Christopher and Peck, 2004; Scholten et al., 2014). In this study, the views of Christopher and Peck
(2004) and Scholten et al. (2014) are adopted in order to understand the contribution of scalability to supply chain resilience.

Scalability in supply chains requires both structural flexibility and information sharing. It has two main phases, scale up and scale down with an exit strategy. The focus here is on scaling up from the dormant stage. Structural flexibility has antecedents of dual sourcing, asset sharing, rapid manufacturing, separating the base level from surge demand, postponement, flexible labour arrangements and outsourcing (Christopher and Holweg, 2011). In addition, it enables dynamic flexibility, which can be considered as the reactive part of structural flexibility.

From the theoretical point of view, this article contributes to DC theory through the discussion on first-order capabilities and second-order capabilities that are needed to build supply chain resilience and scalability. The capabilities that form resiliency in supply chains are evident in the supply chain. Thus, capabilities of supply chain resilience are explained through the lens of DC theory. The discussion shows that scalability can be considered a first-order capability for building supply chain resilience.

The concept of resilience is observed in commercial organisations; therefore scalability can contribute to commercial firms' resiliency in decreasing or preventing the impact of supply chain disruptions, specifically of disasters. In terms of DC theory, scalability and resilience in a supply chain can be seen as dynamic capabilities. Scalability is observed to be a dynamic capability that contributes to resilience in the supply chain. Dynamic capabilities create sustainable competitive advantage (Teece et al., 1997), but their primary strength is based on the manipulation of the resource configuration that creates sustainable competitive advantage (Eisenhardt and Martin, 2000). Scalability enables humanitarian supply chains to be adaptive (Christopher and Holweg, 2011; Dubey and Gunesakaran, 2016) and enable them to sense the threats and reconfigure the antecedents of scalability in case there is a change in the environment. As the theoretical discussion shows scalability is a DC that integrates and reconfigure other capabilities in order to contribute to supply chain resilience.

### 6.1 Managerial Implications

In the humanitarian sector, humanitarian organizations are familiar with the concept of scalability because humanitarian supply chains need to be scalable to increase and decrease their capacities in response to beneficiaries' needs. It is important to find permanent solutions instead of temporary, one time attempts to deal with a surge in demand (Christopher and Holweg, 2011). Thus, structural flexibility (Christopher and Holweg, 2011) and information sharing (Christopher and Holweg, 2017) are important DCs in building scalability and contributing to resilience in supply chains.

In other words, scalability is an important concept for managers working in both business and humanitarian settings. Demand fluctuations are common in business setting due to the seasonality, globalisations and other factors. Anticipation of surges in
demand is required for both humanitarian (Merminod et al., 2014) and business (Lee et al., 2000) settings in order to enable scalability and respond to the surges in demand. In this study, the scalability concept is shown through one of the best cases in the humanitarian sector.

In any setting, resilience should be considered a necessity during the design of a supply chain. Many researchers call for a consideration for resilience in both the design of humanitarian (Day et al., 2012; Tatham, 2012, Dubey et al., 2014) and general supply chains (Christopher and Holweg, 2011; Melynk et al., 2014; Kamalahmadi and Parast, 2016) and sourcing (Colicchia et al., 2010; Pereira et al., 2014). This shows the importance of resilience in dealing with disasters.

An important insight from this study is that scalability can bring a lot of benefits to all types of organisations as markets become more turbulent (Christopher and Holweg, 2011; 2017, Gattorna, 2009). Scalability, as a dynamic capability, enable organisations and their supply chains to sense threats, seize what needs to be done and implement a response. Thus, if managers can learn how humanitarian organisations adopt structural flexibility through dual sourcing, outsourcing, asset sharing and as such, it can be applied to commercial settings as well. Since a humanitarian setting is considered the most dynamic (Kovacs et al., 2012), managers from other sectors can learn implementation and the importance of scalability.

6.2 Limitations and Further Research

One of the limitations of this study is the single case study approach, since generalisations are less possible with single case studies. However, the primary aim of this study is not to offer generalisations from the single case study, but rather to discuss transferability of the knowledge to other scholars in the field of research. Moreover, a single case study approach can illustrate concepts developed theoretically and can motivate other researcher to work further on these concepts (Siggelkow, 2007).

From a theoretical perspective, the aim of this study has been to elaborate on the concepts, scalability and resilience from DCV. In order to see the evolution of capabilities towards becoming dynamic, as future research, longitudinal studies can be exploited in order to understand the concepts from DCV. Also, there is a possibility for researchers to further elaborate the relationship between scalability and resilience in a supply chain with multiple cases and different contexts.
References


Thomas, A., Mizushima, M., n.d. Logistics training: necessity or luxury?


## Appendix 1. Interview guide

**Supply chain member interview guide**

<table>
<thead>
<tr>
<th>General background questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Could you briefly explain what your organisation is doing in Kenya?</td>
</tr>
<tr>
<td>- What is your role in your organisation?</td>
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<tr>
<td>- How does your organisation relate to the nutrition supply chain?</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Scaling up and scaling down of the supply chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How does your organisation respond to deteriorating nutrition situations?</td>
</tr>
<tr>
<td>2. How are the interventions planned?</td>
</tr>
<tr>
<td>a. How is the collaboration between governmental agencies and other agencies and NGOs planned?</td>
</tr>
<tr>
<td>b. Which logistical services do each of the agencies provide?</td>
</tr>
<tr>
<td>c. How is your organisation prepared for interventions?</td>
</tr>
<tr>
<td>3. Triggers</td>
</tr>
<tr>
<td>a. How do you determine vs. receive the information of a need to scale up operations in the nutrition surge supply chain?</td>
</tr>
<tr>
<td>(who determines the need, who disseminates the information, how much in advance to the activation is this information disseminated?)</td>
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<tr>
<td>b. What are the short-term vs. long-term triggers for scaling up operations?</td>
</tr>
<tr>
<td>c. What are the reasons behind the need to scale up?</td>
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<tr>
<td>d. How do you determine when to activate scaling up?</td>
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<tr>
<td>e. How/who do you share the information with?</td>
</tr>
<tr>
<td>4. Scaling-up</td>
</tr>
<tr>
<td>a. What happens when the intervention is scaled up?</td>
</tr>
<tr>
<td>b. What is the planned procedure?</td>
</tr>
<tr>
<td>c. Which actors are involved and what are their roles, responsibilities, and activities during the surge? Who co-ordinates activities?</td>
</tr>
<tr>
<td>d. How are governmental and non-governmental supply chains integrated?</td>
</tr>
<tr>
<td>e. How are information flows organised during the surge?</td>
</tr>
<tr>
<td>f. What are the main challenges during the scaling-up of the intervention?</td>
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<tr>
<td>g. How could the surge be improved?</td>
</tr>
<tr>
<td>5. Scaling-down</td>
</tr>
<tr>
<td>a. What happens when the intervention is scaled down?</td>
</tr>
<tr>
<td>b. How is the decision to scale down made? What triggers the scaling down of the intervention?</td>
</tr>
<tr>
<td>c. What is the planned procedure?</td>
</tr>
<tr>
<td>d. Which actors are involved and what are their roles, responsibilities, and activities during the scaling down?</td>
</tr>
<tr>
<td>e. How are operations handed over, and who takes them over?</td>
</tr>
</tbody>
</table>
f. How are information flows organised during the scaling down?

