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**Managing commercial actors in strategic networks in emergency preparedness:
A study of multiple networks from Sweden**

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Abstract

Purpose – This study analyses the management of commercial actors in strategic networks of emergency preparedness management (EPM) in developed countries and how these strategies connect to the emergency response efficiency. This study uses collaboration, strategy and efficiency to evaluate the private governance of the food, healthcare and transportation sectors and follows an analysis of these sectors' management that finds an ambivalent impact on the efficiency of the worldwide supply chain network (SCN) system. This study discusses many strategic networks and nets of commercial standards with different management structures and emphasizes illustrating the EPM context, thereby offering directions for future research.

Design/methodology/approach – An empirical research approach and triangulation methodology were adopted to design the selection, evaluation and contribution of the observed data and the humanitarian and business literature. An overview of strategic networks' role in EPM in Sweden comprises several network approaches and considers the strategic value of three SCNs for response efficiency.

Findings – The study finds that strategic networks are relevant for EPM and response efficiency and can be delimited and adapted to developing countries' demands. However, growing interest in networks' strategic value for EPM stresses public-private collaboration as a strategic choice to achieve response efficiency. To offer strategic planning that ties demand with supply, public-private actors must collaborate in SCNs.

Originality/value – The study contributes to the existing literature on strategic networks, e.g., industrial networks, by illustrating their strategic value for developed countries' SCNs. It also contributes to the business literature, e.g., on strategic net management. The work is original because it adopts a practical perspective involving buyers and suppliers in planning, the delimitation of their capability in nets, and the strategic value of SCN collaboration.

Keywords – Emergency preparedness management; Strategic networks and nets; Supply chain network; Public-private collaboration; Developed countries

Article classification - Research paper

1 Introduction

The concept of emergency preparedness management (EPM) has gradually emerged in developed countries to describe the actors, resources, and activities that ensure the safety and security of civil society against complex emergencies, changing threats and war (Alexander, 2002; Stadtler and Van Wassenhove, 2016). In EPM, actors¹ are interconnected, forming networks. From a strategic viewpoint, management solves the problems of complex supply chain networks (SCNs), and networks can affect the conduct of commercial actors to increase profitability and efficiency (Gulati *et al.*, 2000; Wilkinson and Young, 2002; Ford *et al.*, 2002). Here, strategic networks benefit EPM by re-engaging with buyers and suppliers in public-private collaboration. From an exploration of the underlying foundations of private-public collaboration, the basic dimensions of the SCNs in EPM are found to be strategy, collaboration, and efficiency (Barratt, 2004; Granovetter, 1985; Gulati, 1998; Möller *et al.*, 2005).

In fact, SCNs “in aggregate are the business”; therefore, the SCN “is a whole-of-business concept” (Gattorna, 2015, p.1). In the EPM context of this study, SCNs deliver value through actors in private-public collaboration (Min *et al.*, 2005). The efficiency value of EPM provided through actors in planning and response includes creating ties with commercial actors to serve the strategic networks and to overcome the related supply difficulties. Commercial actors offer strategic value in collaborations when public-private actors embrace long- and short-term relationships. Thus, at this point, it is not directly apparent how these collaborations can increase the overall efficiency of EPM, as the benefits for the partners are rarely realized due to differences in interests. Solving the problem of complex SCNs (including manufacturers, service companies, public-sector agencies or NGOs) is difficult, as SCNs are different and universal. These differences have led to managerial shortages that occur when complexity makes the true SCN invisible or when actors attack their inherent complexity, seeking only their own profit instead of the SCN’s overall profit or strategy.

Complexity in terms of SCN addresses the negative side of strategy by locking commercial actors into ineffective relationships or preventing them from private-public collaboration (Ellram and Edis, 1996). Failure to see the full extent of the SCN can be damaging; seeing it but confronting it with the wrong solutions can be fatal (Gattorna, 2015, p.5). Thus, an appealing network strategy to address complexity suggests delimiting or re-orienting the management of critical skills, planning capabilities, and resources in collaborative nets (Christopher, 2011). Nets (categorized as current, renewal, new, dormant, and active) are types of strategic networks that represent alternatives to management. Nets are defined as “strategic value systems to increase efficiency” (Möller, 2006, p. 32). In EPM, nets can represent a switch from a “dormant” state (i.e., preparation state) to an “active” state (i.e., response state). Dormant nets are significant because they “prepare for action” (Kovács and Tatham, 2009, p. 216), and active nets are used “to fulfil a temporary

¹ The terms ‘actors’ and ‘organizations’ are used interchangeably in this study to mean the part of civil society that tends towards self-governing, motivated by the competitive advantage to be obtained from private rules in the form of standards affecting a wide range of actors, such as consumers and suppliers across the globe (Fuchs, *et al.*, 2009). Commercial actors are the part of civil society built on self-governing settings, motivated by the competitive advantage from external sources, and managed for profitability (e.g., Barney, 1991; Porter, 1980).

mission” (Aldrich and Whetten, 1981, p. 9). Theoretically, net management aims at adapting (re-arranging) certain types of negotiations in the SCN until the buyer’s orders are received or better information is obtained (Yang *et al.*, 2004). Net management supports supply chains in addressing demand in terms of quality, profitability, and predictability (L’Hermitte *et al.*, 2016). Nets are suggested to be adaptable to meet demand uncertainty (Adger and Vincent, 2005). Moreover, since their introduction, nets have motivated “organizations to jointly agree on goals and roles to achieve benefits in commercial transactions” (Möller and Rajala, 2007, p. 895).

The collaboration of private-public actors, in connection with SCN efficiency, is, in fact, a “living system” driven by commercial actors in profit-seeking behaviour (Gattorna, 2015, p.7). Many researchers have applied private-public collaboration to discuss future SCN challenges (e.g., Christopher and Tatham, 2014; Dwyer *et al.*, 1987; Gulati, 1998). Challenges for developed countries include the government’s ability to prepare and respond efficiently to changing demands (Boin, *et al.*, 2005). Public-private collaboration is broadly defined in strategic blocks that shape SCN structures to secure critical infrastructures (CIs). However, the interesting question here is how CIs bring the SCN to life in response to the safety and security of civil society. For example, healthcare, food, and transportation are three vital CIs (among many) that must be protected to ensure the safety and security of Sweden (Boin *et al.*, 2005; Dwyer *et al.*, 1987; Perry and Lindell, 2003).

Here, EPM efficiency is argued to include reducing costs through networks of commercial actors, increasing the SCN profitability (Boin and Bynander, 2015). This efficiency focus seems inefficient to deal with the current complexity and changing demands (Mentzer *et al.*, 2001). Since the work of Håkansson (1987) on industrial networks, no direct change has happened. Reducing costs must be balanced with reaching the correct buyers and suppliers. Supply can be planned, postponed, or re-arranged in the long and short terms, but must be properly managed (Aldrich and Whetten, 1981; Kovács and Tatham, 2009; Möller *et al.*, 2005). This paper highlights a wider strategic network for EPM that can provide strategic value to the study of SCN (Cowan, 1990; David, 1985). The purpose of this study is to analyse the management of strategic networks in EPM in developed countries and to increase the understanding of how such strategies are connected to the emergency response efficiency.

RQ1: What type of strategic network is necessary to increase the efficiency of EPM in developed countries?

RQ2: How can EPM networks be delimited and managed in public-private collaborations to increase response efficiency?

This paper is organized into six sections. Section two contains a review of the literature addressing strategic network collaboration in developed countries. Developed countries have focussed on developing the management of strategic networks (or nets) in the emergency preparedness context. Section three provides a description of the methodology used. Section four provides a review of the empirical findings on the role of strategic networks and commercial actors in emergency preparedness planning in developed countries. Section five provides an analysis and conclusions. The sixth section presents concluding discussion and remarks. Key terms in this study are defined in Appendix 3.

2 Literature review

Broadening the discourse and the perspective on strategic networks allow for an increase in safety and security efficiency when applied to EPM in developed countries. In the strategic literature, strategic networks are closely connected to the provision of platforms for collaboration, and the selection of the right partners is vital to SCN efficiency. A SCN is any combination of networks that involve processes and functions, along which actors, resources, and activities are managed in commercial relationships (Gattorna, 2015). It also involves all movement of these elements, from planning to response operations (Van Wassenhove and Tomasini 2009). Commercial relationships are achieved through public-private collaboration. Collaboration requires partners to work closely within a delimited set of networks, called nets, which are arranged around the management of “intentionally created business networks” (Möller and Rajala, 2007, p. 895). In networks, public-private actors provide strategic value to SCN and support EPM efficiency (Nolte and Boenigk, 2011; Wolbers and Boersma, 2013). The example of Sweden is particularly appropriate for this study because it allows the comprehensive consideration of safety and security components such as EPM in a developed country, of public-private collaboration, of strategic networks and nets, and of efficiency.

2.1 Emergency preparedness management in developed countries

EPM is a crucial component of the safety and security of civil society in developed countries. Boin and McConnell (2007, p. 50) describe developed countries as modern societies that depend on the effective functioning of networks to provide public services and access to critical resources and to conserve economic growth. These networks are transnational, meaning that there is always an international and global dimension involved (Carl, 2014). However, the global dimension involves a growing dependence on safety and security between countries. Globalization is accompanied by an increased sense of vulnerability due to the new and changing threats to civil society, such as terrorism, complex emergencies, and the threat of war (Perrow, 2007). An urgent issue in several developed countries (such as Australia, Europe and the US) is how such modern societies can prepare themselves to effectively protect their CIs (Boin and McConnell, 2007; Perrow, 2007).

