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A complexity perspective on logistics management
Rethinking assumptions for the sustainability era
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Abstract
Purpose – The purpose of this paper is to elaborate on how perspectives and assumptions embedded in the complexity paradigm contribute to make logistics management research better aligned with real-life logistics. This is necessary, due to increasing supply chain complexity caused by an increasing request for sustainable development (SD).

Design/methodology/approach – The research is exploratory and based on a narrative literature review of logistics and supply chain management (SCM) from a complexity science perspective. Qualitative research interviews have been conducted with 12 logistics and supply chain managers in international companies and have focused on their daily experiences and the underlying assumptions related to their actual work.

Findings – Logistics and SCM research is embedded in the functionalistic paradigm with reductionistic assumptions as the dominant logic. These do not sufficiently align with the complexity related, for example, to the daily work of SD in logistics management practice.

Research limitations/implications – It is proposed that the inclusion of complexity-based assumptions in logistics management research can increase realism in the advancement of the discipline. A key result is that the recognition of logistics as complex means inclusion of human and social aspects which is apparent in any logistics process or phenomenon in logistics knowledge creation processes.

Practical implications – Increased realism in logistics management research by addressing complexity, instead of merely reducing it, will provide logistics and supply chain managers with increased understanding and appropriate knowledge when they deal with emerging challenges such as SD.

Originality/value – Based on Boulding’s levels of complexity, this paper challenges the underlying assumptions of logistics management in research and practice, and provides reflective frameworks for advancing the discipline and aligning it to the complexity of contemporary challenges in logistics management.

Keywords: Sustainability, Europe, Decision making, Agile, Supply chain processes, Qualitative interviews

Paper type: Research paper

1. Introduction
The concern of complexity in logistics and supply chain management (SCM) is often mentioned in the literature (Sanders et al., 2013; Bode and Wagner, 2015). While most literature only describes complexity in general terms, a growing body of literature explicitly addresses it in logistics and SCM (e.g. Christopher, 2016; Manuj and Sahin, 2011; Gerschberger et al., 2017). In the recent special issue of Journal of Operations Management on complex adaptive systems (CAS), Nair and Reed-Tsochas (2019) conclude that complexity perspectives can contribute by providing increasing realism regarding models and by providing more understanding of the highly interconnected nature of contemporary supply chains. They (Nair and Reed-Tsochas, 2019 p. 80) also declare that in much of SCM research, “we consider the simplistic conceptions of organizational and interorganizational
structures, linear relationships between practices and performance, and ignore the adaptive nature of strategies and processes”.

With the increasing concern for environmental and social issues in society, companies have to consider sustainable development (SD) in their strategies and not only prioritise financial performance and results (Porter and Kramer, 2011; Nair et al., 2016). Consequently, the need to handle increased complexity for logistics and SCM can be expected (Sanders et al., 2013; Carter and Rogers, 2008; Wittneben et al., 2009). Cruz et al. (2006, p. 872) state that SD is “perhaps one of the most complex and important demands that has occupied managers’ reflection”, and Hall and Vredenburg (2003) report on the major difficulties which managers have in dealing with SD. Furthermore, Russel et al. (2018, p. 37) state that “everything about achieving sustainable logistics and supply chain management is complex”. For example, based on the multifaceted nature of SD, the interpretation of what SD means in different parts of an organisation or a supply chain is difficult to comprehend (Abassi and Nilsson, 2012).

SD became popular after the Brundtland Commission report of 1987. Today, the perspective on SD requires economic, social and environmental considerations (United Nations, 2005) as sustainability is required to provide economic profitability, social responsibility and environmental conservation (Elkington, 1998). Such an accomplishment requires power, commitment and collaboration as there is not necessarily any correspondence between economic, social and environmental sustainability (Low and Gleeson, 2003). Logistics is an area which is severely challenged when it comes to reaching the goals of Agenda 2030 (UN General Assembly, 2015). The movement of goods requiring set-up of logistics networks, transports between nodes (McKinnon et al., 2010) and delivery policies have all contributed to the huge amounts of emissions affecting our planet today (IPPC, 2014). Furthermore, on the competitive European transport market, depletion of logistics charges has led to lowering of salaries and worse working conditions for drivers (Kummer et al., 2014).

The quest for logistics management research is to evaluate current and former practices and provide guidance to practitioners and policy makers on what to do and how to act in relation to present and future challenges. In the era of SD, this means evaluation of and guidance sustainable practices, theories and methods, i.e. providing the logistics discipline with knowledge on how to work and act in order to achieve Agenda 2030 goals and develop sustainable logistics practices. However, as it is argued in this paper and pointed out in several previous studies (e.g. Mears-Young and Jackson, 1997; Arlbjørn and Halldorsson, 2002; Nilsson, 2006; Carter et al., 2015), the logistics discipline has evolved from problem-solving issues in industry and has been theoretically based on a positivistic epistemology with reductionism as the central assumption.

Coming from this functionalistic paradigm with central assumptions such as controllability, optimality, rationality and objectivity (Nilsson and Gammelgaard, 2012; Nilsson and Christopher, 2018), it is challenging in many ways to handle the rapid change and the multi-natured challenges related to SD. Reflecting on the magnitude of logistics and supply chain activities involving several tiers of suppliers which are globally dispersed, theory recommends that these activities are broken into sub-units in order for us to understand and deal with them, i.e. reduce scope, context and complexity. However, what would happen if we took a holistic perspective and treated the role of logistics in SD in its complex entirety? What if, instead of trying to reduce phenomena to “controllable” and independent parts, we actually studied and understood the emergent outcomes from everyday interactions among individuals based on their self-organising processes (deliberate or not)? What happens if, instead of indisputably believing in unfolding predetermined strategies (formative and deterministic), we regard development as being more transformative as it uses adaptive strategies and activities (transformative and emergent)? As a result, what type of knowledge can we produce by addressing and understanding logistics management from a new set of assumptions better aligned to the complex reality we often experience?
A number of papers have challenged the dominant logic of logistics research and practice. Nilsson and Gammelgaard (2012), for example, investigate the use of the systems theory in logistics and SCM research and conclude that in order to generate new understanding and knowledge on issues such as innovation and learning, the dominating systems approach needs to be rethought, and more complex aspects of real-life phenomena included. Carter et al. (2015, p. 99) address the need to investigate logistics and SCM by acknowledging the complex systems in which companies reside. They (Carter et al., 2015) conclude that multi-level research can help address important, real-world topics and that by addressing the appropriate system level, i.e. individual, team, function, organisation and/or supply chain, understanding and improvement activities can be achieved. In a supply network context, Nair et al. (2016) conclude that the underlying assumptions of CAS have impacts on how to manage complexity. Nilsson and Christopher (2018) discuss the strategic development of logistics management and present new ways of defining and handling paradoxes in logistics and SCM based on principles derived from a complexity paradigm. Finally, Touboulic et al. (2018, p. 330), in their in-depth study of carbon reduction strategies, conclude that “the focus on complexity has allowed us to explore the multilevel factors that influence the emergence of a carbon reduction strategy in a food supply network context”. However, while highlighted papers address the need for new approaches, perspectives and methods to address contemporary challenges in logistics and SCM, the tradition within established domains is strong (Kuhn, 1996), i.e. the assumptions derived from the functionalistic paradigm are well anchored in both practice and research.