6. How do you identify the success of an intervention?
   a. How do you know if the scaling up was successful/met the objectives?
   b. How is success measured?
## Appendix 2. Final template

<table>
<thead>
<tr>
<th>Higher order codes</th>
<th>Lower order codes</th>
<th>Focus</th>
</tr>
</thead>
</table>
| **Supply chain resilience** | Supply chain re-engineering  
- Supply chain Understanding  
- Supply base strategy  
- Supply chain design principles |  
- Mapping out the supply chain  
- Procurement activities  
- Pre-positioning |
| | Agility  
- Visibility  
- Velocity and acceleration |  
- Dormant to action activities  
- Frequency of coordination meetings |
| | Collaboration  
- Collaborative planning  
- Supply chain intelligence |  
- Joint planning  
- Coordination |
| | Risk awareness/Knowledge management  
- Establish supply chain continuity teams  
- Board level responsibility and leadership  
- Factor risk considerations into decision making  
- Information sharing (Knowledge creation) |  
- Capacity building  
- Training  
- Leadership |
| **Supply chain scalability** | Structural flexibility  
- Dual sourcing  
- Asset sharing  
- Flexible labor arrangements  
- Outsourcing  
- Postponement  
- Dynamic flexibility |  
- Sourcing and distribution channels  
- Shared resources  
- Relocation of human resources  
- Outsourcing of transportation and warehouse management activities  
- Pre-positioning  
- Activation of temporary network (Scaling up) |
| | Information sharing |  
- Information sources  
- Information platforms |
Supply chain scalability: The role of supply chain integration

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Supply chain integration (SCI) has long been studied in the scholarly literature on supply chain management (SCM). However, studies of the role of SCI in building scalable supply chains are still scarce in the literature. Thus, the purpose of this study is to further discuss the role of SCI in building scalability. We have used a qualitative methodology with a single-case-study approach that includes semi-structured interviews, group interviews, first-hand observation, and internal and external documents regarding the nutrition supply chain in Kenya. The main data source of this research, however, is interviews. Information integration, as well as the more tangible integration of primary and supporting members during development aid and disaster relief, is evident, and is what enables supply chains to be scalable. From the donor perspective, integration in the supply chain can also be categorised as “customer integration.” Additionally, scalability is highly relevant to the business setting, as it is for the humanitarian setting, and the concept helps managers in both settings understand the mechanisms that enable supply chains to respond rapidly to surges in demand.

Keywords: humanitarian supply chain management, supply chain integration, collaboration, capabilities, scalability.
1. Introduction

Supply chain management (SCM) has been defined as ‘the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole’ (Mentzer, 2001, p. 18). Thus, the integration of a supply chain is at the core of SCM (Cooper et al., 1997; Lambert et al., 1998).

In a humanitarian setting, much effort is required to integrate, collaborate and coordinate different actors with different mandates (Balci̇k et al., 2010), and there is a call for integration from governments and donors (McLachlin and Larson, 2011; Moshtari, 2016). In disaster relief operations, integration efforts may slow down efforts that might otherwise be dedicated to life saving. For long-term development aid, however, there is a need for collaboration and integration efforts that are similar to the commercial sector. Supply chain integration (SCI) provides the members of the supply chain a better understanding of demand and more proper roadmaps to meeting that demand (Sahay, 2003). Operational, informational and relational integration all facilitate the integration of supply chains (Flynn et al., 2016). SCI has been studied in commercial settings in terms of customer, external and internal integration; however, a limited amount of similar research has been done in humanitarian settings due to the short-term objectives of disaster relief (McLachlin and Larson, 2011). In order to answer the call for SCI in humanitarian supply chains (HSCs), borrowing conceptual models from the commercial setting has been suggested (McLachlin and Larson, 2011). As borrowing from other fields advance the effectiveness of humanitarian supply chain management (HSCM), we aim to explore the role of SCI in supply chain scalability.

Although SCI and collaboration are sometimes used synonymously in the SCM literature (cf. Fawcett et al., 2014), supply chain collaboration and supply chain coordination are ‘used to describe the elements of SCI’ (Leuschner et al., 2013, p. 34). While collaboration requires a partnership (Kache and Seuring, 2014), SCI refers primarily to engaging activities between partners in the supply chain (Fröhlich and Westbrook, 2001). In HSCM, there is no clear distinction between these terms, and they are used interchangeably for all practical purposes (Balci̇k et al., 2010). Thus, in the humanitarian setting, we prefer to use SCI as an umbrella term covering the tight relationships and partnerships in the humanitarian field.

HSCM covers both development aid and disaster relief operations (Kovács and Spens, 2007). Disaster relief operations focus on preparedness, immediate response and reconstruction, while development aid focuses on recovery or long-term programmes such as education, construction and nutrition. Generally, development aid and disaster relief are integrated in a country where there are already continuous development programmes in place (Day et al., 2012). Preparedness and reconstruction supply chains are considered to have a permanent structure, while immediate response supply chains have a temporary structure and are activated when a disaster hits (Jahre and Heigh, 2008). Scalability in supply chains refers to the ability of a supply chain to scale up when there is a surge in demand and scale down when the situation returns to the baseline.

In this study, we examined SCI at the organisational level among the humanitarian organisations working together to provide nutritional services to beneficiaries. What we mean by humanitarian organisations here is governmental and non-governmental organisations, including international NGOs, UN agencies and donor organisations. There are different aspects of integration, such as internal, external, supplier and...
customer integration. In this study, we refer to SCI as inter-organisational integration, since the donors can be considered customers in the supply chain (Oloruntoba and Gray, 2009).

This study also explores the role of SCI with respect to scalability in supply chains. Specifically, the study looks into the data collected during early 2014 in the Kenyan nutrition supply chain. The activities of that supply chain were identified as a “best practice” case of combining development and disaster risk reduction by the Food Security and Nutrition Working Group which is “a regional platform, co-chaired by Africa’s IGAD (Intergovernmental Authority on Development) and the UN’s FAO (Food and Agriculture Organization of the United Nations)” (FAO, 2017). The supply chain is under the leadership of the Government of Kenya and partners with UNICEF Kenya.

Although there are many studies examining SCI in humanitarian settings, we assess the concept from the supply chain scalability perspective in order to understand what kind of role SCI plays in achieving scalability. Because the humanitarian setting is defined by turbulence, integration remains a big challenge (Balcik et al., 2010; Maon et al., 2009; Overstreet et al., 2011; Jensen and Hertz, 2016), as there are a great number of relief organisations, all with different mandates. However, integration plays a vital role in coping with the uncertainties inherent in efforts at collaboration and coordination (Wong et al., 2011; Flynn et al., 2016). Moreover, scalability has been a strategy for disaster risk reduction in humanitarian setting, as disaster risk reduction aims to minimise the effects of damage caused by natural disasters (UNISDR, 2017).

Integration in the humanitarian setting can be discussed in three sub-categories: (1) in-country or emergency, (2) the regional level and (3) the global level (Jensen and Hertz, 2016). In this study, we focus on the in-country integration and streamlining of governmental and NGO supply chains with the objective of operational efficiency (Holweg et al., 2005).

Therefore, we present the following research questions:

- What is supply chain integration in HSCM?
- How does supply chain integration contribute to scalability in a humanitarian setting?

The first question addresses SCI in the HSCM context based on our literature review. The second question asks how SCI enables the supply chain to be more scalable in its collaboration and coordination aspects. Scalability through SCI also has outcomes, as it is evident that SCI contributes to collaboration and performance, information sharing, rewards and risk sharing in a supply chain (Kache and Seuring, 2014; Soosay et al., 2008). Moreover, we take both a dynamic capability view (Teece et al., 1997) and a relational view (Dyer and Singh, 1998) in order to explore the role of SCI in supply chain scalability.