There is an increasing body of research on strategies to address the economic consequences for commercial actors that participate in strategic EPM networks (e.g., Harrigan, 1985; Kogut, 1988) in developed countries. The research on commercial actors—and the effects of their efforts on EPM—was among the first in the emergency preparedness field to pay systematic attention to the decision-making processes that shape the destiny of commercial actors in SCNs (Christopher, 2011; Sanders and Premus, 2005). The research on strategic blocks (Nohria and Garcia Pont, 1991), strategic SCNs in emergency preparedness (Van Wassenhove and Tomasini, 2009), and private-public collaboration (Cornall, 2005) has examined interorganizational relationships from a variety of theoretical perspectives, levels of analysis and outcomes. This significant and growing research in the management field shows the importance of inter-commercial actors’ relationships within the general discussion of EPM efficiency and highlights the need for research to focus on this area.

Given the role of commercial actors in EPM, collaboration is another critical element of SCN. This concept has been widely studied across many disciplines for diverse purposes; however, the collaboration associated with EPM and SCN requires further explanation (Barratt, 2004). In

collaboration, commercial actors are in competition that often concentrates on their playing similar roles in the SCN (Garcia-Pont and Nohria, 1999). While commercial actors' competition can suggest efficiency for the SCN, it may also have a negative side and may lock commercial actors into ineffective relationships or prevent them from significant collaboration with public actors (Steigenberger, 2016). The negative side of collaboration due to unhealthy competition can be mitigated if commercial actors are tied to other actors in delimited networks, called nets (Möller and Rajala, 2007, p. 898). An essential motivation behind delimited networks is that they can increase public-private collaboration efficiency, as an actor alone cannot sufficiently meet changing demands and/or respond alone when market competition increases (Kotler, 1997).

2.2 Public-private collaboration as the answer to emergency response

Public-private collaboration is significant for developing and maintaining supply chain solutions along the entire course of an emergency response. It classically “involve[s] complex interactions among people, materials and money” (Altay and Green, 2006, p. 477). Despite the importance of this topic, to date, the research on public-private collaboration has been fragmented (Steigenberger, 2016). However, this definition of public-private collaboration is challenged by Cornall (2005), who proposes collaboration as an EPM capability that embraces lead times, demand predictability, and stable access to resources. In EPM, this capability could be the answer to an all-hazard approach, i.e., to address terror attacks, hurricanes, earthquakes, infrastructure breakdowns, or war (Cornall, 2005, p. 28).

According to Steigenberger (2016), public-private collaboration is a general approach used to reduce budgets and increase efficiency, but most importantly, to reduce the number of public agencies, actors and other organizations that are often involved in response operations. Potential economies of scale also constitute grounds for collaboration across all levels of public authorities, as they offer the basis for creating efficiency, adaptability, and profitability. Moreover, in the SCN, public-private collaboration helps to improve actors' negotiating power, i.e., including a number of available suppliers and their performance ability to achieve the EPM goal in an all-hazard approach (to meet all types of emergencies, threats and war). The all-hazard approach in EPM helps to reinforce and ensure consistent emergency planning and efficient response coordination. This approach has been used by and is of increasing interest to different developed countries, such as Canada, Sweden, Finland, Poland, the US, and Australia.

Public-private collaboration has been widely viewed as a business strategy wherein collaborative partners work together towards common goals with mutual benefits (Min and Mentzer, 2004). Collaborative developments include joint decision making (Stank *et al.*, 2001), joint problem solving (Spekman *et al.*, 1997) and the extension of information sharing among SCN partners (Sabath and Fontanella, 2002). As such, a collaborative SCN involves “two or more public-private actors [that] work jointly to plan and execute operations with greater success than when acting in isolation” (Simatupang and Sridharan, 2002, p. 19).

Further, public-private collaboration is considered to be a strategic network in EPM that adds value to the SCN when CIs in developed countries break down. This situation is critical because the grade of complexity can escalate relatively small disturbances into complex emergencies (Christensen, 2016). When the operational complexity of emergency responses increases (e.g., at several levels in parallel), the collaboration between public-private actors becomes complex across

the SCN, and it is difficult to manage (Barratt, 2004). In that sense, public-private collaboration may be viewed as a mediator to shift a risk forward in the network from manufacturer to suppliers and, in turn, to the customer. The network as a whole cannot provide solutions to avoid the risk associated with complex commercial patterns, such as competition, availability and profitability in connection with EPM. Thus, delimiting the network in adapted settings to new or changed requirements (nets) can be determined based on actors' dependency on one another and/or on actors' geographical boundaries and/or functional dependency (Boin and Lagadec, 2000; Carl, 2014; Quarantelli, 2000; Rosenthal *et al.*, 2001).

Actors' dependency can be channelled through strategic networks, which are known as carriers of efficiency. EPM efficiency will therefore depend on the strategy to be applied, and this decision is made based on the degree of risk to which a country is exposed, by the information upon which the country is willing to act, and on the country's ability to identify and select adequate national and international partners (Comfort, 2007). Long-term efficiency is usually measured based on the result of direct public-private collaboration, communication and the management of strategic networks (Boin *et al.*, 2005; Nolte and Boenigk, 2011).

2.3 Strategic networks and nets to unpredictable demands

The current debates in the network field have highlighted the importance of commercial actors' strategic role in SCNs, as they add value to EPM (Stadtler and Van Wassenhove, 2016). One of the features that distinguish modern SCNs is that they are uncertain and, thus, unpredictable (Christopher, 2011). The network approach is a suitable framework for acquiring and mobilizing massive quantities of resources, products and services provided by commercial actors (Pfeffer and Salancik, 2003). Once commercial actors take a role in the network, they are bound not only by dependency on one another but also by market competition and profitability. Due to competition and profitability goals, commercial actors are organized in different ways through structures that aim at reducing costs and lead times (Laursen and Andersen, 2016). The transaction cost perspective therefore becomes an incentive, as it stresses commercial efficiency by reducing the governance cost of a transaction. This commercial efficiency allows for strategic benefits by optimizing not only a single commercial actor relationship in a network but also the entire network of relationships (Dyer and Singh, 1998).

Considering the entire network of relationships involves commercial actors in the SCN of EPM, and their presence reflects a shift from specialized to arranged networks with diverse structures, modularity, and collaboration (Omta *et al.*, 2001). Network structures must be supported by strong strategies (e.g., adapted procurement models) in which the SCN can efficiently operate (Whipple and Russell, 2007). The underlying logic for adopting a strategy in relation to a network is to be able to apply a combination of agreements and policies (commercial, defence, and public) because strategic networks permit a delimitation that allows access to critical resources based on different types of agreements (Balcik *et al.*, 2010). When procuring critical resources, constructing the network constitutes a major strategic decision in EPM. However, in commercial agreements, it may be unclear whether the SCN design is based on actual demand or if it is simply a strategy to show EPM efficiency (Tomasini and Van Wassenhove, 2009). Following Lundgren and Snehota (1998), networks allow relationships between diverse types of actors. Networks become highly strategic to obtain value added (Håkansson, 1987). However, an interesting issue is that it is not always possible to manage relations based only on agreements in a network frame because it may

challenge actors' long-term trusted and flexible benefits in the SCN (Stadtler and Van Wassenhove, 2016, p. 658). Thus, the management of actors' and/or organizations' relationships is better obtained only if a prominent level of long-term trust and transparency is achieved, i.e., when trust allows nets to become flexible, adaptable and manageable.

About nets

Inspired by Möller and Rajala (2007), network management can be applied to a minor or a major share of the operations in the SCN. As mentioned above, intentionally delimited networks are called “nets” (Möller and Rajala, 2007, p. 898). Nets are defined as value systems, i.e., by increasing the efficiency of the commercial activities in the network. Commercial activities are performed by the actors involved in the net and can be managed. There are several types of nets, i.e., current, renewal, and new nets. Möller and Rajala (2007) argue that what is important regarding the various types of nets is that they can be managed based on their strategic intent (value creation), their different levels (buyers-suppliers), their forms of collaboration (public-private), and their strategic consequences for the SCN (Min *et al.*, 2005). In the view of Möller and Rajala (2007), the management of nets is a vital component of SCN efficiency. In predicted environments, nets are less important in supporting actors'/organizations' gains from collaboration. However, in uncertain environments, nets must be delimited (or adapted) to fit requirements in a larger network and to suit changes attributable to market uncertainty. A significant factor when delimiting nets is that they are created for a specific purpose. The strength of nets lies in their ability to cope with the uncertainties that are mostly inherent to the market changes to which actors/organizations adapt in their commercial strategies. Tatham and Kovács (2010) argue that for nets to work in uncertain environments, the involved actors/organizations must build trust when the relational environments are more predictable. That is, actors/organizations are required to learn from one another's capabilities and the forms in which they can collaborate. Conversely, when collaboration is difficult, trust can be a useful strategy in management. The management of nets and requirements are modelled as shown in **Table 1**.