The purpose of this paper is to elaborate on how perspectives and assumptions embedded in the complexity paradigm contribute to more comprehensive research in, and management of, logistics, especially in pursuing the increasing challenge of SD. Moreover, the aim is to contribute to the paradigmatic discourse of assumptions and their effects on the kind of knowledge being created within the logistics discipline. In addition to the conclusions Wieland et al. (2016) make on further research developments for the discipline, i.e. the issues of sustainability, risk, humans, innovation, analytics and complexity “require strong interdisciplinary thought and rigorous approaches”, this paper therefore argues that the rethinking of underlying assumptions is a vital factor for the advancement of logistics theory and practice.

The remaining paper is organised as follows: first, an assessment of underlying assumptions of logistics management research and practice is elaborated, followed by the introduction of complexity science representing theories which might prove fruitful for increased realism of contemporary logistics challenges, both in research and management. Based on a qualitative, in-depth interview study of logistics managers’ everyday practice, underlying assumptions are elaborated on and key findings presented. These relate to the interplay of simplicity and complexity in logistics management practice, and are especially related to the inclusion of human and social aspects in the knowledge generation process. The paper ends with a conceptual model of the type and nature of knowledge and level of assumptions we are using and generating in order to tackle contemporary challenges such as SD. Finally, a concluding discussion of assumptions derived for a complexity perspective can contribute to the advancement of the discipline by including human and social aspects into logistics research and management.

2. Assessing assumptions in logistics management research and practice
In order to develop the logistics discipline, the process of knowledge creation, i.e. epistemological considerations, is central. Arlbjørn and Halldorsson (2002) address the process of knowledge creation on three different levels: the practice level, the discipline level and the meta-level. The practical level concerns the actual logistical work being accomplished in day-to-day operations. The discipline level is where the majority of the logistics-related research is focused. It is on this level that new logistics methods are developed; either from research with an empirical focus, where best-practice solutions are reported and “glory stories” (New, 1996) presented, or as theoretical borrowing from other
theories (Stock, 1997). The meta-level is where ontological, epistemological and teleological debates are centred and thereby lie as the foundation for the paradigm the logistics researcher and practitioner belongs to. Ontological assumptions are assumptions about reality (Guha and Lincoln, 1998) which influence how we understand and explain reality with knowledge, i.e. epistemology (Burrel and Morgan, 1979). Teleological assumptions relate to how the future is considered and to what purpose a phenomenon serves (Ackoff, 1973; Stacey et al., 2000).

Meta-level assumptions have direct implications for the methodology and the methods chosen and thereby constrain the basic beliefs about reality. This affects the knowledge to be produced or attained during the research process (Burrel and Morgan, 1979). Consequently, a reassessment of assumptions on the meta-level may benefit the logistics discipline by increasing our consciousness of why we as researchers and practitioners do the things we do, and of how we do them. When we enter a research field the common assumptions and beliefs which exist in the community are transferred, in explicit as well as implicit modes, and sooner or later taken for granted (Kuhn, 1996). Kuhn (1996, p. 46) states that “Scientists work from models acquired through education and through subsequent exposure to the literature often without quite knowing or needing to know what characteristics have given these models the status of community paradigm”. An indication of this process is described by Rajkumar et al. (2016), reporting on a continuing decline in the number of PhD dissertations in logistics and SCM which contain philosophy of science discussions.

However, Trim and Lee (2004, p. 473) state that “management researchers need to have the confidence to challenge basic assumptions relating to interpreting research outcomes, and what constitutes appropriate research”. Morgan (1983, p. 14) adds that if problem contexts are viewed from different paradigms we can “see and understand how we can research organizations (and any other aspects of social life) in ways that tell us something new about the phenomenon in which we are interested”. Consequently, while the reductive and formative oriented approach suits various problems where reductionism can be assumed (Dent, 1999), it may not benefit problem situations where context and phenomenon are complex. In other words, as stated by Robertson (2003, p. 61), “if the business world is viewed as being complex, it is inappropriate to consider models developed under paradigms of equilibrium, stability, and linearity to produce an analysis of a turbulent environment”. Allen (2000) addresses two basic reasons for the complexity perceived in a given situation. Either the complexity is the result of many interconnected parts where the connections are known, or it is the outcome of non-linear interactions with bifurcation points, which may result in a multitude of outcomes based on creative and surprising responses. The complexity of the first kind (i.e. complicated systems) only needs more computer power to unravel it while the second type needs novel perspectives and approaches the functionalistic paradigm cannot contribute. However, as a consequence of the dominant functionalistic knowledge produced and disseminated, firms put a lot of money, time and resources into models and techniques which focus on control and prediction and where cause and effect relationships are attainable, even if the situations managers encounter are complex.

3. Complexity perspectives on logistics management

Complexity science entails theories of complex phenomena. As Allen and Strathern (2003, p. 8) state, it is a scientific area of change and transformation, [...] without it “social and organizational change could only be driven by trial and error and by people’s accumulating experience and confusion”. Complexity theories challenge the Newtonian and positivist rationale of science such as order, objective reality, reductionism, deliberate design, rationality, stability, determinism, value-freeness, controllability, linearity, centralisation, hierarchy and uniformity (Nilsson, 2005; Nilsson and Gammelgaard, 2012).
Complexity theories provide transformational perspectives for the study of complex phenomena and are regarded as the evolution of systems theories together with contemporary social and behavioural theories (Simon, 1996; MacIntosh and MacLean, 2001; Nilsson and Gammelgaard, 2012; Thietart, 2016). With this perspective, changes, interrelationships, non-linearities, learning and innovative capacities, dynamics and paradoxes existing in supply chains can be studied. Complexity perspectives can comprehend transformative transition of supply chains towards sustainability targets and consider the fact that the transition path may not be uniform, deterministic and controllable for different types of supply chains (Nair et al., 2016; Rotmans et al., 2001).

As declared in the purpose of this paper, what are proposed are perspectives for logistics management research and practice based on an extensive set of assumptions which are more aligned to real-life logistics (see Figure 1), i.e. when logistics is considered complex. An extensive set of assumptions means that those dominating the discipline, e.g. linearity, reductionism, determinism, objective rationality, etc. (found in the middle of Figure 1) are still apparent and useful; however, they are of limited value when it comes to logistics questions being handled and understood in multi-level contexts and with human aspects being addressed (e.g. power, decision making, identity). Instead, these need to be extended with assumptions of complexity, subjective rationality, self-organisation and emergence, all of which are central to complexity perspectives and highly apparent in real-life logistics processes.