The rest of the study is structured as follows: i) First, theoretical foundations of the study are introduced with the literature on SCI and scalability in the humanitarian setting. ii) Next, the research design is presented, using a single-case-study approach along with data collection, analysis and trustworthiness, as well as the theoretical framework of the study. iii) Findings and discussion with testable propositions follow. iv) Last is our conclusion, with a theoretical contribution and managerial implications.
2. Theoretical Background

2.1. Theoretical foundations: Dynamic capabilities and relational view

SCI is a way of coping with uncertainties (Flynn et al., 2016). The dynamic nature of the humanitarian setting is evident (Kovács et al., 2012). Therefore, the appropriateness of using both a dynamic capability view (DCV) and a relational view (RV) as the main theoretical lenses in the study becomes evident in order to construct our framework. DCV and RV are both extensions of the resource-based view (RBV), as DCV has an evolutionary aspect (Barney, 2001). RV is another extension of RBV that claims that the assets gained through relational capabilities (RCs) provide a competitive advantage (Dyer and Singh, 1998). RBV (Barney, 1991) basically refers to having a sustained competitive advantage by using its capabilities and resources. The main logic of this lens is to turn resources into capabilities and to create a competitive advantage via these capabilities. To be able to achieve a sustainable competitive advantage, a firm's resources should be valuable, rare, imperfectly imitable and non-substitutable (Barney, 1991). Similarly, Grant (1991) presents four barriers to resources and capabilities: durability, transparency, transferability and replicability. In order to create a sustainable competitive advantage, RBV focuses on the identification of an organisation's internal resources and skills (Kovács et al., 2012).

In SCM, RBV has been used extensively, especially in the SCI literature. Liu et al. (2013) use RBV to explain the link between SCI and performance, and Xu et al. (2014) take RBV as a theoretical background to examine the effects of intra-organisational resources on inter-organisational capabilities. Likewise, Ralston et al. (2013) use RBV as a theoretical framework to evaluate the impact of logistics salience on logistics performance and capabilities.

Relative to coping with disruption in supply chains, Gligor and Holcomb (2014) use RBV to examine the antecedents of supply chain agility. In HSCM, studies have both contributed to and been adopted for RBV and DCV (Tabaklar et al., 2015). DCV explains capabilities in a turbulent environment, and it is an extension of RBV with the added aspect of evolution (Barney et al., 2011). Richey Jr. (2009) uses RBV in the disaster pyramid and points out that the managerial goal of RBV is to develop core competencies. Tatham et al. (2012) adopt defence lines of development, which are rooted in the RBV of a firm, in order to explore and analyse preparedness, planning and response when facing a cyclone in two different countries. Kovács and Tatham (2009) examine the resource configurations of military and humanitarian organisations by using the theoretical lens of RBV.

Kovács et al. (2012) investigate the skills of humanitarian logisticians based on RBV and DCV. Matopoulos et al. (2014) use RBV to develop a framework to classify the impact of local resources and resource configuration in HSCs in delivering humanitarian aid. On the other hand, scalability can be considered a DCV (Teece et al., 1997; Eisenhardt and Martin, 2000) in a supply chain configuration. DCV has three sub-capabilities, which are sensing, seizing and transforming (Teece, 2007). We conceptualise scalability as a DCV; thus, supply chain scalability can sense the risks or emergencies, seize the time to scale-up and transform resources and other capabilities in order to respond to emergencies.
On the other hand, from RV, RCs have the drivers of (i) relation-specific assets, (ii) knowledge-sharing routines, (iii) complementary capabilities and resources, and (iv) effective governance (Dyer and Singh, 1998) in order to create a competitive advantage amongst the competitors. SCI is proposed as RC in the study, since supply chain relationships are critical capabilities amongst all (Mclachin and Larson, 2011).

Scalability enables HSCs to reach more beneficiaries more quickly; e.g., this step could be done better by having two or more humanitarian organisations working collaboratively (Mclachin and Larson, 2011). In the discussion, DCV is used as a background for developing the theoretical basis for the role of SCI in building scalability in HSCs. Thus, SCI’s collaboration and coordination aspects are resources that form SCI’s capability for scalability.

Our purpose in this study is to discuss the contribution of SCI to the supply chain’s scalability. Thus, we can argue that scalability is a (DC), as the main objective of scalability is to scale up and down rapidly in order to respond to demand surges in a rapidly changing environment. RC explores dyadic and network relationships (Dyer and Singh, 1998); therefore, like Paulraj (2011), we posit SCI as a relational capability in the Kenyan nutrition supply chain.

2.2 Scalability in disaster relief and development supply chains

Humanitarian logistics is ‘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’ (Thomas and Mizushima, 2005, p. 60). The term humanitarian logistics involves both disaster relief and development programmes (Kovács and Spens, 2007). Short-term relief activities ‘focus on providing goods and services to minimise immediate risks to human health and survival,’ and development activities ‘include establishing permanent and reliable transportation, healthcare, housing, and food’ (Beamon and Balcik, 2008, p. 5). HSCs consist of diverse actors such as relief organisations, host governments, military organisations, private sector companies and local and regional relief organisations (Balcik et al., 2010).

The humanitarian setting is defined by turbulence and uncertainty (Kovács and Spens, 2007; Balcik and Beamon, 2008; Carroll and Neu, 2009; Kovács and Tatham, 2009; Ergun et al., 2010; Kovács et al., 2012). In this kind of environment, the integration of actors with diverse foci and mandates remains a key challenge (Kovács and Spens, 2007, Balcik et al., 2010); however, it is a necessity in order to respond to disasters effectively (Akhtar et al., 2012). HSCM consists of three phases (Kovács and Spens, 2007) or three different ‘lifecycles’ (Melnyk et al., 2014). The different phases are defined by different practices in humanitarian relief operations, where ‘preparedness’ and ‘immediate response’ are explained in terms of permanent and temporary structures, respectively (Jahre and Heigh, 2008).

In moving from preparedness to immediate response, there is a shift from a ‘lean’ philosophy to an ‘agile’ philosophy (Kovács and Tatham, 2009), and in moving from immediate response to reconstruction, there is a shift from an ‘agile’ philosophy back to a ‘lean’ philosophy (Taylor and Pettit, 2009, Cozzolino et al., 2012). In this sense, long-term development aid supply chains have a more permanent structure than disaster relief supply chains. Furthermore, there are countries where development aid and disaster relief go hand in hand (Day et al., 2012). HSCs are as agile (Oloruntoba and Gray, 2006) as they are flexible (Gattorna, 2009). Flexibility is the antecedent of
agility (Swafford et al., 2008). Thus, the transition between the phases of HSCs is relatively quicker, which also proves the scalable nature of HSCs.

Thus, HSCs are scalable, as they can quickly scale up from preparedness by activating immediate response supply chains, and they can also go from the lean to the agile phase, which requires the quick mobilisation of resources (Kovács and Tatham, 2009) and anticipation capability (Merminod et al., 2014). As the situation improves and humanitarian organisations start exiting a disaster scene, relief operations are scaled down, and immediate response supply chains revert into reconstruction supply chains with lean principles.