Table 1. Business net attributes and management mechanisms

<i>Management</i>	<i>Current nets</i>	<i>Renewal nets</i>	<i>New nets</i>
<i>Strategic Intent</i>	Relatively stable over time Multi-level structures Relationship orientation High transparency Trusted	Temporary in nature Specialized knowledge Embedded in persons, communities of practice, and routines – tacit, partly explicit	New with radical change Changes existing value systems Uncertain because emerging Interrelated Dispersed, vaguely held ideas
<i>Forms of Collaboration</i>	Value of efficiency Achieves integration Joint planning Public-private Complementary resources	Renews existing business Leverages resources and skills Public-private Develops specified solutions Profitable	Influences emerging fields Creates new solutions Public-private Joint performance Time and timing
<i>Strategic Consequences Efficiency</i>	Strong interdependence High level of specialization Control over efficiency Coordination of resources Coordination hierarchy High control by focal firms Effectiveness Predictability	Coordinates resources Pooled and reciprocal Interdependent Bridges boundaries of firms Coordinated collaboration Trusting culture Joint technical development Shared benefits Appropriate lead times Efficiency	Largely reciprocal Interdependent Self-coordinating Informal leadership Weak ties (trust, norms) Cannot be managed Actors linked to multiple nets Concerned with profitability, efficiency and adaptability

Adapted from Möller and Rajala (2007) and Min et al. (2005)

2.4 Efficiency – a consequence of collaboration

The link between collaboration and efficiency has been addressed in the literature on strategic collaboration (e.g., Dwyer *et al.*, 1987; Gulati, 1998). Collaboration is an SCN strategy that provides efficiency. A consequence of collaboration is the generation of efficient frames of networks “to respond quickly to changing customer needs” (Zhang, 2005, p. 71). Collaboration in an SCN is understood as the strategic behaviour of the included actors/organizations in terms of their ability to identify and choose appropriate partners. This strategic behaviour in networks is often the result of direct long-term relationships. As such, public-private collaboration can help to shape the knowledge, communication and processes that contribute to SCN efficiency (Boin *et al.*, 2005; Nolte and Boenigk, 2011). SCN efficiency becomes obvious when addressing environmental or market uncertainties. Stank *et al.*'s study (2001) involves three main types of flows in SCN that must be managed when addressing uncertainty, i.e., material flows, information flows, and cash flows. Information flows are supported by collaboration, which in turn enables knowledge transfer (Boin and McConnell, 2007; Möller *et al.*, 2005). By allowing the objectives of public-private collaboration in the SCN, the management of information flows through nets can benefit knowledge transfer efficiency (Min *et al.*, 2005).

The ability to manage the “competitive strategy”, according to Porter (1970), is obviously critical to success. However, material and cash flows should not eliminate the consideration of uncertain environments. We know that much is involved when competitors and the external environment can limit the SCN's capability. La Rocca *et al.* (2016) argue that managing SCN uncertainty is similar to the field of risk management in terms of the probability of undesirable incidents occurring. Both require suitable management. Another concern in the strategy literature is whether to make or buy supplies and services (Gulati and Lawrence, 1999). This perspective has been extended to examine how networks can be limited and adapted in nets as a substitute for procurement solutions, mobilization, or ways to cope with access to adequate resources, which also implies significant strategic alternatives in EPM (Kaneberg *et al.*, 2016). For instance, Kaneberg *et al.* (2016) contend that in emergency operations, the material and cash flows are vital elements of response operations. However, for these flows to be operational in response operations, they must be integrated as essential elements of emergency planning. One question for EPM is therefore how to delimit the actors and/or organizations in nets to support strategic intent response operations and increase SCN efficiency.

When efficiency is required for the mobilization of and access to vital resources (products and services) in EPM, a strategic view involves the SCN's ability to react to the unpredictability caused by complex emergencies, changing threats to civil society or war (Tomasini and Van Wassenhove, 2009). Because a strategic goal of the commercial actors involved in EPM is to eliminate redundancies in response operations, their profit and cost requirements can be motivated through time, timing and efficiency, i.e., commercial actors will supply what is required when it is required and expect to be regulated by timely agreements (de la Torre *et al.*, 2012; Tomasini and Van Wassenhove, 2009; Van Wassenhove, 2006). Time and timing have long been concerns of SCM scholars, especially in relation to preparedness and response. Cornerstone concepts such as “dormant” (Kovács and Tatham, 2009, p. 216-218) and “active” (Aldrich and Whetten, 1981, p. 9) nets address time and timing and capture critical aspects of the speed, mobilization, and availability of supplies. Organizations in dormant structures are concerned with a longer-term set of crucial capabilities; in active structures, organizations are brought together to rapidly respond

to emergencies. These subgroups are organized around the functions of planning and coordinating direct services and resource transactions. Because no single organization can deliver all emergency capabilities on its own, relationships (or lack thereof) with different organizations support (or constrain) the repetitive use of other relationships.

2.5 Summary of the literature review

In summary, the existing research on EPM suggests the adoption of a network frame as a strategic alternative when investigating response efficiency (Kaneberg *et al.*, 2016). Broadened perspectives on strategy that allow actors/organizations to take profitable roles in the EPM of developed countries have not been sufficiently studied in earlier research. Few studies of EPM recognize emergency planning as the carrier of essential elements obtained through collaboration. As such, public-private collaboration is associated with SCN efficiency when adapted supply solutions, rapid mobilization, joint resources and services are negotiated and delivered along the entire course of emergency response operations. When collaboration is linked to a network frame in EPM settings, different forms of collaboration add strategic value and are essential components of the SCN. Additionally, networks offer strategic access to resources when they are delimited to be managed and adapted as current, renewal, new, dormant, and active nets. Adapted nets are therefore fundamental to EPM efficiency. Researchers place considerable emphasis on the commercial actors that play a role in such nets. Despite a wealth of relevant research on commercial networks, there is little evidence on nets as a strategic component of SCN, either in EPM or in response efficiency in developed countries. Filling this gap is critical, given the current emphasis on complex emergencies and changing threats (and the threat of war) to civil society in developed countries. This emphasis has led to increased attention on EPM with regard to its ability to support the safety and security of civil society. The development of EPM is crucial from a theoretical and practical perspective. Further analysis is required on the theoretical and practical perspectives of this often-uneasy relationship when they relate to commercial actors addressing SCN shortages.

3 Methodology

A strategic network in the EPM context offers a perspective that allows emphasis on SCNs as a different type network that, when delimited, can offer efficiency. This view can be approached using an empirical research study method (Eisenhardt, 1989; Yin 2009), as is becoming increasingly accepted in the research. A research study method enables studies to make sense of empirical data insights on complex and relatively unexplored fields. According to Saunders *et al.* (2009), the empirical sense-making of data in terms of selection, evaluation, and contribution addresses practical complications (e.g., the problem of complex SCNs in EPM). Saunders *et al.* (2009) also note that this sense-making is best achieved by using multi-disciplinary (e.g., business, humanitarian, and military) and cross-functional approaches (e.g., the safety and security of countries) (de la Torre *et al.*, 2012; Tomasini and Van Wassenhove, 2009; Van Wassenhove, 2006). More specifically, Ellram and Edis (1996) and Yin (2009) discuss how empirical research could “take a brother role” using diverse sources of information, and they therefore call for the application of qualitative research (e.g., the study of SCN efficiency uncovering new perspectives and complications when it is used in the EPM context in developed countries). Therefore, a qualitative empirical research study (Näslund, 2002) is thought to be relevant to fulfil the purposes of this research paper.

Here, an “empirical research study” and the “triangulation method” were used (Silverman, 2011) to select key actors/organizations that are active in SCN roles in the EPM of Sweden. In this regard, quality, validity, reliability, transferability, dependability, and confirmability have been widely regarded as useful empirical research criteria (Guba and Lincoln, 1994; Halldórsson and Aastrup, 2003; Seuring, 2008). The triangulation method employed here comprises “a combination of analytical tools, i.e., multiple sources of data are collected and the interrelation among these sources are analysed” (Denzin and Lincoln, 2011 pp.198-199). In addition, based on earlier acquaintance with decision-makers in some of the organizations, as well as geographical reach and proximity, Swedish EPM offered a good basis for the selection of key actors/organizations. In this framework, the actors/organizations chosen for this research study were selected mainly because of their role in a network, their actor/organization type, their influence in the SCN, their responsibility for CI, their role in public-private collaboration and their strategic intent. The actors/organizations that were selected are specifically public and private actors that hold diverse roles at all levels of Swedish EPM, i.e., planning, management, civil defence, SCN, and response operations. All the public-private actors are Europe-based and widely active in Sweden and Scandinavia. Concerning their types of resources, services, and product ranges in the SCN, some of these actors could be classified as critical, possibly in terms of a commercial category in EPM (e.g., COOP, OneMed, and Air Liquid Gas AB).