Complexity-based assumptions can be related to the seminal work by Kenneth Boulding on the system theory and the hierarchy of complexity. The nine levels of complexity proposed by Boulding (1956, pp. 202-205) were aimed to provide academics with a framework for identifying gaps of theoretical and empirical knowledge (see Table I). The first level relates to static structure; the second to clockworks, i.e. dynamic, simple systems; on the third level, control mechanisms and cybernetic systems are introduced; and the fourth level introduces the first living organisms. Here, life in the form of cells is distinguished from the former levels of “not-life” and it becomes the level of open systems. Going up the levels, the fifth level introduces what Boulding calls genetic-societal level, where the “plant” is the empirical example. The sixth level represents the animal level, which is characterised by increased mobility, teleological behaviour and self-awareness. The seventh level is where the human being is introduced. Boulding states that “in addition to all, or nearly all, the characteristics of animal systems, man possesses self-consciousness, which is something different from mere awareness”, i.e. the human not only knows, but

![Complexity-based assumptions and Functionalistic-based assumptions as an extension of the functionalistic-based assumptions dominating the logistics discipline](image-url)
knows that he/she knows. Social organisations and societies are on the eighth level. “At this level we must concern ourselves with the content and meaning of messages, the nature and dimensions of value systems, the transcription of images into a historical record, […] The empirical universe here is human life and society in all its complexity and richness” (Boulding, 1956, p. 205). He describes the final level as transcendental, which involves what he defines as the “ultimates” and the inescapable “unknowables”.

Combining Boulding’s levels of complexity and associated assumptions presented in Figure 1 it is possible to relate the functionalistic-based assumptions to the first three levels of complexity, while the assumptions based on a higher degree of complexity (the outer eclipse) are added on higher levels. Furthermore, knowledge can be interpreted in numerous ways related to its stability over time and context (Allen and Strathern, 2003). In one dimension, as represented in classical science with the physical laws of nature, e.g. Newton’s law of gravity, knowledge can be assumed as quite stable over time and context (primarily levels 1–3). Another dimension of knowledge relates to human behaviour, perception and sense making, which are all far more dynamic and interdependent with present-day contexts, and are based on internal cognitive patterns (levels 7–8). Knowledge in terms of corporate strategies, management philosophies or consumer expectations relates to quasi-stable attractors which are socially constructed, i.e. trends and patterns which emerge in the interplay of interpretations among humans, organisations and institutional bodies. In order for companies to stay ahead, be profitable or retain attractiveness, change is needed, and novel ways of acting, responding and driving activities co-evolve in the contemporary contexts. Consequently, in the context of logistics management, knowledge needs to be seen in a dialectic way with alterations of stable and transformative knowledge.

Logistics management as a functionalistic discipline, i.e. built upon reductionistic and mechanical assumptions, often assumes logistics representable at the third level, i.e. that of
control systems (thermostats) and cybernetically derived principles. Consequently, the knowledge generation process targets the exploration and exploitation of general laws, optimisation of routes and inventory, deliberate design of logistics set-ups and the aspiration to be able to realise decided strategies and designed systems. The unquestioned assumptions of reductionism drive both researchers and practitioners to reduce observable phenomena into “solvable” parts (e.g. production or inventory) (McCarthy, 2004), fix and adjust each part (optimisation of inventories at one actor’s) and then implement the solution in the “real” life setting again. Checkland (1993) exemplifies the insights in the management context by stating: “a typical management science model constructed in terms of multiple interacting feedback loops, even if complicated, is only a level 3 model and hence can cover only certain aspects of a management problem at level 8. Management scientists have been known to claim more”. In the field of economics, von Hayek (1989) provides criticism of economic models derived and/or borrowed from natural science for being misleading and ways of simplifying “since it involves a mechanical and uncritical application of habits of thought to fields different from those in which they have been formed” (p. 3). Axelrod and Cohen (2000, p. 29) provide a good explanation for the dominating functionalistic and mechanical approach in management: “No doubt, machines and hierarchies provide easier metaphors to use than markets and gene pools. So it is no wonder that most people are still more comfortable thinking about organizations in fixed, mechanical terms rather than in adaptive, decentralized terms”. With this level 3 (see Figure 1) and epistemological assumptions in mind, “better management is often seen as simply running the ‘machine’ faster or more efficiently” (Allen, 2000, p. 1). However, while this reductive process suits various problems where reductionism can be assumed (Dent, 1999), it may not benefit the result if the phenomenon under study consists of interdependent parts which are difficult or impossible to unravel, i.e. problem situations where context and phenomenon are complex.

4. An empirical investigation of logistics management

In order to empirically explore the role of assumptions in logistics, an interview study was designed and conducted. In total, 12 semi-structured interviews were carried out focussing on the everyday practice of logistics/supply chain managers and with a specific reflective part of the interview related to the assumptions highlighted in this paper. SD was addressed in the analysis of the interviews based on identified aspects related to economic, social or environmental issues in daily work, examples and challenges.

The motivation for the chosen method relies on the need to obtain an in-depth understanding (Merriam, 1994; Stake, 2000) of real logistics management practice; several questions included narrative examples of different situations the managers had experienced. The research approach was explorative with the aim of better understanding the many aspects, considerations, assumptions the managers experienced (Campion et al., 1999), i.e. the managers’ perceptions of various situations related to contemporary problems, and how these affect their approaches to different circumstances. The aim was to gain understanding of the meaning of what the interviewees said (Kvale, 1996). As in qualitative theory-building studies (Eisenhardt, 1989), data analysis and data collection were interwoven. Based on a solid foundation in theory, both on a meta-level and discipline level of logistics, the initial indications and findings from the first interview drove further exploration of the study so that it is in line with the principle of theoretical sampling (Punch, 2001). Consequently, the inclusion of interviewees was driven by the interplay between new insights and findings from interviews, literature and theoretical reflections. While the content of each interview was unique (experiences, situations, examples, etc.), a number of patterns emerged rather quickly in the process of analysis and reflection. After four interviews, the first common patterns emerged, and after the tenth interview, the first feeling of theoretical saturation was reached. Two more interviews were then conducted,
both to enrich the material and understanding, but also to elaborate on the emergent themes found. Due to the subjective nature of theoretical sampling, it was difficult to know when saturation was reached. However, for the purpose to obtain in-depth understanding of the role of basic assumptions in logistics and the everyday life of logistics and SC managers, the 12 interviews were found to contribute with comprehensive representation. Nonetheless, while the small number of informants limits the generalisability of the results, they still provide guidance for further theory-testing research. Furthermore, combined with the literature reviewed and the paradigmatic reflections provided, theoretical generalisations can be attained and guidance for the logistics discipline provided.