### 2.3. Supply chain integration in the humanitarian setting

SCM has also been defined as ‘the integration of business processes from end-user through original suppliers that provide products, services and information that add value for customers’ (Cooper et al., 1997, p. 2). Integration is a crucial aspect of SCM (Mentzer et al., 2001). Flynn et al. (2010, p. 59) define SCI as ‘the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organisation processes’ or, from a broader perspective, ‘SCI is the scope and strength of linkages in supply chain processes across firms’ (Leuschner et al., 2013, p. 34). Collaboration and integration are used synonymously in the literature (Fawcett et al., 2010). They can also be considered antecedents of each other (Soosay et al., 2008; Jin et al., 2013, Kache and Seuring, 2014). Recent literature reviews by Soosay and Hyland (2015) demonstrate a distinction between collaboration and integration whereby integrated supply chain processes are seen as components of supply chain collaboration. However, we follow the distinction made by Bagchi et al. (2005), Kache and Seuring (2014), Jin et al. (2013) and Leuschner et al. (2013). Kache and Seuring (2014) claim that SCI is the ultimate goal and that collaboration is its component. This view is supported by Jin et al. (2013), as they discuss collaboration and coordination in relation to the rhetoric and reality of SCI. Low-intensity collaboration is called arm’s length collaboration, while high-intensity collaboration is referred to as integration (Moshtari, 2016).

Furthermore, Leuschner et al. (2013) see supply chain collaboration and coordination as elements of SCI. SCI is also the integration of primary and supporting members of a supply chain. Primary members are ‘all those autonomous or strategic business units who actually perform operational and/or managerial activities in the business processes designed to produce a specific output for a particular customer market’. Supporting members are ‘companies that simply provide resources, knowledge, utilities or assets for the primary members of the supply chain’ (Lambert et al., 1998, p. 5).

As more empirical studies have been called for (Fabbe-Costes and Jahre, 2008), many studies show that SCI positively impacts the performance outcomes of SCM (Bagchi et al., 2005; Flynn et al., 2010; Wong et al., 2011; Cao and Zhang., 2011). It has even been suggested that more SCM integration leads to more performance increases (Bagchi et al., 2005). SCI also is a way of dealing with uncertainties in the environment (Zailani and Rajagopal, 2005; Wong et al., 2011) and leads to flexibility in supply chains (Flynn et al., 2010). The alignment of activities increases risk and resource sharing along with roles in HSCs (van Wassenhove, 2006), and SCI enables the supply chain to align its activities and goals (Simatupang et al., 2002).

SCI efforts in HSCM generally remain one-time or episodic (Zacharia et al., 2011; Moshtari, 2016) or transient (Day et al., 2012), as, thereafter, humanitarian organisations scale down and exit disaster operations. However, in countries where a
certain programme is going on, a permanent development programme is generally integrated with disaster relief supply chains. When a sudden-onset disaster strikes, disaster relief or a temporary supply chain activates from permanent supply chains. Thus, SCI efforts become more important.

The terms that refer to relationships and interactions in HSCs, especially collaboration and coordination, are generally used interchangeably (Russell, 2005; Balcik et al., 2010), and overall integration initiatives improve the ability to save lives (Balcik et al., 2010). Collaboration in supply chains refers to “a partnership process where two or more autonomous firms work closely to plan and execute supply chain operations toward common goals and mutual benefits” (Cao and Zhang, 2011, p. 166) and coordination in HSCs refers to “the ability to define the problem or task, to make joint decisions, to properly assign roles and responsibilities to each partner, and to evaluate the collaborative performance” (Moshtari, 2016, p.5).

Information sharing, incentive alignment, logistics synchronisation and collective learning are considered the antecedents of coordination, which leads to SCI (Simatupang and Sridharan, 2005). More broadly, SCI requires the following collaboration capabilities: information sharing, goal congruence, decision synchronisation, incentive alignment, resource sharing, collaborative communication and joint knowledge (Cao and Zhang, 2011). In the humanitarian setting, there has been the expectation by donors and governments for members of supply chains to integrate more (Moshtari, 2016). In HSCs, SCI is operationalised in various ways. Information sharing takes place mainly in regular meetings with the organisations involved (Akhtar et al., 2012; Kabra and Ramesh, 2015). Cluster systems (Jahre and Jensen, 2010) as well as monitoring and evaluation (Heaslip et al., 2012) could be other ways information can be shared. Information sharing can be in any form, such as maps, reports and so on (Van Wassenhove and Pedraza Martinez, 2012).

We have borrowed most of the antecedents of SCI from Cao and Zhang (2011), who described them broadly and profoundly; moreover, it has been suggested that HSCs can borrow conceptual relationship models from commercial supply chain literature (McLachlin and Larson, 2011). Goal congruence may refer to the objective of humanitarian operations or standardisation (Balcik et al., 2010; Van Wassenhove and Pedraza Martinez, 2012), and it can be aligned with a leadership (Akhtar et al., 2012) and supply chain understanding through coordination meetings. Moreover, commitment is prised in HSCM (Moshtari, 2016), which can be evaluated under goal congruence. Decision synchronisation can take place through a decision support system or through the meetings and cluster system. Incentive alignment can be interpreted as risk sharing or cost-reduction (Balcik et al., 2010; Ergun et al., 2014) among the members of HSCs, since generally actors have little incentive to work together, which is a challenge (Tomasini and van Wassenhove, 2009). Resource sharing is an important dimension of SCI. It could take place through sharing warehouses and transportation (Balcik et al., 2010) or through sharing human resources (Van Wassenhove and Pedraza Martinez, 2012). In the humanitarian setting, resource sharing contributes to operational outcomes (Kovács and Tatham, 2009). Moreover, coordination is a way of improving SCI, since coordination can contribute to information flow and increase the integration in HSCs (Akhtar et al., 2012).
Figure 1: The relationship between SCI and supply chain scalability

Figure 1 shows the relationship between SCI and supply chain scalability. Arguably, SCI is one of the initiators of scalable supply chains, as it has collaboration and coordination aspects which ensure information exchange and sharing of other resources amongst the member of a supply chain. It is important to have coordination with regular information sharing through coordination meetings, and collaboration is important for a common understanding and visibility across a supply chain. Thus, members of a supply chain must be aware of when to scale up and scale down relief operations.

3. Research Methods

This study is based on a single in-depth embedded case study (Yin, 2009), as the case study approach is suitable for SCM studies (Seuring, 2008). The template (Appendix 1) is adapted from the extensive literature review on scalability and SCI, with its theoretical lens based on RV and DC. The main objective of this study is to elaborate on the contribution of SCI to supply chain scalability in a humanitarian setting as well as illustrating our theoretical foundations through a case study and so motivating researchers (Siggelkow, 2007) in the field to further investigate the role of SCI in good practices. In other words, we are aiming to emphasise theory elaboration by borrowing a conceptual model (Tabaklar et al., 2015) from a commercial setting. Theory elaboration aims to do 'reconciliation of the general with the particular' (Ketoviki and Choi, 2014, p. 236) and focus on 'the contextualised logic of a general theory' (Ketoviki and Choi, 2014, p. 236). According to Yin (2009), certain elements need to be considered when doing a case study (p. 27):

- A study's questions
- Its propositions, if any
• Its unit(s) of analysis
• The logic linking the data to the propositions
• The criteria for interpreting the findings

The research question in the study is related to scalability and SCI. The empirical context of the case study is the Kenyan nutrition supply chain, which consists of high-impact nutrition intervention activities. The case study under investigation is explorative and at the same time it is representative of a best practice case of combination of disaster risk reduction and integrated supply chain. In this section, we elaborate on the sampling, data collection, data analysis and trustworthiness of the study.