Table 2. Overview of actors/organizations involved in the collected data

<i>Group type</i>	<i>Actor/organizations represented</i>	<i>This study</i>	<i>Number</i>	<i>Role</i>
<i>Public buyers</i> (8 interviews)	1. National Board of Health and Welfare 2. Swedish Contingencies Agency 3. Swedish Armed Forces 4. Swedish Association Local Authorities 5. Swedish Defence Materiel Administration 6. Swedish Institute for Food Agriculture 7. National Food Agency	NBHW MSB SAF SKL FMV SIFA NFA	2 interviews 1 interview 1 interview 1 interview 1 interview 1 interview 1 interview	Hold different preparedness responsibilities at different levels in the Swedish system; e.g., planning, collaboration
<i>Private suppliers</i> (7 interviews)	1. OneMed 2. COOP Stockholm, 3. COOP Supply Chain and Logistics 4. Strukton 5. Air Liquide Gas AB 6. Ericsson, Telecommunication 7. Tele 2 SE	OM COOP COOPSC ST ALG ETC TDC	1 interview 1 interview 1 interview 1 interview 1 interview 1 interview 1 interview	Business structures delivering emergency supplies to the system, e.g., food, healthcare, transportation, special skills
<i>Public suppliers</i> (7 interviews)	1. Swedish Army 2. Förråd, Service och Verkstäder 3. 3. FörsvarsM Logistik 4. Customs Department 5. Transport Department 6. Danderyds Hospital 7. Procurement at the FMV	SA FSV FMLOG SCD TD DSH FMVP	1 interview 1 interview 1 interview 1 interview 1 interview 1 interview 1 interview	Public actors with specialized responsibility to deliver services and products to CI, e.g., communication, logistics, energy, water supplies

To safeguard “concept validity” (Yin, 2009), the first triangulated source of data comprises a total of 22 interviews that were conducted over the period from September 14 to November 11, 2016, with each lasting approximately 40 to 70 minutes. An overview of the actors/organizations

involved in the data collected is provided in **Table 2**, in which two key actors are the Swedish Armed Forces and the Swedish Contingencies Agency; these actors are responsible for EPM, civil defence and military planning and public-private collaboration in the SCN. For this study, the respondents were classified as follows: *public buyers (PB)* in permanent forms carry out different EPM responsibilities at the national, regional, local, and international levels (e.g., planning communication, logistics, information, and collaboration); *private suppliers (PS)* are active commercial actors in EPM that, through the SCN, provide access to resources, services, skills, and products; and *public suppliers (POS)* are public actors with specialized roles in structures in CIs (e.g., food, healthcare, transportation, communication, energy, water, and medical products) to ensure the safety and security of the country.

To fulfil reliability, “demonstrating that data collection can be repeated with same results” (Yin, 2009), the questions used in the interviews were grounded in the literature. All respondents are large in terms of size (number of employees and annual turnover), according to the description of The European Commission (2005). Multiple cases of public-private collaboration (e.g., healthcare, food, and transportation) were selected to represent network strategies that allow for the development of a rich empirical framework (Saunders *et al.*, 2009). Yin (2009) also contends that with the use of multiple data sources, the findings are likely to be more robust than with data from a sole source. The data were collected through a combination of “semi-structured” and “qualitative” interviews with experts and decision-makers in different fields. Here, “semi-structured interviews refer to a context in which the interviewer has a series of questions that are in the general form of an “*interview guide*” but can vary (Yin, 2009, p.90). An interview in a “qualitative context embraces both semi-structured and structured kind” (Mason, 2006, p.201). This approach makes it possible to standardize interviews so that differences between interviews are minimal. By means of an *interview guide*, a set of questions grounded in the existing literature was sent to the interviewees in advance. In addition, the questions were grouped and categorized into different areas, as shown in **Appendix 1**, to allow for transcription in blocks, i.e., actors, relationships, and the activities of the strategic networks of EPM.

Dependability is a key measure to access validity (Guba and Lincoln 1994). Here, a second source of data comprises a “key informant approach” (Bryman, 2016), which was used to both gain an understanding of the EPM field and to select suitable respondents. An informant approach was used when participating in conferences, workshops, and visits to obtain an understanding of strategic network practices from a variety of perspectives. In terms of “snowballing”, the key informant approach provided expert contacts, and, in turn, these contacts were asked to recommend respondents for further interviews. **Table 3** shows an example of the secondary data collection on EPM strategic networks.

Table 3. Overview of conferences-workshop visits in secondary data

<i>Date</i>	<i>Area</i>	<i>Place</i>	<i>Type</i>
2016-03-07-13	Public-private collaboration and preparedness (Swedish Defence College)	Finland	Session
2016-05-16	Emergency preparedness and logistics planning (TD)	Sweden	Visit
2016-11-03-04	From international responses to local preparedness (Perl)	Norway	Conference
2016-04-20-24	Roles and responsibilities in EPM and in the Civil defence planning (FM)	Sweden	Conference/field visit
2016-05-03	Collaboration and dialogue on civil defence planning for war (MSB-FM)	Sweden	Workshop
2016-09-22	Food security (NFA)	Sweden	Visit
2016-05-11	CBRNE in society - future threats and risks (MSB)	Sweden	Discussion seminar

Confirmability “through broad coverage, long span of time, many events and many settings” (Yin, 2009) can be ensured by using an additional third source of triangulated data. Here, information was found in archival materials, organizational reports, articles, letters of regulation, and policy documents, as shown in the examples listed in **Appendix 2**. These sources were evaluated to enable the adjustment of practical knowledge (Schwandt, 1996) on EPM in Sweden. However, using triangulation as a confirmatory strategy alone may involuntarily hinder the development of the field (e.g., documentation is outdated or used for other purposes). Thus, an important assumption underlying the confirmability approach to triangulation is that “validating is what is most important in research” (Hammersley, 2008, p.24). For example, Tables 2 and 3 and Appendixes 1 and 2 provide a combination of multiple sources of information that are triangulated to increase the validity of this research study on the SCN of EPM in Sweden.

Transferability is another measure of validity that “enables critical understanding and ensures applicability to other contexts” (Carson *et al.*, 2001, p.29). With a purposeful presentation of the SCN cases (i.e., food, healthcare and transportation), the results and the findings, this research study is based on the case of Sweden, and it can be transferable to the EPM of other developed countries when operating on a commercial basis similar to that of participating Swedish public-private actors (e.g., Canada, Finland, Poland, the US, and Australia). Additionally, capturing detailed descriptions of the interrelationships in the case enables a critical understanding and ensures better transferability.

Further, while validation and credibility were ensured by multiple data sources, as suggested by Seuring (2008), the author of this study needed to describe the network to explicitly state that a SCN is another type of network that embraces public-private collaboration when it is used to increase EPM efficiency. In a simple search, the major electronic databases of ABI, EBSCO, Elsevier, Emerald, Wiley, Springer and Google Scholar were selected for their breadth and interdisciplinarity, and they were methodically searched for investigations using “network”, “strategic” and “network management” as key words (Aissa Fantazy *et al.*, 2009). Three prominent journals (among several) (i.e., *The Journal of Humanitarian Logistics and Supply Chain Management*; *Journal of Contingencies and Crises Management* and *Strategic Management Journal*) were searched for “SCN” and “emergency preparedness” to ensure that relevant articles on the SCN in EPM were identified (Stevenson and Spring, 2007). The focus for this article is strategic networks in the context of EPM, motivated by the need for an empirical application to address the problems of complex SCN in emergencies, and changing threats that involve uncertainty and, hence, unpredictability (Christopher and Tatham, 2014).

4 Empirical findings

In Swedish EPM, the Swedish contingencies agency (MSB) coordinates the planning of actors, resources, and activities at the national level. This planning targets access to essential resources and therefore requires a strategic focus. As such, public-private collaboration is used as a strategic approach and is critical to solving the problem of SCN efficiency at the regional and local levels. Contemporary SCNs provide Swedish civil society with CIs, e.g., roads, water, IT, power, food, healthcare, and transportation. Based on personal and written information, the focus on healthcare, food, and transportation sectors is highly relevant, as those sectors (among several) are considered critical to Swedish safety and security (MSB, 2013). While this study’s focus is on complex emergencies and changing threats, the analysis of CI is accurate due to the current constraints on

EPM efficiency and adequate responses. As such, the terms ‘current’, ‘renewal’, ‘new’, ‘dormant’ and ‘active nets’ have been used to address strategic relationships. The term ‘relationship’ has been used to discuss the SCN of buyers-suppliers in Swedish EPM and to better understand commercial networks and the considerable interdependence in the international and national networks that serve EPM.

4.1 Swedish emergency preparedness management

Swedish planning for the access to and safeguarding of critical resources before, after and during response operations is a strategic function of civil society. This planning requires a strong interdependence between actors, their resources, and the activities that must be managed to secure the availability of supplies in a timely manner (MSB, 2013). In Sweden, the public-private sectors are actors in EPM, are involved at the local, regional, and national levels, and are responsible for planning and collaboration to achieve efficiency. According to the respondents, public-private collaboration in Swedish emergency planning is difficult to achieve, as public-private actors often and in parallel join disconnected planning structures, i.e., civil defence planning, military planning and/or commercial policies. Disconnected planning structures challenge the management of response efficiency in Sweden. *“To bridge the gap between planning and response efficiency, the Swedish system requires a different type of strategy that builds on a holistic cross-sectoral and all-hazard approach”* (PB.1). By applying public-private collaboration, multiple actors can access resources and critical supplies to increase EPM efficiency. However, public-private actors in Sweden frequently collaborate based on complex policy processes that complicate their profitable relationships. *“We try to keep public processes as efficient as we possibly can, but there are financial pressures in terms of improving public efficiency, as well as the efficiency of the whole investment when expensive services and materials are required, e.g., medical treatment and technology advances, IT systems”* (PB.1).