The interviewees chosen for this study were logistics or SC managers within large, international, companies (> 500 employees). Their experience of logistics and SC-related work ranged from four to 40 years. The companies they represented covered several industries ranging from mobile technology and medical technology to food producers. All companies were in business-to-business relationships with customers in industry or retail. The initial contact was made by phone to contacts found in my own and close colleagues’ networks. After a short description of the research area and purpose, all managers expressed willingness to participate. The phone call was followed by an e-mail with a short description of the study, and the date and time we had agreed on for the interview. All interviews were carried out at the interviewees’ work places in order to contextually capture their work situation. The set-up of the interview was in four major stages, starting with, open-ended questions of their everyday activities as managers with in-depth explanations of selected situations. This was followed by fixed-response schemas where the interviewees were asked to fill in pie charts of their actual and desirable work situations, followed by reflections on central assumptions in logistics. Finally, the interviews finished off with a short section of the future challenges interviewees faced in their role as logistics/SC managers. The interviews lasted between one and half and two hours, were recorded and transcribed within two days. All interviews were carried out during a two-month period.

4.1 Interview findings

The in-depth discussions on everyday practice with the logistics and SC managers highlighted a number of interesting aspects. A common theme found in all interviews was their need to have a holistic perspective and the perception that other parts of their organisations had a more silo-based thinking. Consequently, they viewed themselves as facilitators for how different parts of their organisations fit into the bigger picture of suppliers and customers. Governing this holistic perspective was explained to be one of the most challenging tasks in practice. Some raised the issue of information and especially the lack of sufficient information contributing to this challenge, while others the unpredictability of demand and difficulties in being able to understand how different projects and efforts affected each other as well as the ongoing supply chain operations. As a result, during the initial part of the interviews, the interviewees explained themselves being able to deal with “real” objects or entities, i.e. business functions, customer behaviour, inventory systems and suppliers, and view these from their holistic supply chain perspectives. With more information, the missing pieces of the “objective” picture were sought for by the managers, to make their life more controllable.

However, during the interviews and especially when stories of successful as well as less successful changes were told, the interviewees expressed their perceived situation out of human and social aspects, i.e. by providing a more subjective rationality and view of reality. This included how to make sense of all the information that was available and turn this into knowledge for both decision makers and other co-workers. As explained by one manager, “to reach out with information and the understanding of how to use it” presented a
major challenge. Furthermore, how different perceptions of both current and future states (desirable or not) as well as aspects of power, competition (not least internal) and understanding were explained to affect both processes and results. One interviewee expressed that “power is central in companies – positions of strength – but I hope we have a little less of it since we have a positive development right now. I think it will be more of it, I mean power battles, if the development stagnates”. Furthermore, while the reliability of deliveries and the stability of inventories were expressed as highly aspirational, insights into how difficult it was to predict market changes, technology developments and social and political influences were expressed. In addition, the unpredictable behaviour of these aspects evolved, sometimes “under the radar”, and turned up as surprises related to new customer demands or legislative changes affecting the business logic and models of their organisations. From their reflections on challenges they are confronting, interviewees raised a number of issues related to SD, and especially to the multifaceted nature of how future operations should be able to consider several target functions at once, i.e. not only the dimensions of efficiency and cost.

4.2 Logistics management assumptions

The logistics managers were asked to reflect on basic assumptions and how these mirrored their perception of their work situation. In the following sections, examples and insights from four combinations of assumptions presented in Figure 1 are described.

4.2.1 Simplicity – complexity. Most of the interviewees (i1–3; 6–9; 11–12) expressed their work situation as being mainly perceived as complex, two explained it as both simple and complex (6 and 10), and one regarded it as mostly simple (i5). i8 expressed that they all the time strive for more simplicity in their activities but operate in a reality characterised by high degrees of complexity. The simplicity was expressed in the activities which had been routinised, such as receiving customer orders, picking ordered products at a storage facility, and delivery. Complexity was described in relation to human and social factors and to the interplay between details and holistic views. One interviewee expressed the challenge of “in relatively detailed questions where interests are set against each other, being able to gain enough understanding of the whole to make right decisions.” A dimension related to time was also incorporated in the interviewees’ reasoning and related to the interplay between the effects of small changes in activities on the whole supply chain. This time dimension related to both time-delays of wanted (or unwanted) effects, and the time needed to understand and interpret emergent patterns created by people involved.

4.2.2 Objective rationality – subjective rationality. Concerning the type of rationality in daily logistics practice, the managers describe several situations and examples of this being mainly subjective, from individual, functional and company perspectives. One interviewee expressed the fact that “we talk a lot about processes, but people think in functions – mine, mine. Hence, to tear down barriers is difficult, very difficult”. Another made a similar statement: “we talk about processes and value chains but since our measurement systems are targeting different aspects, we act as separate functions that optimise each own parts”. The use of more and more advanced enterprise resource systems with a growing number of automatic functions was raised as a way to gain more objective views of operations, as more people had access and could make use of all information. At the same time, the highly interconnected systems made it challenging for operators and decision makers to interpret changes being real or “system” failures and make correct decisions. As one expressed it, “IT and logistics are closely related, however, how do we get human beings involved?”

4.2.3 Control – self-organisation. One logistics manager expressed that “I can certainly try to plan everything, make superior plans and create a world class system, but then when
I turn around, having my plan ready, the customers have changed”. Another explained: “we have more or less control over the minor parts, but the big picture [...] how can you treat all the variables and get co-workers and partners to understand it”. Two of the interviewees (1 and 4) assumed it possible to control most of their logistics activities, while i5–6, 10–11 took the standpoint that what happened was a mixture between deliberate management efforts and self-organisation processes which emerged from local practices, misunderstanding, etc. Five interviewees (i2–3; 7–9) emphasise the role of self-organisation to be more influential on what really happened within their supply chains than what they perceived they were able to control.

4.2.4 Independence – interdependence. While the interviewees consider it quite easy to identify several processes and activities that could be improved in their logistics processes, they declare it to be far more difficult to understand how activities and processes affect each other and to know which efforts produce and/or the lower number of unwanted side effects. The majority of the interviewees (i1–3; 5–7; 11–12) perceive high interdependence among processes, activities, functions in their work while three (i4; 9–10) perceive some aspects to be fairly independent and other aspects interdependent. Only one interviewee (i8) perceives logistics operations and related functions and activities as mainly independent.

To sum up, the reality confronting managers could be related to both functionalistic-based and complexity-based assumptions and be highly contextually dependent. It was clear from the interviews that, depending on the scope of the supply chain, logistics could be reduced to observable operations within specific settings where the use of routines provided predictability. At the same time, in more holistic settings, the interplay between minor activities and changes in interplay with other processes or organisations, for example, more complex assumptions became apparent.