3.1. Sample and data collection

There has been a call for exploring relationships in a humanitarian setting (McLachin and Larson, 2011; Moshtari, 2016); therefore, with this study, we aim to shed some light on the contribution of SCI to scalability. The case under investigation here is the Kenyan nutrition supply chain, which consists of activities that fight malnutrition in Kenya. The supply chain is under the leadership of the Ministry of Health on behalf of the Government of Kenya.

![Figure 2. Data collection process](image)

The Kenyan nutrition supply chain is identified as a best practice case by the Food Security and Nutrition Working Group (FWNWG) in East Africa in the scope of an Academy of Finland project, which is the reason that we wanted to study this case from different perspectives. The data collection process lasted one month in early 2014 in the city of Nairobi and two counties—Isiolo and Turkana—with a research team of four. Figure 2 shows the data collection in detail.
<table>
<thead>
<tr>
<th>Code</th>
<th>County</th>
<th>Organization</th>
<th>Respondent (s) Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>Nairobi</td>
<td>MOH</td>
<td>Assistant Chief Nutritionist Officer</td>
</tr>
<tr>
<td>2</td>
<td>Nairobi</td>
<td>MOH</td>
<td>Program Officer (Division of Nutrition)</td>
</tr>
<tr>
<td>3</td>
<td>Nairobi</td>
<td>NASCOP, under MOH</td>
<td>Nutritionist and Program Officer</td>
</tr>
<tr>
<td>4</td>
<td>Nairobi</td>
<td>KEMSA, Procurement agency</td>
<td>Resource Mobilization Advisor and Procurement Manager</td>
</tr>
<tr>
<td>5</td>
<td>Nairobi</td>
<td>CONCERN Worldwide, NGO</td>
<td>Country Director</td>
</tr>
<tr>
<td>6</td>
<td>Nairobi</td>
<td>Kenya Red Cross (KRC), Red Cross chapter</td>
<td>Nutrition Specialist</td>
</tr>
<tr>
<td>7</td>
<td>Nairobi</td>
<td><em>Merlin / Save the Children, NGO</em></td>
<td>Nutrition Co-ordinator</td>
</tr>
<tr>
<td>8</td>
<td>Nairobi</td>
<td>Save the Children, NGO</td>
<td>Nutrition MandE Specialist and Procurement Officer</td>
</tr>
<tr>
<td>9</td>
<td>Nairobi</td>
<td>UNICEF, Aid agency</td>
<td>Supply and Procurement Manager</td>
</tr>
<tr>
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<td>UNICEF, Aid agency</td>
<td>Specialist, IYCN and HIV/AIDS</td>
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<td>Chief Nutrition Section</td>
</tr>
<tr>
<td>12</td>
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<td>UNICEF, Aid agency</td>
<td>Chief Emergency and Field Operations</td>
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<td>Nutrition Specialist, Emergency</td>
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<td>Nutrition Specialist, Emergency</td>
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<td>Nairobi</td>
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<td>Head of VAM and Nutrition</td>
</tr>
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<td>Nutrition Officer</td>
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<tr>
<td>19</td>
<td>Nairobi</td>
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<td>Nutrition Manager</td>
</tr>
<tr>
<td>20</td>
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<td>World Vision, NGO</td>
<td>Nutrition Program officer</td>
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<tr>
<td>21</td>
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<td>Action Against Hunger</td>
<td>Logistics specialist, Head of</td>
</tr>
<tr>
<td>No.</td>
<td>Organization/Role</td>
<td>Position/Title</td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>22</td>
<td>(ACF), NGO</td>
<td>Nutrition Program Coordinator, Deputy Nutrition Manager</td>
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</tr>
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<td>23</td>
<td>Mercy USA, NGO</td>
<td>Program Managers</td>
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<td>24</td>
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<td>Senior Emergency and Resilience Advisor</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>DFID, Donor</td>
<td>Research Analyst</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>World Bank, Donor</td>
<td>Lead Health Specialist</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>ECHO, Donor</td>
<td>Advisor</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>FAO, UN agency</td>
<td>Regional Food Security Advisor</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Kimetrica, Information management consultant</td>
<td>MandE and Survey Expert</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Deloitte, Supply chain consultant</td>
<td>Director, Senior Consultant</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Kuehne and Nagel, Logistics service provider</td>
<td>Sub-regional Manager and Emergency and Relief Logistics</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>MOH</td>
<td>Isiolo County Nutrition Officer</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Isiolo District Hospital</td>
<td>Interim County Health Director</td>
<td></td>
</tr>
<tr>
<td>34*</td>
<td>Kenya Red Cross, Red Cross chapter</td>
<td>Regional Nutritionist</td>
<td></td>
</tr>
<tr>
<td>35**</td>
<td>UNOPS, NGO</td>
<td>Substitute Nutrition Support Officer</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>WFP, Aid agency</td>
<td>Head of Office</td>
<td></td>
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<tr>
<td>37</td>
<td>ACF, NGO, Merti</td>
<td>Assistant Program Manager</td>
<td></td>
</tr>
<tr>
<td>38</td>
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<td>Nutrition Specialists</td>
<td></td>
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<tr>
<td>39</td>
<td>IMC, NGO</td>
<td>Health and Nutrition Programme Manager</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>MOH</td>
<td>Turkana County Nutrition Officer</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>MOH</td>
<td>Sub-county Nutrition Officer / Turkana West</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>MOH</td>
<td>Sub-county Medical Officer / Turkana Central sub-</td>
<td></td>
</tr>
</tbody>
</table>

*Isiolo

**Turkana
We have used theoretical (Eisenhardt, 1989) and purposeful sampling (Patton, 2005) in order to identify first set of interviewees. Then, in order to identify the interviewees, we used snowball sampling (Patton, 2002). In total, we have conducted 52 semi-structured interviews and 16 group interviews with caregivers of beneficiaries. For the purpose of the study, group interviews are not included in the analysis and are primarily used for data triangulation in order to confirm validity. The average time for interviews was 40 to 45 minutes for semi-structured interviews. We have used the semi-structured interview guide deducted from the literature review. We recorded all interviews and took field notes during the interviews.

### 3.2. Data analysis and trustworthiness

We started our analysis by transcribing the interviews. One of the authors and a professional transcriber transcribed the interviews. Then, the author read and corrected all interviews to avoid any misunderstandings, misspellings and inaudible parts as much as possible.

The coding of the data was done through Nvivo 10 and 11 software. For coding, the template was developed with the concepts under investigation and with the help of the interview guide. We used template analysis (King, 2012) and followed the steps (data reduction, data display and conclusion) proposed by Miles and Huberman (1994) by using the template based on the theoretical framework (Appendix 1) and interview guide.
In order to provide trustworthiness, triangulation was applied. Triangulation is defined as 'an approach to research that uses a combination of more than one research strategy in a single investigation' (Streubert and Carpenter, 2011, p. 349). It is commonly used in the case study approach (Eisenhardt, 1989; Voss et al., 2002). There are four types of triangulation: data triangulation, investigator triangulation, method triangulation and theoretical triangulation (Denzin, 1989; Streubert and Carpenter, 2011).
<table>
<thead>
<tr>
<th>Antecedents of SCI</th>
<th>Operationalization in HSCs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SCM</strong></td>
<td><strong>Goal congruence</strong></td>
</tr>
<tr>
<td></td>
<td>Objective of disaster relief or development operations and donor’s expectations, leadership, standardization, commitment</td>
</tr>
<tr>
<td><strong>Information sharing</strong></td>
<td>Meetings, monitoring and evaluation, clusters</td>
</tr>
<tr>
<td><strong>Decision synchronization</strong></td>
<td>Decision support system, meetings, clusters</td>
</tr>
<tr>
<td><strong>Incentive Alignment</strong></td>
<td>Incentive alignment between different players such as cost reduction, success, donors attention</td>
</tr>
<tr>
<td><strong>Resource sharing</strong></td>
<td>Shared warehouses, vehicles, equipment and other assets</td>
</tr>
<tr>
<td><strong>Collaborative communication</strong></td>
<td>Meetings, Trust</td>
</tr>
<tr>
<td><strong>Joint knowledge</strong></td>
<td>Joint decision making, procurement and planning</td>
</tr>
<tr>
<td><strong>Primary and supporting members</strong></td>
<td>Streamlining the objectives</td>
</tr>
</tbody>
</table>