4.2 Strategic networks and/or nets in supply chains in Sweden

Healthcare, food, and transportation are three vital types of CI (among many) that must be protected for safety and security in Sweden. In contrast, the structure in the non-public supply chain is geared towards collaborative benefits. Suggestions of non-public collaborative antecedents (strategy and value creation) are provided at regular intervals in meetings held centrally for the European collaboration (e.g., the European Competition Network and the European Defence Agency). In EPM, all public actors involved registered their interest in preserving their respective collaboration, despite private rules in standards that have far-reaching consequences for buyers and suppliers worldwide. As claimed by the respondents to this study, the implication of private governance organisations on the availability of the global system is that they are ambivalent, given that we define availability as including the requirements of food, healthcare, transportation safety, and suppliers’ incomes. These implications may tend to be positive in some respects, such as food safety in developed countries, but very negative in others. To achieve such requirements for planning, actors need to collaborate with different private actors and allow profit benefits. This public-private collaboration serves as the foundation for central procurement organizations (e.g., Swedish Defence Materiel Administration (FMV) and Swedish Defence Logistics Plants (FSV)) to negotiate with suppliers.

Strategic networks' typical lead-time from contract to delivery is approximately three years. The design of the supply chain is usually not tailored to individual national markets, and most business steps, including buyers (often public) and suppliers (often public and private), are strategic and employed upon request. Offering the adaptation of contracts could be construed as a form of collaboration (in nets) between sources (makers, distributors, and suppliers); however, all aspects of contract adaptation are generally decentralized and difficult to manage. In the absence of adapted agreement procedures, costs can rapidly escalate (MSB, 2013).

The healthcare sector networks

Fig. 1. The healthcare supply chain networks in Sweden (an example)

Figure 1 illustrates SCN complexity when producers and manufacturers, often spread across many countries, are small, marginalised producers and retailers that subsequently create economic inequality due to expansion in private ideals. Complexity can arise in emergency modes if marginalised producers and retailers do not find the motivation to deliver greater effort when extraordinary supply demands appear. This case is also applicable to Sweden, as the purchasing power of private healthcare actors, the current SCN, makes private standards obligatory for any actor who seeks to participate in the (worldwide) market. The goal of healthcare is to guarantee good health and care to the entire population equally (Social Board, 2016). The degree of network collaboration applicable to Swedish healthcare is limited. The requirements are the same at all levels of the country, and many medical products and services are available on the national market. Except for different types of networks between key organizations, there is no difference in the contract conditions to allow adaptation to sources, manufacturers, distributors, or suppliers of different operational abilities. For Sweden, the SCN conditions are not managed based on international directives but are strategic, and they are adapted to fulfil the national requirements for medical services and products and the planning requirements.

The Swedish healthcare sector consists of 21 regional councils and regions with the overall mandate to offer good health and dental care to civil society. The objectives and rules of its overall responsibilities in this sector are embodied in regulations and controls of providing medical and dental services. The production systems in healthcare differ from those in other industries in several ways (FMV, 2016). The goal of healthcare is to provide care in a safe environment, which is rather different from industry goals to sell products competitively. The management structure is different, and PBs' influence in healthcare is less than it is in industry: *"the supply chain network of healthcare is characterized by a demand that generally is greater than the supply; the limited ability to supply is restricted by state bodies and higher patient expectations of service and quality"* (PS.1).

The interviewees argue that uncertainties concerning the health and social services provided by municipalities are part of the SCN environment. As such, *"one supply chain network is always dependent on other vital areas such as, for example, public transport, water, roads, power, fuel, IT, and technical communication infrastructure in counties and municipalities"* (POS.6 and PS.4). Some of these dependencies are unreliable and affect or limit network coverage: *"one main problem is related to the lack of structures, processes and abilities in which the healthcare and social services are included in exercises, risk and vulnerability evaluations and in the governmental project framework of civil defence"* (PB.5).

Although in crises, operations must be executed more quickly, occasionally, it is difficult to plan response operations over the longer term; additionally, there is no system for managing emergency supplies in crises. Consequently, emergency operations remain unmanageable, and key actors have no guidance: *"municipalities and county councils, social boards, public health agencies, food agencies, and medical transportation suppliers, among others, are thus seeking a procurement policy that could provide guidance"* (PB.3). For example, *"[in] socially vital activities in civil defence, the MSB could bring guidance and common strategy for commercial suppliers to be included in planning"* (POS.7). However, there are few commercial players in the preparedness system; some adaptations may occur to include PS in the overall planning of medical preparedness at the National Board of Health and Welfare (PB.5).

Network collaboration constraints stem from deficiencies in managing commercial activities, and this area is underdeveloped; *"for example, in municipalities and county councils, there are no routines or collaboration principles. In other words, they do not know on what basis to collaborate. Awareness of such problems appeared when dealing with contacts for cost-driven applications, e.g., the certification of suppliers and pharmacy decentralization, meaning that medicines must be stored differently"* (PB.4 and PS.1). Similarly, SCN effort is particularly focussed on efficiency. For procurement agreements, individual public and private actors' financial constraints drive efficiency. Medical contracts are often placed with suppliers only after agreements to cover immediate demands are made. Thus, it is very difficult to manage long-term demand and to adapt commercial networks efficiently. For example, several strategic suppliers and other major commercial players are struggling to deliver vital services: *"Stockholm's municipality (e.g., clearing snow, road maintenance), county councils (delivering primary healthcare), and hospitals and centres (e.g., procuring medicines, equipment, medical products, and service skills), need proper 'long-term' adaptation to future demands and management"* (PB.5).

These difficulties are internal components of the preparedness system and are related to the inability of the MSB to provide guidance on network collaboration to actors who are performing the same type of commercial activities. Due to multiple uncertainties, interviewees argued that the system is weak and must develop a sense of strategic networks to meet current demands. Thus, related dependencies that lack management – infrastructure, transportation, roads, IT, electricity, and fuel – must be ensured through collaborative agreements. These agreements are highly strategic for Swedish security and safety: *“there is not an overall safety and security strategy; therefore, Sweden is extremely vulnerable in its supply chain network. This is, in part, a consequence of legislation that is limiting public-private collaboration to ensure supplies over time in civil defence planning to preparation for war”* (POS.5 and PS.6).

The food sector networks

Fig. 2. The food supply chain networks in Sweden (an example)

Source: adapted by the author, 2016

Figure 2 displays the current food governance in Sweden. In the food SCN, private actors and business organisations play a larger role than ever before. They have become leaders rather than followers in determining, implementing, monitoring and enforcing rules and regulations to an increasing extent. Such private governance can take a variety of forms, ranging from networks, nets, and collaboration to self-regulation to co-regulation (e.g., public-private collaboration) and may include importers, primary producers, and exporters in cooperative agreements, codes of conduct, and commercial reporting, as well as accounting and self-auditing. Food security in Sweden has a complex and multi-level structure when discussed in emergency preparedness. The SCN of the food sector is a CI in which numerous public and private buyers and suppliers collaborate on primarily a daily basis: *“food suppliers receive up to 1500 pallets of groceries, of which approximately 70% are supplied from midland Europe and 30% from Sweden, and approximately 50 trucks leave one warehouse to deliver groceries to the local stores, every day”* (PS.2 and PS.3).

Network collaboration exists largely because longer planning horizons are necessary in the production, distribution and supply of food and water to end customers. For example, *“the food supply in Sweden, much of Europe and rest of the world depends on a constant supply of energy and large amounts of diesel, fuel oil and fertilizers necessary to keep food production alive. In EPM, the long-term networks with private suppliers are strategic and must be properly managed”* (POS.6 and PB.6). This observation applies not only to the primary production of vegetable and animal foods but also to collaboration within the food-processing industries to ensure that raw food supplies are always ready for consumers. Collaborative networks in the various stages of the food supply chain and in transportation are strategic, as they are highly interdependent (nationally and internationally) and are needed to ensure fuel and energy in the food sector (Baky *et al.*, 2016).

The grocery flow from raw materials to finished food consists of many stages, and many players are significantly involved in foreign trade (i.e., import of foodstuffs, primary production, export, and processing). Important actors (i.e., buyers and suppliers at the national level) experience common challenges in coordinating their commercial activities. Thus, in the absence of effective communication and management (e.g., few actors receive the bulk of information communicated through the network), a variety of critical dependencies (e.g., technical communication systems, transportation, staff, power, packaging, and infrastructure) generate numerous challenges, and public actors must attempt to adapt their own management to them (Baky *et al.*, 2016). Other supply network pressures comprise the adaptation of public and private networks of greater complexity when meeting demand; this phenomenon has been observed not only in food supply (to meet changed scenarios) but in all supplies to CI from society in general; *“the threat to food security (when hostile threats and war appear) has been considered in terms of collaboration, communication, and the management of buyers and suppliers, and the short lead-time from contract to delivery is a condition that allows other forms of commercial-based contracts”* (PB.2 and PB.6).

Disrupting factors are frequently the result of supply restrictions. Those restrictions often originate from the substantial dependency in strategic networks. As such, *“the food supply chain network is very much controlled by the demand for food and water, and the demand is controlled by the free market. For example, in continuity, commerciality and demand bases, ICA, and COOP (the largest private suppliers of food in Sweden) own and control the largest, most fundamental food warehouses in Sweden”* (PB.6). SCN dependency can cause delays, extra costs, and supply uncertainty; for example, private commercial suppliers finance the storage of various grocery supplies in collaboration (e.g., electricity, IT, staff, and power) (PB.1). Furthermore, this lowers the requirements for the public network regarding collaboration with commercial PS, for example, *“the food agency in its role is a key actor coordinating and supporting public and private collaboration, with the objective to maintain suppliers with conditions that allow longer-term contracts”* (POS.6).