4.3 Management bias of functionalistic assumptions
An interesting finding from the interviews was interviewees’ similar views on what constitutes good logistics management. In the section of the interviews when the managers described their work situation (i.e. in a pie chart outlining their main activities during a work period), firefighting was a common activity which constituted 20–40 per cent of their perceived work duties. When managers were asked to outline their desired work situation in another pie chart, the firefighting part was heavily reduced and work time focussing on strategic and/or tactical planning increased instead. With more time for strategic/tactical planning, a better feeling of control was emphasised in interviewees’ explanations. The emphasis on planning, and thereby prediction, and control implies a formative and/or rationalist teleology (Stacey et al., 2000). As a result, it implies that the logistics manager has a position outside the system being controlled, which puts them in the position of an observer. The manager or the management team has the freedom of choosing future goals for the logistics system, and the opportunity to design its structure and how and when flows are determined to take place. One logistics manager expressed the situation after a redesign of their supply chain in the following way: “I imagined a more simple supply chain than it became. The new factories have increased the complexity. The structure has not become simpler and the information has become more difficult to handle”. Consequently, there seems to be a management bias related to interviewees’ ambitious belief in being the designer of the logistics operations and in control of its activities, while finding themselves in complex settings with interdependence and self-organising processes generating unanticipated short-term and long-term changes, out of their control. This is in line with the observations Stacey et al. (2000, p. 18) made that managers in their day-to-day operations were “the ones in charge but repeatedly finding that they were not in control”. The anticipation of being in control and able to plan (living in line with functionalistic-based
assumptions), while most often being in complex settings and in their practices doing “firefighting” activities (confronted by complexity-based assumptions), causes tensions, not at least for logistics managers who are “supposed” to be in charge. This finding is in line with Choi et al. (2001), who declare that firms’ efforts to manage logistics systems and processes have often resulted in frustration and anxiety.

Consequently, the reality which confronted logistics managers was found to be both “simple” and observable (e.g. the set-up of new production facilities, new partners in sourcing), and complex and interpretive (e.g. the actual use and sense making of data and information). A key aspect related to managers’ pluralistic view of reality is the inclusion of human and social aspects, which is also put forward in complexity thinking (Nilsson and Christopher, 2018) as well as other socially related theories (e.g. participatory paradigm (Towers and Chen, 2008)). As a result, in line with Boulding’s levels of complexity, it was found that different levels of complexity and associate assumptions need active reflection when logistics management issues are dealt with in order to provide relevant and useful understanding and knowledge.

5. Creating relevant and useful understanding and knowledge for logistics management

In the sustainability era, experts, consumers and citizens are calling for SD instead of the focus on economic development in previous eras of industrialism. Under these circumstances, it is apparent that knowledge is emergent. Existing knowledge suffers from a lack of research and experience in the complex and multifaceted dimensions of sustainability and the ongoing transformative processes in today’s experimental economies and societies.

A starting point for most applied research, as well as for management in general, is often a sense of the “real world”, the messy reality that we subjectively and/or inter-subjectively relate to in our everyday practices (Figure 2). Within this world, people, at least within the fields of logistics and SCM, recognise organisations which work together (i.e. inter-organisational phenomena), and flows of products which serve industries, shops and consumers/users. The dominant logic, influenced by the classical sciences and the functionalistic paradigm, has been

**Figure 2.** The reduction of logistics phenomena into simplified representations based on level of complexity and the type of knowledge which can be used or generated

**Source:** Inspired by Allen (2000)
to reduce the real-world phenomena into controllable and solvable parts within clearly defined system boundaries. This logic of reasoning, i.e. simplification by reductionism, follows Occam’s razor principle: “given two explanations of the data, all other things being equal, the simpler explanation is preferable” (Blumer \textit{et al.}, 1987), one of the fundamental tenets of modern science (Domingos, 1999). In Figure 2 the process of reduction is illustrated related to the type and nature of knowledge (x-axis), and the aggregation of assumptions (y-axis).

Starting with reality and following the dominant logic of logistics research, the process of reduction leads to system descriptions (defined by the researchers and/or managers involved), in which hypotheses can be set and tested based on analytical procedures of collected data (the further separation of system elements). Cause–effect relationships are seen as particularly important for research. The knowledge generated is in its purest form stable, robust and deterministic, i.e. it can be used to explain and predict the relationship between the specific aspects defined for the system and can be generalised to other problems in other settings. Nair and Reed-Tsochas (2019, p. 89) state that “Several data sets in the operations and supply chain arena are likely non-linear in nature. Yet, we use linear methods to interpret regular structure in the data sets, with an assumption that the intrinsic dynamics of the system are governed by the linear paradigm that small causes lead to small effects”. The attention from managers for simplifying deterministic models and explanations are strong since, as found in the interviews, their desire for control and predictability in their logistics operations could make their workdays less troublesome. This desire for “simplicity” is addressed in cognitive science, where it has been found that people do seem to favour explanations which are simpler, i.e. with they have few independent assumptions or root causes (Lombrozo, 2016). Blanchard \textit{et al.} (2018, p. 1356), from their studies of the principles of Occam’s razor, suggest that “people’s preference for simpler hypotheses may in part be a natural consequence of the fact that their judgments approximate Bayesian inference – although it is unlikely that all effects of explanatory considerations in reasoning can be explained in this way”. Necessary assumptions for this knowledge generation process to function are independence, objective rationality, determinism and order, i.e. levels 1–3 in Boulding’s hierarchy of complexity, and the lower right section of Figure 2. The transfer of results back to the real world is often seen as troublesome (Choi \textit{et al.}, 2001).

The dominating logic based on Occam’s razor can be contrasted with Ashby’s (1956) law of requisite variety, that is, “control can be obtained only if the variety of the controller is as least as great as the variety of the situation to be controlled”. Something that in complexity thinking has been further described as the concept of incompressibility. Richardson (2004, p. 77) states that “the concept of incompressibility suggests [sic] that the best representation of a complex system is the system itself and that any representation other than the system itself will necessarily misrepresent certain aspects of the original system. This is a direct consequence of the nonlinearity inherent in complex systems”. The question therefore remains: to what degree can supply chain phenomena be reduced and still generate relevant, useful understanding and knowledge? Not least when new phenomena, knowledge and context are co-evolving.