In this study, mainly data triangulation was used, as we have utilised transcripts, field notes, direct observation, an extensive literature review and documents to enrich the big picture of the phenomena under investigation, although the main data source in this study is semi-structured interviews. Interviews were conducted by different researchers from the team in order to decrease biases and increase reliability and validity. Documents were collected from UN agencies, while NGOs and other related organisations were used to validate the data collected. Observation is another important component of data triangulation. Field study gave us the opportunity to observe the context of the environment. This includes experiencing the dry season in Kenya, observing the signs of malnutrition in health centres and listening to the accounts of caregivers of the malnourished. Additionally, one of the authors is a nutrition expert from the Kenyan nutrition supply chain, which gave us the opportunity to avoid factual mistakes.
4. Findings

4.1 Scalability in the Kenyan nutrition supply in times of a disaster

The main objective of the Kenyan nutrition supply chain is to strengthen nutrition access and increase the performance of high-impact nutrition intervention services to children under five years of age during an immediate response in the event of a disaster as well as at regular times through a permanent supply chain. There are members in the supply chains supporting the Government of Kenya and strengthening the nutrition system in Kenya.

Kenya experiences droughts regularly, and a high rates of acute malnutrition ongoing even when there is no drought or disaster. Therefore, there is a development programme that fights malnutrition in children under age five. The development programme, or, as we call it from the SCM perspective, development aid supply chain, provides basic public healthcare. It is highly integrated with a temporary disaster relief structure. Overall, we call it the nutrition supply chain. Therefore, in this sense, there is already a programme integrated into the nutrition supply chain.

During disasters, the supply chain has the ability to quickly scale up nutrition services to target more beneficiaries than usual by mobilising human resources and nutrition commodities where the intervention occurs. Scaling up quickly requires anticipation, which is done through weather forecasting and continuous monitoring of the nutrition situation at the beneficiary level through community health workers. Beneficiaries’ food access deteriorates during droughts due to the unavailability of food and malnutrition rates among children increase. In order to respond, the nutrition intervention is scaled up. As malnutrition rates return to normal, intervention is scaled down.

A devolution process took place during our data collection. This process delegated responsibility to county government to decide the time for activation. However, national government approval is still needed. The nutrition systems work under the leadership of the Government of Kenya, as represented by the Ministry of Health. The main partner of the government is UNICEF Kenya, which has the mandate of supporting the government in key areas such as the delivery of nutrition services at the national, county and community levels. It also has the mandate of ensuring that nutrition commodities are of high quality and available, and that technical expertise and health workers are on hand.

4.2 Goal congruence and information sharing in the Kenyan nutrition supply chain

Goal congruence is operationalised in the humanitarian setting through the objective of the operations, donors’ expectations and standardisation. In the nutrition supply chain, the main objective is to support government nutrition activities and strengthen nutrition services, since the government structure is weak. Therefore, UN agencies and supporting members of the supply chain integrate with the government structure to improve it in terms of service quality and continuation.

From the donors’ perspective, since they can be considered customers in HSCs (Oloruntoba and Gray, 2009), their expectation is to ameliorate the nutrition situation in Kenya by measuring the success of the operations in terms of the global acute malnutrition (GAM) rate and facility check-ins.

Information sharing is the backbone of every supply chain, as it provides the anticipation and preparation of what is coming. However, in HSCM, there is still
uncertainty about the demand level and what kind of commodity is needed for relief operations and the scale of a disaster. However, in the nutrition supply chain, commodities are known as they are already the basic commodities; however, the scale of a disaster can be unpredictable:

“...we have the DNTF, which is the District and Nutrition Technical Forum. But, it's now -- With the devolution, it's going to be the sub-county nutrition technical forum, which meets every month, and we are as partners -- It's a monthly meeting, that every nutrition stakeholder should come. The DNTF, or Sub-County Nutrition Technical Forum is for strictly nutrition partners in that sub-county. They meet and discuss their apprising issues, share information, and of course, it helps to reduce duplication of efforts. If another partner is coming and they want to do the same thing that you are doing, then we say, we already know what is here, they are doing this, so maybe you can intervene differently” [23]

In order to scale up the capacity and the operations, it is important to be aware of what is happening around the focal region where the supply chain runs its operations. Thus, information sharing enables a supply chain to scale-up when there is a nutrition-related emergency, and to scale-down when the nutrition situation improves.

4.3. Decision synchronisation and collaborative communication through coordination mechanism

In order to synchronise decisions among the members of the supply chain, coordination meetings are held in which all members are present. In Kenya, coordination meetings take place once a month at the national and county level. The meetings are called the Nutrition Technical Forum (NTF) at the national level and County Nutrition Technical Forum (CNTF) at the county level:

“We have the Nutrition Technical Forum that is held on a monthly basis whereby partners from the entire county meet to discuss issues on nutrition so that we have people identify any gaps, We have highlights, updates from different partners so that we know what is happening in whatever area”[38]

The frequency of the meetings can be increased as the situation nears an emergency in the country. These meetings also enable members of the supply chain to have collaborative communication.

“...during emergency when you are scaling up there is very regular and intense meeting so when you are scaling down, the meetings are also, they remain regular but like on a monthly basis as supposed to if you meet almost every day to review the situation when there is an emergency” [32]

4.4. Incentive alignment and resource sharing in a nutrition supply chain

In the business setting, incentives in supply chains encourage members to collaborate more, as they can share their risk and reward and maximise their profit. However, this must be interpreted differently in the humanitarian setting, since the main objective is to decrease vulnerability. Thus, instead, the incentives here will be such things as cost reduction through joint procurement, risk sharing by collaborating with all the partners in the nutrition supply chain, and advocacy for future funding for the continuation of services.
In the Kenyan nutrition supply chain, the main incentives are the success of operations when the GAM rate and admission rates to health facilities decrease; moreover, some organisations state that the continuation of operations is the success. The success, though, for humanitarian organisations can also be drawing donors’ attention to the need to continue funding their operations in the future or to scale up the intervention, since first responders typically need to apply for additional money from donors.

From the government perspective, however, the success is community sustainability and the government’s ability to perpetuate operations on their own.

Resource sharing is another aspect of SCI. This is observed in Kenyan nutrition supply chains, as some humanitarian organisations share human and physical resources such as warehouses and transportation. One example is that the Ministry of Health is using the Kenya Red Cross warehouse in Turkana County.

### 4.5. Joint knowledge

Joint knowledge is operationalised through coordination meetings in which much information sharing happens in the nutrition supply chain. As the members of the supply chain gather regularly, they make decisions jointly regarding nutrition intervention in Kenya. Joint planning also takes place through coordination meetings.