In emergency operations, the respondents indicated that some parts of Sweden will find it easier and some will find it more difficult to obtain their food supplies when these supplies are dependent on international suppliers. Groceries are bought from independent wholesalers in Sweden or Europe; these wholesalers buy at European auctions. COOP, for instance, allows the procurement decisions for groceries to be taken relatively late, hence increasing adaptability. *“COOP maintains*

a limited buffer stock, but such stock is maintained at a minimum due to the receptivity of consumers regarding short expiry dates. In any case, to ensure lead times, the food volumes transported into Sweden are significant: approximately 50 million tons/year” (PS.2, P3). Truck transport modes dominate in the country and within Europe. Ship transport predominates for goods transported between continents, whereas air and rail transport possess a very small share of the food transport market: “large parts of northern Sweden and greater Stockholm, for example, depend heavily upon incoming food supplies, whereas Skåne, and Gotland for example, are less dependent upon the incoming food transports” (PS6.). Considering these differences, the connection to emergency planning and response operations should be able to shorten the steps to achieve higher flexibility. Organizations, processes, systems, and CI must be connected to stable supply networks to overcome any type of disruption whenever it arises (PS.3).

The transport sector networks

Fig. 3. The transport supply chain network in Sweden (an example)

Source: adapted by the author, 2016

Figure 3 displays an example of a transport SCN developed in relation to international manufacturers and suppliers to ensure the national availability of warehouses and distribution centres. This SCN covers common international standards with the aim of improving the safety of individuals, the industry, suppliers and society. The Swedish transportation sector represents a form of CI, and emergency managers are responsible for planning and securing the transportation embedded in all SCNs. This sector is significantly dependent upon international and national collaboration. The transport administration is responsible for long-term planning for the transport system, which encompasses all types of traffic, and for building, operating, and maintaining public roads and railways (SCD, 2016)

The Swedish Transport Administration is an authority that collaborates with the Civil Aviation Authority, the Swedish airports, Air Navigation Services, the Swedish Maritime Administration, and the Swedish Transport Agency, among others, to supply travellers’ preferred modes of

transportation by sea, road, air, and rail; *“collaboration is a condition in the manufacturing and supply of technical transport solutions and the supply of several modes of transport, e.g., trucks, trains, ships or planes”* (POS.1 and POS.2). Therefore, except in public-private collaboration, managing buyer-supplier networks (i.e., authorities, private and public actors, and NGOs) is a strategic issue because it helps to avoid disruptions; this is the foundation of the Swedish transportation system (POS.5).

The transport administration manages the test of professional transport licences and certificates of professional transportation competence (POS.5). In a multichannel system, particularly with the recent increase in uncertainty, it provides solutions for effective and safe trade: *“the Swedish Customs Department is primarily concerned with revealing false goods declarations, for example, to look for drugs, alcohol, and cigarettes”* (POS.5 and POS.4). The Authorized Economic Operator applies the EU standard for firm risk assessment. To facilitate collaboration, the goal is to impose fewer controls and to enable firms to gain efficient benefits. The need for Customs Administration operations is greater than ever in Sweden. The core businesses of law enforcement and efficient trade have gradually increased the staffing of Swedish Customs in the most recent five-year period, increasing the complexity of the system (SCD, 2016).

With increased awareness of environmental change and its damaging effects on European road systems, maritime shipments and rail transportation have increasingly become essential modes for suppliers to deliver many supplies within a certain geographical area: *“these concern, for example, maritime transport, which has great strategic significance but takes a considerably longer time than land transport”* (PS.7 and POS.4). Conversely, unlike other modes of transport, the railway system has not been fully functional in recent decades. At the community level, *“the problem is the lack of double and triple tracks, which is making the railway a bottleneck in the Swedish transport system”* (POS.1 and PS.4). In business activities, public-private networks are often responsible for the ownership of transport systems based on contractual agreements that include the management of warehouses, the distribution of transportation modes, and security to provide transport flexibility in emergencies (POS.3).

In some contract terms, suppliers are made responsible for delivery, even in unstable situations. Many physical transport distribution activities could be more accurately maintained by collaborative suppliers: *“one of the biggest concerns in the transportation sector is the policy of public procurement (LOU), which is placing restrictions on collaboration and trust because those have a duration of a maximum of five years before the agreements must be renewed”* (POS.6). Due to the decentralized nature of the transportation business, different guidelines and legislation could have different impacts on emergency preparedness efficiency. For example, there is a need for the government to work together with private actors, as increased threats and uncertainty add complexity to these actors' operations, and thus, they need legislative guidance (PO.4). In general, the respondents agreed that using a multichannel policy that applies to similar transport networks and multiple deliveries could mitigate difficulties in collaboration.

5 Analysis and conclusions

This study analysed the management of strategic networks in EPM in developed countries to increase the understanding of how such strategies are connected to the emergency response efficiency. One form of strategic intent in SCNs is public-private collaborations, which involve

commercial relations that impact EPM efficiency. Interestingly, however, the public-private collaborations applied by the three CIs in this study by themselves do not guarantee EPM efficiency in Sweden. Rather, as shown in the examples in **Table 4**, public-private actors have different strategic intentions in terms of combining, joining or adapting their resources, relationships, and activities in commercial relationships during planning. In EPM, public-private actors must therefore be adequately delimited to allow adaptation in their types, forming nets. Here, current, renewal, new, dormant, and active nets can be applied as frames of collaboration to allow for SCN efficiency. Collaborative nets in SCNs appear to offer actors a foundation for generating strategic value to EPM in terms of, e.g., efficiency, adaptability, profitability, and stability. However, and most importantly, the nets can be managed when they are adequately delimited. This study incorporates a different strategic network for EPM. In it, the SCN as a framework is surprisingly consistent with the given grounds on strategic networks, as presented in chapter 2. In fact, the results overlap substantially between the industrial network approach of Håkansson (1987) and the CSN of Stadler and Van Wassenhove (2016) when used to increase the safety and security of civil society against complex emergencies, changing threats and war.

Table 4. Strategic networks in EPM the empirical examples

<i>Strategic intent of actor (e.g., collaboration creation)</i>	<i>Strategic value to the SCN in EPM (e.g., of strategic value)</i>	<i>Diverse forms of collaboration in Nets (examples of actors' delimitation in nets)</i>				
strategic combination joint planning joint problem solving network adaptation	<i>Delimited networks</i>	<i>current</i>	<i>renewal</i>	<i>new</i>	<i>dormant</i>	<i>active</i>
stable, trustable responsible, complex	<i>Efficiency</i>	MSB SAF	SKL FMVP SIFA	SCD DSH	NBHN MSB SIFA	SA
stable, reliable trustable, multifaceted	<i>Stability; time and timing</i>	FMV FMLOG	FSV DSH	FSV FMVP		
changeable, temporary profitable, efficient specialized	<i>Adaptability and profitability</i>	TD COOPSC ST	ETC			
specialized over time, temporary, profitable, required continuous communication	<i>Predictability and profitability</i>	COOP	TDC	OM ALG		NGOs

Source: adapted by the author, 2017. Some of the public-private actors are involved in more than one network/net

SCNs capture public-private collaborations aimed at increasing EPM efficiency with regard to actors' strategic intent. For example, if stable, trustable, responsible, and complex interactions between actors, resources, activities, and profits (Altay and Green, 2006) are to be expected, private and public actors will depend on occurrences in relation to the market, to suppliers and to other customers in the SCN. This phenomenon is illustrated in the examples of the three CIs in Sweden, which are related through diverse types of collaborative relationships. The collaboration between the public-private actors of Sweden, when applying delimited nets (the four examples in

Table 4), involves a strategic orientation that is supported by the healthcare, food and transportation SCNs of Sweden, and it can be read both positively and negatively. Dysfunctional strategies hamper the ability of an SCN to efficiently adapt to changing demands in response operations, e.g., a frequent problem is communication. Communication provides an operational and legal understanding of mechanisms of collaboration (Aho *et al.*, 2006). The respondents confirmed that unreliable and incompatible communication structures are employed by different actors in the Swedish EPM. This significantly affects public-private collaboration, for example, because few people receive complete information about what is communicated through the SCN.

The strategic value of SCNs for EPM can be a consequence of public-private collaborations, which are often associated with adaptability, stability, predictability and profitability benefits (Zhang, 2005). Due to the complex nature of threats to developed countries and the increased vulnerability of their CIs, different strategic forms of value and management are required. As such, a complex commercial market is a network in which nets are commercial units, i.e., manufacturing, supply and service organizations and the relationships among them are the threat. Both the threat and the nets (units) in the commercial context could have impacts on EPM and response efficiency. Different strategies applicable to nets can also have a possible negative side effect when public-private actors become locked into ineffective commercial relationships or when their collaboration is hindered. Therefore, to develop and tailor strategic networks to more specific EPM requirements, changes in policies and management practices are required, according to the respondents, and nets must be applied the context of an all-hazard approach, meaning that they must be adaptable to all type of threats, even war. In the respondents' view, trust and broad communication are among the benefits that create value for the SCN; however, communication and trust can be affected by cultural similarities or differences. For example, a lack of communication can affect actors' awareness of the overarching goals when addressing cost-driven and short-term contracts. However, a lack of trust affects many of the value-creation benefits derived from buyer-supplier relationships. Similarly, no single relationship can be understood without reference to the wider network. Each organization gains benefits and incurs costs from the network and, ultimately, trusts the strategic value of the actors, resources and activities in the SCN.