In order for us to comprehend and handle higher levels of complexity, complexity theories (e.g. CAS and complexity thinking) brought into logistics management provide interesting approaches and models allowing us to understand, explain and improve the discipline. The number of papers using CAS theory for both understanding and knowledge generation of logistics and SCM has been growing, with Choi \textit{et al.} (2001) providing one of the early influential papers for the discipline. Using a CAS approach, assumptions made in levels 4–6 are emphasised and often used to more accurately explain the empirical reality being captured in the research (Thietart, 2016). Logistics phenomena are described in open-system settings where “observable” elements such as different actors
(e.g. focal company, supplier, customer) in chains or networks are treated by their heterogenetic nature (illustrated in the middle of Figure 2). Knowledge is regarded as based on a mixture of context-dependent aspects of a transformative nature linked with the ability to find rules in the system which can be identified and proactively designed to change the results of an organisation (Brown and Eisenhardt, 1997). The latter aspect is much influenced by biological observations and theories such as the flocking of birds based on a set of simple rules and the self-organising behaviour of ants. The increased realism from including heterogeneity, non-linearity and emergent patterns in models eases the transferability of results back to their original context. However, while an increased complexity is considered, a formative teleology is still present and the inter-subjective dimensions of interpretation and sense making marginalised.

As recognised from the interviews and apparent in the everyday life of most people, the human and social dimensions of various organisations are multifaceted and complex; levels 7–8 in the complexity hierarchy. The “necessary” reduction of reality for a study of logistics and supply chain phenomena where human and social aspects are still considered means that an aggregated set of assumptions appropriate to the context and situation studied should be kept (upper left part of Figure 2). On this level, lower-level assumptions are included and used for the appropriate parts of the phenomena studied, e.g. the routinised processes around picking goods, the time and distance between a storage facility and a retail outlet. However, due to the inter-subjective dimensions and the emergent outcomes from creative and adaptive processes where people are involved, these aspects cannot simply be reduced but need to be included in empirical investigations to ensure an understanding of the situation and context being targeted. Treating logistics as complex implies human involvement and consideration of paradoxes created in human interactions (Nilsson and Christopher, 2018). It also means considering the concrete, actual work being done and the mental models created by the humans involved in this work. As Nilsson (2005, p. 36) puts forward, “in such a situation there is no way the paradox can be resolved or eliminated by positivistic assumptions and claims, and therefore a different kind of logic is needed; a logic of a dialectic character”.

A dialectic logic of SD of supply chains, for example, calls for the need for several perspectives which can contribute to, and challenge each other in, the pursuit of improved situations. As Richardson et al. (2001, p. 13) state, “a principal requirement of a complexity-based epistemology is the exploration of perspectives”. The prime goal is not to reach harmony or resolve these paradoxes since the generation of solutions only creates new paradoxical situations in new circumstances – it is all part of the transformational process of identities, values, etc., which humans and organisations are co-creators of. Instead, paradoxes are sources of important tensions which, due to self-organisation, can lead to new innovative configurations as well as destructive ones (Ramirez, 2012). Nonetheless, while predictability and being fully objective and rational are seen as non-valid in any complex phenomenon involving people, a central assumption in complexity theory is that approaches and solutions can be developed which are more appropriate than others. For many situations, this calls for contextually derived approaches and methods, or at least contextually modified ones in which human behaviour is included and considered.

6. Concluding discussion
In this paper, the emphasis on perspectives and assumptions embedded in the complexity paradigm has been elaborated on aiming to contribute to more comprehensive and appropriate research in, and management of, logistics. It is proposed that complexity assumptions can be further included as an extended set of assumptions appropriate to increased realism in the advancement of the discipline. A key result, and input for further research, is that the recognition of logistics as complex means inclusion of human
and social aspects (which is apparent in any logistics process or phenomenon) in the knowledge-creation processes of logistics. While interconnected technical artefacts, i.e. physical and information-related devices, can be regarded as both complicated and complex to a certain degree, another dimension is added when these artefacts are put into a social context. In reality, this means that the subjective and often inter-subjective perceptions and interpretations of decision makers working with the artefacts increase the complexity of logistics phenomena. Consequently, this paper manifests that logistics processes and phenomena, where humans and different levels of organisational structures are involved, are not simply a sequence of mechanical devices which can be assumed to work along reductionistic and deterministic beliefs. Instead, logistics processes consist of a complex network of interdependent, living, innovative, and creative individuals who react and adapt dynamically to their perceived environment, and try proactively to create what they themselves, or collectively with others, find to be beneficial for their own and/or their organisation’s interests. It is in the interaction between people that coherent patterns of meaning and identity are perpetually created. The iterative results of these processes are paradoxical situations where the interests of different groups of people (i.e. teams, departments, functions, firms, supply chains, governmental bodies, etc.) are continually creating opportunities, at the same time as these processes restrain the developments of other processes. This is a perpetual process, and as Stacey (2003, p. 326) states, there are no levels separating the interacting groups of people, “only paradoxical processes of individuals forming the social while at the same time being formed by it”.

To conclude, it is proposed that by actively reflecting and deliberately considering more complexity in models constructed and knowledge generated by logistics researchers and managers, our ontological views may change, and thereafter the way we communicate our reflections and thoughts: our epistemological considerations. In the process of understanding change in any phenomenon, the individuals involved choose different levels of observation and perspectives based on their presumptions. While their choices are based on a great number of factors, the consequences of assumptions, perspectives, levels of observation and details in description are central for the type of understanding, explanation and results to be produced.

The further discourse is encouraged for the exploration and exploitation of the epistemological considerations into a paradigmatic view where the functionalistic emphasis is still incorporated, but other assumptions such as emergence, non-linearity, heterogeneity and self-organisation are brought into a comprehended view of logistics. This, not least, when the landscape in which logistics and supply chain managers are engaged in involve emerging concepts and practices such as circular economy and new business logics based on resource and value sharing in both social and industrial contexts. In line with Carter et al. (2015) proposing more multi-level research, and Nair and Reed-Tsochas’ (2019) inclusion of CAS-based empirical techniques, this paper suggests further studies with the inclusion of an extended set of assumptions and understanding of knowledge, especially related to human and social levels of complexity.

References


Further reading


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Abstract

Purpose – The purpose of this paper is to explore the processing of product returns at five case companies using a complex adaptive systems (CAS) logic to identify agent interactions, organization, schema, learning and the emergence of adaptations in the reverse supply chain.

Design/methodology/approach – Using a multiple-case study design, this research applies abductive reasoning to examine data from in-depth, semi-structured interviews and direct researcher observations collected during site visits at case companies.

Findings – Costly or high-risk returns may require agents to specialize the depth of their mental schema. Processing agents need freedom to interact, self-organize and learn from other agents to generate emergent ideas and adapt.

Practical implications – Limiting the depth of individual agent schema allows managers to better allocate labor to processing product returns during peak volume. To boost adaptability, managers need to craft a dynamic environment that encourages agents with diverse schema to interact, anticipate, and self-organize to brainstorm new ideas. Managers need to resist the urge to “control” the dynamic environment that ensues.