Moreover, the procurement is done jointly, as there is one organisation responsible for securing nutrition commodities. During our data collection, nutrition commodities were procured with a loan from the World Bank. Thus, on behalf of the Government of Kenya, UNICEF Kenya acted as a procurement agency. Procurement plans are made based on the information gathered through nutrition partners and early warning data from the National Drought Management Authority regarding quantities needed and the target destination of the commodities, which is called the Annual Supply and Distribution Plan. This is followed by UNICEF Kenya making the order centrally. The quantification of the demand is done annually, but can be updated anytime, since nutrition partners continually monitor the situation.

### 4.6. Streamlining development and disaster relief efforts through leadership and commitment

The streamlining of efforts and different objectives is one success of the Kenyan nutrition supply chain. As we stated earlier, in the dormant phase, there is continuous public healthcare that provides services to the beneficiaries. This supply chain has a permanent structure, as it is the development aid supply chain in the country. During the action stage or the immediate response stage, temporary structured disaster relief is activated when there is a surge in demand:

“during those operations the supply chain is one, and now what is happening is now, they are streamlining towards taking all the commodities through a central pipeline which is the KEMSA, Kenya Medical Supplies Agency, so there has been a lot of reorganization trying to streamline so that the pipeline is very clear. SO that all the, you know, commodities are channelled through the same pipeline and this helps to avoid duplication and also helps us in terms of planning.” [32]

Streamlined efforts for disaster relief and development objectives are important for demonstrating leadership skills. Leadership is another antecedent for integrating HSCs, as they have been criticised for lacking leadership (Waugh and Streib, 2006). Commitment among the members of the supply chain (Kabra and Ramesh, 2015) also
can contribute to the streamlining of the supply chain and can be seen as one of the initiators of supply chain integration in HSCM.

Table 4. Summary of findings

<table>
<thead>
<tr>
<th>Antecedents of SCI</th>
<th>Findings from Kenyan nutrition supply chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal congruence</td>
<td>The commitment of GoK, as well as the leadership of the GoK ensure the goal congruence in the supply chain</td>
</tr>
<tr>
<td>Information sharing</td>
<td>Information is shared through the coordination meetings which are held regularly and more frequently during emergencies.</td>
</tr>
<tr>
<td>Decision synchronization</td>
<td>Through information sharing at coordination meetings.</td>
</tr>
<tr>
<td>Incentive Alignment</td>
<td>Risk sharing through implementing the programme and success of nutrition services are incentives for members as well as funding opportunities from donors</td>
</tr>
<tr>
<td>Resource sharing</td>
<td>Sharing warehouses, information and human resource.</td>
</tr>
<tr>
<td>Collaborative communication</td>
<td>Through coordination meetings</td>
</tr>
<tr>
<td>Joint knowledge</td>
<td>Through coordination meetings and information exchange amongst member of the supply chain based on NDMA and other related forecasts</td>
</tr>
<tr>
<td>Primary and supporting members</td>
<td>NGOs, UN agencies and other members of the supply chain are working together both regular times and during emergencies.</td>
</tr>
</tbody>
</table>

Commitment is also vital for achieving goal congruence among the members of the supply chain. In the nutrition supply chain, some partners identify commitment as one of the important antecedents of scaling up and scaling down the operations. It is also considered one of the initiators of coordination.

“... even at the county we find it very easy working with the nutritional stakeholders because of the commitment, there's a lot of commitment at the county level, from the Minister of Health, from other players” [51]

5. Discussion

We presented the findings related to SCI implementation from the Kenyan nutrition supply chain in the previous section. As we conceptualised SCI as a relational capability, the SCM literature also supports that as such. Relational capabilities have also relational accounts which can only be achieved through relationship building; therefore, organisations create competitive advantages through relational capabilities.

Based on the findings from the data analysis, in this section we will illustrate how SCI, as a relational capability, contributes to supply chain scalability in a humanitarian setting. First, SCI in humanitarian settings has diverse relational rents, which creates advantages in enhancing HSC performance. Second, this contributes to scalability in HSC through contributing to speed and anticipation. Through SCI, the Kenyan nutrition supply chain has procurement advantage, division of roles, a standardised objective and organisations with first responders. Additionally, SCI enables HSCs to
scale-up quickly through information exchange and knowledge creation as well as complementing resources amongst the members of the supply chain.

We focused on SCI capabilities such as information sharing, joint knowledge and decision synchronisation through coordination mechanisms in Kenyan nutrition supply chains. Our findings show that information sharing is an important antecedent capability for all types of relationships in SCM. Hence, SCM and SCI help cope with surges in demand as well as enable supply chains to be scalable. A coordination mechanism to enable SCI is key, since scalability requires the capability of anticipation (Merminod et al., 2014) and quick resource mobilisation (Kovács and Tatham, 2009) to achieve efficiency of time and to overcome duplication and overlap during operations. Information sharing also contributes to visibility throughout the supply chain (Tomasini and van Wassenhove, 2009; Maghsoudi and Pazirandeh, 2016) and to alignment (Wong et al., 2012) and to integration (Tomasini and van Wassenhove, 2009). Information is shared through coordination meetings that also demonstrate the importance of the meetings. Overall, information sharing is an RC that leads to SCI along with other antecedent capabilities. SCI enables members of the supply chain to be aware of what is happening in their environment in order to sense the emergencies and address the needs so as to respond to these contingencies through working together in a humanitarian supply chain. Thus, we posit:

**P1: Scalability can be built on supply chain integration.**

Supply chain scalability requires anticipation and quick mobilisation capabilities in order to meet the swelling of beneficiary demand during disaster operations. SCI makes it easier for members of a supply chain to mobilise commodities quickly, as information sharing through coordination meetings and joint knowledge creation through demand forecasting enables members to act together and avoid duplicated efforts. Thus, we would also argue that, with assets such as information and physical and human resources, agility can increase as HSCs are already the most agile components of any supply chain (Oloruntoba and Gray, 2006).

Therefore, we posit:

**P2: Supply chain integration yields more agility in scalable supply chains.**

The literature on HSCs supports this proposition, as Oloruntoba and Gray (2006) state that SCI and the integration of internal capabilities improve the agility of HSCs. However, our data are not sufficient to validate this proposition. In order to deepen our understanding of the mechanism of those capabilities, we need to have more cross-sectorial case studies. From the perspective of RBV and DC, our findings show that there is a best practice outcome from scalability through SCI. This is supply chain resilience, since integration is one of the important capabilities of supply chain resilience (Christopher and Peck, 2004; Ponomarov and Holcomb, 2009; Scholten et al., 2014; Scholten and Schilder, 2015; Hohenstein et al., 2015; Brusset and Teller, 2016; Kamalahmadi and Parast, 2016). Therefore, we posit:

**P3: Scalability through supply chain integration contributes to supply chain resilience.**
SCI contributes to flexibility (Flynn et al., 2010), and flexibility is considered an antecedent of agility (Swafford et al., 2008). SCI is observed in the Kenyan nutrition supply chain data, as it also contributes to flexibility through resource sharing, information sharing and other coordination and collaboration aspects. Therefore, as a result of our analysis and discussion, we develop an SCI integration framework that shows the role of integration (Figure 3). The framework depicts propositions as well as possible future research areas between supply chain scalability and SCI. SCI contributes to both anticipation capability (Merminod et al., 2014) and the quick mobilisation of resources (Kovács and Tatham, 2009), which leads to the scalability of HSCs.