Diverse forms of collaboration can be delimited to capture the best use of nets in the EPM context. Table 4 shows that by charting the public-private actors' participation in this study, these actors can be delimited in diverse types of nets based on their strategic intent and their strategic value in the SCN. When actors are delimited, they can adapt to enact strategies based on the design of working choices mediated between the planning and the response operations (Aldrich and Whetten, 1981; Kovács and Tatham, 2009; Möller and Rajala, 2007). Several important consequences occur from this delimitation for any decision-maker within an organization. One indicates that the diversity of the nets gives any manager numerous opportunities to perform and the freedom to do whatever he or she wants. However, according to the respondents, their ability to perform and the effects of their actions may be inhibited by the existing structure of the nets. Many nets are straightforward, relatively stable, and well recognized for their strategic value for emergency planning (e.g., civil public: MSB, SKL, SIFA; military public: SAF, FMV, SA, and NGOs). However, integrating buyers and suppliers in the commercial activities of nets leads to increased complexity that can affect decision-makers' perceptions of the collaborative benefits for emergency planning. Cornall (2005) discusses that in EPM, planning requirements include lead times, predictability, and stability to add strategic value to the SCN efficiency. In terms of

efficiency, negotiating power, including the availability of suppliers to all types of response operations, is likely one of the main drivers of changes in the structure of nets. The respondents indicated that there may be a way for public-private actors to change: through changes in the structure of the nets. In their view, a further extension of the network strategy includes managing different actors along the SCN to differentiate their strategic value.

In the current net categorization, there is a critical debate on the usefulness of planning for emergency response. The respondents argue that the nature of uncertainty should link the net strategy to an all-hazard response. In developed countries, CI has long been associated with great demands on SCN efficiency. As such, demands can be used as rhetorical tools to establish legitimacy within a system, e.g., emergency planning versus civil defence planning, rather than developing policy guidelines for EPM. According to the respondents, there is heavy commercial regulation (e.g., Swedish LOU and LUF). As such, contingency planning is considered the most appropriate and efficient approach for both contingency planning and support services to fulfil the specified requirements for EPM efficiency (emphasized through nets). However, much uncertainty can be observed when the healthcare, food, and transportation sectors plan their commercial relationships for unpredictable and complex emergencies. Except for the adaptability of OM's and ST's central procurement planning, predicting long-term demand becomes a daunting task, particularly in an environment in which buyers-suppliers are limited to agreement through short-term contract conditions due to inflexible regulations.

When the SCN is analysed in this study, it provides little empirical evidence that dormant nets are of functional importance for EPM or that there is any regulation appropriate to support its uses. While it was clear that even the current (nets) planning cannot guarantee the efficiency of EPM or the response, it is due to the uncertainty involved. The respondents provided support for the idea that efficiency is substantially strengthened by policy and contractual decisions (through, e.g., public procurement policy). The likelihood that MSB supports public-private collaborations (including actors, resources, and their activities) and that the SAF makes it possible for civil defence to apply planning to a higher level of alertness allows the use of dormant nets. In that sense, the respondents argued that problems occur in procurement processes at, for example, FMV, FMVLOG, FSV, and SA. Such planning problems are embedded in communication failures and policy inertia when logistical supplies are suddenly required in emergency operations. In commercial agreements (of three to five years), PS such as TD (transportation modes), COOP (groceries, raw food, and water) COOPSC (food warehouse) and ST (roads, transport technology, and skills) are vital for the safe functioning of CI. The dormant net strategy may not necessarily offer structures or resources to adapt to EPM structures, as it is more difficult for private actors to achieve change and adaptation by seeking dormant partners. Nevertheless, PS plays a strategic role in facilitating skills, resources, and technology and must be able to identify the potential benefits of the dormant nets and be prepared to incur the charges, make the necessary investments, and admit the effects on their organizations' existing collaborations.

Additionally, in response operations, new nets suddenly appear. These nets often address profitability in financial flows. In the view of Stank *et al.* (2001), private buyers and suppliers tend to benefit from existing uncertainty. This finding was exemplified when looking more closely at active nets and their speed, mobilization, and provision of logistics, food, medical, and transportation supplies to the areas of operation. In complex emergencies, for which central

management has a delimited capacity, active nets are therefore not a major issue. Moreover, the strategic intent behind renewal nets offers guidance to temporary public-private collaboration (Barratt, 2004) and focuses attention on specialized knowledge to achieve optimal results (Möller & Rajala, 2007). In Sweden, there is clearly a strong emphasis on operationally oriented planning, where strategic value induces buyers-suppliers to grow, capture market share, and/or improve services with other networks to grow the SCN collaboration process.

In this study, efficiency is a consequence of strategic choices; however, it requires actors along the SCN to adopt changed commercial views that lead to development and adapted action in diverse types of agreements. Efficiency is thus both a strength and an impediment to development. The cost and time needed to build nets and to adapt to an unusual way of working may mean that it makes sense for an actor to develop new relationships in which the need for accurate resources is weakened or in which some commonality exists in the SCN. This finding may be in accordance with Balcik *et al.* (2010) because actors have the same relationships. In renewal nets, the selection of the correct SCN partners is critical (Nolte and Boenigk, 2011). The respondents recommended adopting diverse types of strategies for different types of responses, e.g., semi-assembled public-private collaboration. Delimiting the number of actors in nets can help the public sector to more easily control PS and predict supplies by planning before a contract is elaborated and established. The respondents recognized that the SIFA and TD are examples of public actors that specialize in managing the supply and mobilization of food products in Sweden; however, due to uncertainty at the regions of product origin, Sweden, other Nordic countries, and the US must adapt to other types of strategic networks. These views are in accordance with Christopher (2011) regarding the unpredictability of the SCN due to uncertainty. Here, the management of an actor's interactions with regard to the net's uncertainty is important but risky. Thus, actors should aim to obtain information, technology, communication, and management, but as soon as actors have acquired some control over the closest SCN, they should take advantage of the variety of relationships and the profitability for the SCN's stability. Examples that facilitate the availability of food supplies to large parts of northern Sweden, Stockholm, Skåne, and Gotland are COOP and ICA. These private actors modified their network positions and control what occurs in their own and others' SCNs. However, their management task is primarily to encourage and help other suppliers to continuously adapt in the functioning of nets in emergency response in Sweden.

6 Concluding discussion and remarks

The purpose of this study was to analyse the management of strategic networks in EPM in developed countries and to increase the understanding of how such strategies are connected to the emergency response efficiency. This study contributed to a much-neglected topic within the area of EPM by exploring how the strategic network view is applied to the context of Swedish safety and security and how its application can be connected to public-private collaboration in SCNs. By studying three different but interrelated CIs, i.e., healthcare, food and transportation, the results of this study showed that the strategic network concept can be applied to increase EPM and response efficiency by adding strategic value to the SCN. In EPM, efficiency is a consequence of strategic choices/intent along the SCN, as shown in figure 4. As such, the SCN constitutes the framework for commercial relationships in which a strategic intent is public-private collaboration. The study showed that the SCN is associated with a strong focus on actors' collaboration and that due to the uncertainty and unpredictability of relationships, these relationships among actors are part of the threat. Both threat and strategic intentions could therefore have an impact on efficiency when

actors become locked in ineffective commercial relationships or when their collaboration is hindered. One important conclusion of this study concerns the management of actors' interactions with regard to uncertainty and unpredictability. The management of strategic relationships is important but risky, given that adequate supplies are related to adaptability, profitability, and stability, and that relationships have become strategic requirements for a CI with too-high vulnerability. The study concludes that to meet the requirements of an all-hazard approach, networks must be delimited to adapt their responses to complex emergencies, changing threats and war. When networks are delimited, they can adapt in nets to enact strategies mediated between planning and the response operations; most importantly, nets can be managed.

What type of strategic network is necessary to increase the efficiency of EPM in developed countries? This study found that in general, a greater use of a strategic network could be associated with higher efficiency in EPM. Despite this connection, the network does not appear to be the sole determinant of efficiency. Diverse types of public-private collaborations with strategic value can also provide efficiency in the SCN. The use of diverse types of nets, i.e., current, renewal, new, dormant, and active nets, appears to be an enabler of value and a further extension of strategic intent in EPM in developed countries. Nets include different combinations of actors along the SCN and can be delimited to enhance their strategic value. The SCN involves multiple nets that are necessary to increase the efficiency of EPM. Nets are geographically dispersed and are often identified before the planning begins. Given its speculative structure, EPM strives for public-private collaboration to ensure that vital supplies are delivered in response operations.

How can EPM networks be delimited and managed for public-private collaboration to increase response efficiency? In the SCN, public-private collaboration is of strategic value for EPM, as it greatly affects efficiency. For this collaboration to function, the actors, resources, and activities must be properly managed to create value in the SCN. Such requirements call for the delimitation of the SCN, and different management arrangements can be adapted. This study showed that collaborative nets can have different value outcomes that can be traced back to actors' priorities and strategic choices. In EPM, planning does not necessarily lead to better processes in solving procurement problems. Finding a fit between strategic nets and management, actors should aim for information, technology, communication, and control. Therefore, actors should acquire some control over the closest SCN, and they should take advantage of the variety of relationships and profitability for overall SCN stability.