Originality/value – This paper builds on existing research that studies the key decision points in the analysis of product returns by exploring how processing-agent behaviors can create adaptability in the reverse supply chain. Additionally, this research follows in the tradition of Choi et al. (2001) and Surana et al. (2005) and proposes the application of CAS to a specific part of the supply chain – the processing of product returns.

Keywords North America, Case study, Reverse logistics, Supply chain processes

1. Introduction

Customers today expect more than ever before when shopping (e.g. instantaneous access to products, seamless shopping experiences), and forward supply chains have begun to respond to these demands by developing fast moving retail supply chains and omnichannels (Jones, 2018; Petro, 2018). Increasingly, customers are assimilating desires for accessibility and convenience into their expectations for returning products. So far, few supply chains have made modifications to their product return strategies to offset the costs associated with these evolving expectations (Dennis, 2018; Lindsey, 2016). However, the crucial role that product returns play in forging productive and sustainable consumer relationships is undeniable (Hjort et al., 2013). While every consumer/firm transaction
provides an opportunity to create consumer value (Kumar et al., 2010), returns are unique in that they begin with a negative experience that precipitates the return. When a firm acts to turn a negative experience into a positive one, consumers are often motivated to purchase again from the same firm and spread the word to others about the turnaround experience (Gesenhues, 2017).

Product returns require companies to perform a balancing act between setting policies that are simple enough to encourage repeat shopping, yet strict enough to prevent return abuse, while also maintaining an effective process to dispose of returned products (Goldman, 2016; Jack et al., 2010). Traditional product return strategies have focused on optimizing return policies to minimize returns as much as possible and/or identifying characteristics of “serial” returners (Daunt and Harris, 2012; Davis et al., 1998; Janakiraman and Ordonez, 2012). However, this optimization approach significantly downplays the importance of human behavior in product returns and largely ignores insights generated from the processing of returns. Returning a product involves the interaction of at least two people (e.g. the customer and the employee accepting the return) but typically more, all of whom have different motivations, power, and information-processing capabilities. Companies have traditionally assumed customers behave rationally when returning products (i.e. return a product because it is defective). However, shopping trends indicate customers are increasingly prioritizing their needs at the expense of the seller’s (e.g. buying multiple sizes of the same product with the intention of returning the sizes that do not fit; Welson-Rossman, 2018). Furthermore, the employees who evaluate and process returned products are not immune to decision-making errors. Thus, in comparison to return behaviors by customers, behaviors of employees processing product returns have received little attention in the literature, despite their substantial impact on a firm’s profitability.

Embracing and leveraging employee behaviors during the returns process represents one relatively untapped, alternative approach to the optimization of customer behaviors, with the potential to reveal product quality issues and suggest solutions to those issues in real time (Storer et al., 2014). This research applies complex adaptive systems (CAS) theory (Holland, 1995) to explore the different parts of the system that interact during the processing of product returns. More specifically, we will closely examine how employee behaviors can benefit or harm the system. Unlike an optimization strategy that assumes customer and employee behaviors do no harm, CAS theory studies both the benefits (e.g. creativity) and drawbacks (e.g. conflict) of human behavior on the system (Nilsson and Gammelgaard, 2012). One important research question that arises is:

**RQ1.** How can employee behaviors during the processing of product returns increase the reverse supply chain’s adaptability?

The objective of this paper is to explore the product returns process from a CAS perspective. Specifically, this research examines how interactions, learning, and adaptations occur during the processing of product returns. To achieve this purpose, we examine the product returns process at five different case companies to develop an in-depth understanding of the roles employee behaviors play. In the next section, we review the relevant literature, and offer a brief description of our abductive case study methodology. Next, detailed descriptions of the product return processes observed at each of the five case companies are provided, followed by a discussion of CAS-grounded patterns that emerged across the cases. The paper closes with a discussion of the implications of the current research and directions for future research.

### 2. Literature review

The conceptual research framework (see Figure 1) for this research is based on the intersection of the product returns process and CAS theory, and is grounded in research insights from the reverse logistics, supply chain management, natural and social sciences literatures.
2.1 Processing product returns

Timely processing is a strategic weapon companies can utilize to reduce the financial impact of returned products and build customer loyalty despite the failure of a product (Kocabasoglu et al., 2007). Monitoring product return rates has the potential to identify product issues that can be corrected immediately to prevent additional returns of the same product, however, few companies dedicate the necessary resources to gather and act on this type of information (Goldman, 2016; Ho et al., 2012; Lindsey, 2016).

Research by Stock et al. (2006) and Rogers et al. (2002) describes the typical product returns process as a series of steps products pass through sequentially. Stock et al. (2006) outline five key steps during which a returned product arrives at the processing center, is organized (by type of return, date received, etc.), inspected, and reconciled against the returns authorization before being dispositioned to recoup value. Rogers et al. (2002) take a broader view of the overall returns process, starting with the customer’s initial request to return a product and ending with monitoring return rates to identify problematic products. In practice, the order of the steps varies. For example, original equipment manufacturers of home domestic products (e.g. vacuum cleaners) that use third-party logistics (3PL) providers to facilitate product returns analyze product returns earlier in the process because they must determine if the retailer or 3PL will disposition the product (Bernon et al., 2013). Following an established returns process allows companies to reduce excess inventory, avoid storage costs and minimize the risk of product obsolescence (Autry et al., 2001; Blanchard, 2010; Stock and Mulki, 2009).

Analyzing product returns is the most important step in the returns process because employee decision making during this step will directly affect the disposition option chosen, and subsequently the value recouped from a returned product (Stock et al., 2006). Despite the significant financial implications of analyzing product returns, surprisingly few researchers have explored how employees make these decisions. Hazen et al. (2012) study employee disposition decisions and outline seven components of a disposition decision, such as scanning the external environment to determine if a market exists for an imperfect product. Tan and Kumar (2006) model key decision points (e.g. make or buy repair parts) that shape the profitability of returns. Beyond these few studies that identify important decision points in dispositioning returned products, very little is known about how employee behaviors impact the efficiency of the product returns process.
In addition to studying the analysis step in the product returns process, prior research also examines system design options to manage the flow of returned items (e.g. closed loop supply chain; Blackburn et al., 2004; Turrisi et al., 2013), including optimizing the put away of returns with picking orders for outbound shipments (Schrottenboer et al., 2017), and different disposition options (Hazen et al., 2012; Stock and Mulk, 2009). Ultimately, issuing partial refunds to customers to offset the costs of coordinating the processing of product returns may be the ideal return process outcome from the company’s point of view (Altug and Aydinliyim, 2016; Su, 2009).