6. Conclusion

Supply chain integration is crucial for SCM, as it evidently contributes to performance outcomes (Cao and Zhang, 2011). In this study, we have investigated SCI from the scalability perspective. Scalability is a concept that aims to cope with surges in demand and, in order to be scalable, we have found the integration of the humanitarian supply chain is key to the ability to respond to rapid changes by scaling up and down. We have answered the call for the need for relationship studies in a humanitarian setting (McLachin and Larson, 2011; Moshtari, 2016).

6.1 Theoretical contribution

Information sharing enables an awareness of the demand fluctuations in a supply chain (Lee et al., 2000). Therefore, we see information sharing as another key to achieving scalability in supply chains. However, in development aid and disaster relief operations, information sharing by itself may not be enough, as there are limited funds available to sustain development aid and relief operations. Therefore, when we assess the Kenyan nutrition supply chain, integration of information, of the public service supply chain (or development aid), and of disaster relief supply chains is indispensable. Moreover, the integration of the whole supply chain needs to be scalable.

HSCs are flexible and agile as they rapidly respond to changes; hence, they are scalable. Day et al. (2012) call for the adoption of supply chain risk management approaches, such as supply chain resilience in humanitarian settings. As supply chain resilience
requires collaboration, supply chain reengineering, risk awareness/knowledge management and agility capabilities, SCI also has a positive impact on resilience in scalable supply chains. Thus, we have proposed P3.

The main theoretical contribution is to further develop a conceptualisation of SCI in a humanitarian context and thus an operationalisation of the scalability concept with regard to the role of SCI. This study contributes to SCI in HSCs as well as supply chain scalability and overall SCM literature. The findings and discussion of the study give another insight into SCI’s role in building scalability in HSCs. Supply chain scalability enables HSCs to scale up and scale down, which is key in a disaster relief operation.

Scalability and SCI are operationalised in a specific humanitarian context—the Kenyan nutrition supply chain—where development programmes and the disaster relief effort go hand in hand.

Scalability has been studied in flexible manufacturing systems; nevertheless, it is relatively new to SCM, especially HSCM. Moreover, the main theoretical lenses that have been employed in this study are RV and DCV, which explain resource bundles that eventually form capabilities to create a competitive advantage. In this sense, it may be argued that the best practice here is scalability and building resilience through scalability. Supply chain resilience is highlighted as one of the concepts that should be borrowed from the commercial counterpart of HSCM (Tatham, 2012; Day et al., 2012) and has been studied in supply chain risk management. We elaborated on theory, as suggested in case study research (Ketokivi and Choi, 2014), as the main purpose behind it is to illustrate the theoretical view rather than really test theory.

6.2. Managerial implications

Humanitarian SCM has been an important management field for many decades, as it handles situations in dynamic environments. Therefore, management skills are an important asset in order to mitigate and manage the risk of disruptions from disasters. In this study, we have looked at scalability and SCI and at how SCI plays a role in shaping the scalability of supply chains. For managers running organisations in dynamic, volatile environments, we believe our findings will be helpful.

The aspects of SCI, collaboration and coordination, are important factors in the enhancement of integration in the Kenyan nutrition supply chain. Also important are information sharing and resource sharing, whether physical or human, which are both key to building integrated supply chains. Specifically, to overcome sudden surges in demand, it is evident that information sharing is crucial (Lee et al., 2000), which our case also shows.

Thus, SCI enable HSCs to be scalable in times of disaster. Through SCI, there is a way for members of the supply chain to create a resource pool to complement each other's lack of ability. Moreover, information sharing allows members to get information upstream and downstream which enables a supply chain to sense the threats, in this case surges in demand. Additionally, joint knowledge creation allows the members of the supply chain to create common knowledge on market conditions so that a supply chain can seize the time to scale up the capacity in order to meet the surges in demand. Overall, SCI has the ability to help shape resources and capabilities in order to enable a supply chain to scale-up or scale-down.

For humanitarian organisations, scalability is a good practice in disaster risk reduction efforts, as it enhances the responsiveness of humanitarian organisations, where speed and anticipation are indispensable to the success of humanitarian operations. However,
scalability is also good supply chain strategy for commercial organisations, as turbulent environments are not rare anymore (Christopher and Holweg, 2011;Gattorna, 2009).

6.3 Limitations and recommendations for future studies

In order to further our understanding of SCI in HSCs and overcome limitations, some points remain to be developed in future studies. Longitudinal studies may help to observe the evolution of capabilities in order to understand the RCs and DCs further. Therefore, our first suggestion would be to test the propositions with longitudinal studies and/or across other contexts and countries.

Our second suggestion would be to extend the framework to encompass sustainability, in order to link scalability to sustainability. In the development aid stream of HSCM, the main objective, after all, is to help communities to sustain themselves.

Our third suggestion would be to include beneficiaries in the process of SCI, and to conduct research on how to do so. In so doing, a co-creation process can be initiated, as an example of joint knowledge creation for the sake of increasing the quality of the nutrition services. Incorporating a market orientation into SCM, for instance (Gligor et al., 2016; Jüttner et al., 2010; Min et al., 2007), can both enhance beneficiary integration and allow for real-time monitoring of the communities, thereby increasing the accuracy of demand forecast.

Overall, our findings and discussion show that better integration leads to better scalability and resilience in HSCs in a context where permanent development aid and temporary disaster relief are integrated in a single, more comprehensive supply chain.
References


### Appendix 1. Final Template

<table>
<thead>
<tr>
<th>High-order codes</th>
<th>Lower-order codes</th>
<th>Focus of the statements</th>
</tr>
</thead>
</table>
| Supply chain integration (Cao and Zhang, 2011; Cooper et al., 1997) | Goal congruence | Understanding whether the objectives are understood by all stakeholders  
- Nutrition programmes objectives |
|  | Information sharing | Information channels  
- Coordination meetings  
- Reporting  
- Monitoring and evaluation |
|  | Decision synchronization | Decision-making  
- Leadership of government  
- Coordination meeting |
|  | Incentive Alignment | Incentives  
- Risk and awards sharing  
- Advocacy |
|  | Resource sharing | Resources  
- Warehouse  
- Fleet  
- Human resources |
|  | Collaborative communication | Communication channels  
- Coordination meetings |
|  | Joint knowledge creation | Joint planning  
Joint procurement |
|  | Primary and supporting members | Integration of governmental and NGOs |


As disasters are affecting millions of people around the world, humanitarian supply chains are changing to identify needs and to respond to those affected. To achieve successful humanitarian operations, humanitarian supply chains need certain capabilities to anticipate the effects of a disaster, quickly mobilise the necessary resources and provide better services through these capabilities to the people in crisis. In other words, they must be resilient while scaling up quickly to meet unpredictable demands. Thus, the primary aim of this thesis is to explore the concept of scalability and understand how scalability contributes to various outcomes, such as resilience in HSCM, through three essays. The first essay is based on a systematic literature review to deepen the understanding of theoretical approaches and concepts borrowed from other research fields in humanitarian supply chain management. It is entitled ‘Borrowing Theories in Humanitarian Supply Chain Management’. The second essay is ‘Investigating Scalability for Building Supply Chain Resilience’, and the third essay is ‘Supply Chain Scalability: The Role of Supply Chain Integration’. Both the second and the third essays are based on a single case study in a humanitarian setting. A framework of scalability is developed through the dynamic capabilities view, as humanitarian organisations are operating in one of the most turbulent environments. Furthermore, this thesis contributes not only to humanitarian organisations but also organisations that face regular turbulence because the business environment is becoming increasingly turbulent.