Practical implications

Several implications for practitioners can be drawn from this research paper. A temporary delimited network does not address only how preparedness planning involves suitable public-private collaboration to ensure overall SCN profitability; it also deals with adequate management. Since the actors have adapted to the delimited perspective that permits them to become involved in parallel settings (outside nets) to optimize profitability, instead of re-adapting in uncertain permanent planning, the collaborative SCN will not be able to hastily adapt to changes. By eliminating potential management problems, actors in public-private collaboration also resolve the problems of SCN complexity caused by market changes and poor strategic choices. As such, a key question is how to find a balance between planning and response priorities. Another implication relates to when buyers and suppliers in EPM planning should be involved. The delimitation of their capability in nets suggests that the realization of strategic intent can lead to increased

adaptability and predictability. Instead of shifting responsibilities to other actors, the collaborative SCN offers developed countries a mutual arrangement to resolve the strategic planning so that commercial actors can focus on creating strategic value for EPM, enhancing overall profit without risking an organization's individual commercial existence.

Future research

Future studies could elucidate the extent to which strategic networks can be considered in other study designs or include other possible management concepts and efficiency goals. Future studies should consider employing a configuration theory approach to understand how suppliers' nets can be developed and associated with different collaborations' priorities and add strategic value to humanitarian SCNs. From a managerial standpoint, this study provides insights into how different strategic networks can be applied in connection to EPM efficiency. Due to the changes in the safety and security of developed countries, civil society actors are required to be linked together in different ways. More research is required, therefore, to describe the management of commercial transitions from temporary networks (short-term planning) to permanent networks (long-term planning) in EPM.

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Appendix 1.

Interview guide for gathering information on strategic networks in the EPM system in Sweden

Interview questions targeted at public and private actors/organizations

Issues addressed to public-private buyers and suppliers regarding access to essential resources, services and products in the context of EPM and in the event of changing threats and war. The questions below are meant to serve as an interview guide during the interview.

Block one: about actors/organizations in EPM

- Please provide brief information regarding your organization: role, experience, position, duties and duration of your service and within your organization
- Information and general background about your organization's role in EPM and SCN (customer and/or supplier)
- Central areas for your organization's relations in EPM and in emergency response (type of capability, material, logistics and/or service, etc.)
- Type of collaboration your organization is involved in

Block two: strategic activities in the SCN of EPM

- What are the criteria for being a strategic supplier in EPM?
- How many strategic suppliers are included in your network?
- How are these suppliers categorized in the SCN?
- What kind of services, products and other capabilities can strategic suppliers deliver in EPM? (e.g., leadership, information systems, logistics products, food, and energy)
- Which parameters are most important for building strategic networks in EPM?
- What positive and negative effects can strategic networks bring in terms of management and response operations?

Block three: strategic relations and public-private collaboration

- How are your strategic relationships linked to EPM networks?
- How often and in what ways does interaction within the network occur?
- Are there relationships that are activated only rarely (e.g., only in response to emergencies)?
- Is there a need for greater collaboration with other organizations in response to emergencies?
- Is there a need to delimit the network to supply a minor share of operations in SCN?
- Can delimited networks add value to the commercial activities and the efficiency of EPM?
- Do you have a documented procurement strategy (e.g., buy or make, collaboration)?
- Are these strategies adapted to diverse types of buyer-supplier requirements (examples)?
- How are strategic partners chosen and involved in the SCN to ensure access to resources, goods and services in the context of EPM?
- What does their geographical distribution look like and how does it impact supplies under uncertainty (Sweden, Europe, and other countries involved)?

Block four: commercial conditions for strategic relations

- What types of contracts are required for suppliers to be considered strategic?
- In what setups can management be adapted to a strategic network?
- How is information organized and managed between buyers and suppliers in EPM?

- What does the collaborative model of EPM look like (who meets, what level, how often, what meetings have what structure, etc.)?
- How are suppliers involved in planning to ensure access to essential resources in response operations (location of stocks, rapid delivery in specific types of emergencies, etc.)?
- Who is responsible for managing and controlling SCN during emergency operations (transportation, material, information, packaging stock, personal resources, services, etc.)?
- Who is responsible for the follow-up of the required supplies to fulfil the contract?

Block five: EPM efficiency

- How should suppliers be chosen for involvement throughout the whole emergency response?
- When and how is emergency planning operational, and when is the suppliers' value-added essential (warehousing, logistics, and transportation)?
- What are the main problems regarding supply in emergency response?
- What are key areas for increasing SCN efficiency?
- In what way do you think public-private collaborations add efficiency to the SCN?
- Can commercial relationships be adapted to support SCN efficiency?
- In what ways are the collaborative relations in EPM impacted by market uncertainties?
- How can appropriate partners in collaboration be chosen and how can partners change over time based on their ability to offer efficiency?
- Why, if so, have public-private collaboration changed?

Block six: key informant suggestions for possible respondents – snowballing

- Which buyers-suppliers involved in EPM do you think are appropriate for me to talk to?
- Please provide their contact information.
- Are there additional actors/organizations (public-private) that you can suggest?
- Are there other sources of information relevant to this investigation?

Appendix 2.

References to the reports, articles, letters of regulation, and policy sources were evaluated to enable the adjustment of practical knowledge (e.g., Kaneberg et al., 2016, pp 145-147)

Policy and regulation documents (examples)

- European Parliament and Council Decision (1313/2013/EU): Civil protection mechanism for the Union, and the Constitution Act (1974:152).
- The Act (1992:1403): total defence and heightened preparedness.
- Ordinance (2006:942): crisis preparedness regulation.
- The Act (2006:544): municipalities' and county councils' actions before and during emergencies in peacetime and increased readiness.
- Ordinance (2006:637): municipalities' and county councils' actions before and during extraordinary events in peacetime and heightened preparedness.
- The Act (2003:778) and Ordinance (2003:789): protection against accidents.
- The Act (1984:387): police and social services.
- The Act (2001:453): healthcare.
- The Act (1982:763) and (1991:900): local government.
- Ordinance (2007:825): county administrative board instruction.
- The national board regulation and general medical guidelines (SOSFS 2013:22): medical preparedness
- Regulation (2009: 1426) with instructions for the Food Administration

Organizational documents, reports, other articles (examples)

- Host country support in the event of a high level of preparedness (FOI, 2015. R-4198-SE)
- Food Security: FOI analyses of the Food Supply Area. Our efforts range from threats to primary production, through emergency preparedness in the supply chain, to consumer accessibility to food (2016).
- The National Food Administration (from 1 January 2010) is responsible for national coordination in the field of crisis and contingency planning of the food supply in the line after primary production; its responsibility has partly changed.
- Think before: risk and vulnerability analysis from a property perspective. Swedish Municipalities and County Councils (SKL, 2011).
- Suggested target structure and goals in five areas (MSB, 2014-2378).
- Budget authority for customs duty. Budget year: 2014-2016 The government Ministry of Finance.
- Project report (2009). Threat and safety in the food chain: Transport of food. Heat and safety in the food chain is the focus of the food supply during a crisis.
- The National Board of Health and Welfare Risk and Vulnerability Analysis 2016.
- Strategy for environmental and social responsibility for healthcare products (FMV 2016).

Appendix 3.

Definitions of key terms

Developed countries are classified according to their level of development. The World Bank's (2017) definition of developed countries includes advanced democracies with substantial economic growth and complex structures. Definitions from between 1970 and 2010 are associated with developed economies that have shifted from the emerging to the developed category (Babecký, *et al.*, 2012; World Bank, 2002; 2017). Within the EU, developed countries such as Sweden are member states supported by "The Treaty of Lisbon" signed on 13 December 2007. This focus on developed countries particularly concerns the vulnerability of CIs, which is an essential concern in the discussion of safety and security (Boin and McConnell 2007).

Civil society describes a broader capability to provide safety and security through a variety of functions (Foley, 1996). The term "civil society" and how it relates to safety and security capability play a critical role in EPM through different strategies (Adger and Vincent 2005). The concept denotes a collaborative engagement involving organizations and individuals (Walzer, 1992). According to Foley (1996), such collaborative engagement is learned and re-enforced through trust. Kaldor (2013) highlights civil society as the trusted channel through which social agreements between the state and organizations are negotiated and reproduced. However, civil society's capability to adopt safety and security changes in developed countries is still questioned (Bhalla and Lapeyre, 2016).

Civil protection describes activities taken to protect civil society against emergencies, disasters, and threats (Mauro, 1996). The term is interchangeable with the term 'emergency preparedness', which has been adopted by developed countries such as the US. Civil protection has moved away from command-and-control methods to rely upon forms of collaboration and information sharing (Masri and More, 1995). Civil protection has gradually and rather inconsistently emerged from civil defence (Anderson, 1969). *Civil defence* implies the management of civil society in the face of actual or potential aggression (war). It places considerable emphasis on authoritarian management techniques and the restriction of individual freedoms (Anderson, 1969).

Critical infrastructure (CI) varies widely, ranging from hardware such as cables and wires to networks for the generation and supply of energy sources, food supplies, healthcare, transportation, and public order. The degree of criticality is understood differently across systems and cultures; however, they all recognize that a breakdown of one or more of these critical systems has the potential to cause very serious problems (Boin and McConnell, 2007; Perrow, 2007).