2.2 Optimizing customer return behaviors
A second strategic weapon companies can rely on to protect their bottom line is their return policy. During the creation of return policies, companies often include specific restrictions (e.g. a 30-day return window) that stipulate the conditions under which a product can be returned (Piron and Young, 2001). The restrictions included in a return policy tend to increase the level of effort a customer must exert to return a product (Janakiraman and Ordonez, 2012), and the return policy itself acts as a pre-purchase signal of the quality of the retailer (Bonifield et al., 2010). Many companies view lenient return policies as a competitive way to signal their goodwill to customers and increase spending post-return, particularly in online transactions (Bower and Maxham, 2012; Janakiraman et al., 2016a; Oghazi et al., 2018). In fact, online firms such as Amazon have made it so easy to return, that consumer expectations have evolved to expect a no-questions-asked return policy (Safdar, 2018).

A sizable stream of research in the product returns literature studies how companies can reduce returns by optimizing the leniency of their policies (e.g. Petersen and Kumar, 2009; Powers and Jack, 2013). However, newer research is increasingly finding that too much leniency may damage the retailer–customer relationship. For example, Hjort and Lantz (2016) warn retailers to use caution when crafting lenient return policies, finding free returns tend to attract less profitable customers. Janakiraman et al. (2016b) instead suggest companies be selectively lenient based upon the reason for the return or the established relationship quality of the customer. However, optimized return policies often overlook the employee interactions involved in a product return, and ultimately limit the value that can be created during the returns process.

2.3 Complex adaptive systems theory
A CAS is “an interconnected network of multiple entities that exhibit adaptive action in response to changes in both the environment and the system of entities itself” (Pathak et al., 2007, p. 550). CAS theory studies how agents (defined as entities in a system that can be changed; Holland, 2014) relate and interact within a system to create super-additive outcomes (Nilsson and Gammelgaard, 2012). Agents in CAS can be humans, processes or important items that possess unique abilities to influence other agents in interactions and subsequently, the system as a whole (Holland, 1992; Nilsson and Gammelgaard, 2012).

One unique ability human agents possess in CAS are agent schema, or internal mental networks of information learned through prior experience, that agents rely on when processing information and making decisions (Choi et al., 2001; Pathak et al., 2009; Surana et al., 2005). Agents organize their schema by developing nodes (defined as a central mental location that stores information about similar topics) and linkages (defined as mental associations that connect related nodes; Hawkins and Mothersbaugh, 2010). With experience, agents develop heuristic information-processing mechanisms for routine decisions, so that in future interactions, the activation of one node will automatically activate other nodes heuristically associated with it (Hawkins and Mothersbaugh, 2010; Vohs et al., 2008).
Agents in CAS frequently learn from their own experiences and through interactions with other agents. When agents encounter a novel situation, they may perform first-order learning where they attempt to craft a solution by comparing familiar aspects of the situation to information stored in their mental schema (Dooley, 1997). Based upon the comparisons and their intuition, agents experiment with solutions to solve the problem (Allen, 2000). CAS also encourages second-order agent learning (defined as an agent’s ability to learn how to learn in new ways; Schon, 1975) through interactions with other agents. Effective strategies generated by one agent through first-order learning can be shared directly with other agents in interactions, which become adaptive interactions when those other agents learn how to respond to novel problems through the experience of the first agent (Holland, 2014).

As agents make decisions after interactions with other agents, feedback loops form (Stacey et al., 2000; Wysick et al., 2008). Even seemingly small decisions (such as “is the information I have obtained from this interaction useful?”) can quickly be magnified and influence other agents in the system (Holland, 2014). For example, if an agent decides the information learned in a recent interaction is not useful, s/he may refrain from sharing it with other agents and/or avoid interacting with specific agents in the future (Nilsson, 2006; Stacey et al., 2000). This chaotic, non-linear behavior, where a small decision by an agent has a disproportionately larger effect on CAS, coupled with the frequent occurrence of unusual events (called fat-tailed behavior) keep the CAS in a state of perpetual novelty and require agents to constantly adapt (Choi et al., 2001; Holland, 2014; Surana et al., 2005).

CAS rarely reach a state of equilibrium, which forces agents to make decisions and adapt based on imperfect information about the state of other agents and the consequences of their decisions (Holland, 2014; Nilsson and Gammelgaard, 2012; Simon, 1991). Agents compensate for this dynamic state through self-organization, whereby they rely upon information provided by fellow agents rather than a formalized system leader to anticipate necessary changes (Choi et al., 2001; Potts, 1984). Anticipatory agent actions add additional non-linearity to CAS, but yield emergent adaptations, where the whole adaptation is more than the sum of the ideas generated by individual agents (Holland, 2014). The diverse schema, shared experiences and skills of agents within an uncertain, dynamic CAS environment are the essential ingredients for the emergence of adaptations to occur (Allen, 2000; Choi et al., 2001).

In the supply chain management literature, Choi et al. (2001) were among the first to apply CAS theory to supply networks and identify specific behaviors complex adaptive supply networks (CASN) exhibit. Choi et al. proposed that firms with similar levels of shared schema within a supply network will perform better than firms with different levels of shared schema. Surana et al. (2005) also argue for supply chains to be treated as CAS, and utilize CAS concepts in conjunction with network dynamics to improve the modeling of collaboration relationships in supply chains. Nilsson and Darley (2006) offer insights to improve the modeling of interrelationships between manufacturing and logistics operations using agent-based simulations to increase the knowledge and intuition of decision makers. Wysick et al. (2008) study supply networks through the lens of CAS theory, and explore the vulnerability of these networks to fat-tailed behavior, like the bullwhip effect, and recommend the implementation of neural networks to help manage extreme events. Li et al. (2010) examine the internal and external forces that drive the development of CASN, and offer a self-organizing evolutionary model to explain how CASN form.

In the reverse logistics literature, the application of CAS theory has revealed how to evaluate different value recovery options for original equipment manufacturers (Lehr et al., 2013) and how to best manage green supply chains (Sarkis et al., 2010). CAS theory has many useful applications in reverse logistics beyond these initial studies, particularly as a means of understanding agent behaviors during the processing of product returns.
3. Methodology

3.1 Research approach

The purpose of the current research study is to explore the product returns process through a CAS theoretical lens. Agents within the product returns system serve as the unit of analysis for the current research. We collect the knowledge and opinions of reverse logistics managers across different reverse supply chains to understand the various types of agent behaviors in the product returns system (Yin, 2018). All informants generously granted us access to their managers who oversee product returns, who by the nature of their positions, were able to provide us with the in-depth information we required. Understandably, most informants could not grant us full access to their product return processor employees due to the time-sensitivity of their business.

A case study methodology was selected because the processing of product returns is a function embedded within a company’s supply chain, and case study research is well-suited for studying a phenomenon “in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident” as the boundaries between forward and reverse logistics often are not (Yin, 2018, p. 15). Specifically, an abductive case study methodology allowed us to identify generalizable and specific CAS properties among our five case companies (Kovacs and Spens, 2005). Following the established abductive research procedures discussed by Kovacs and Spens (2005), our research occurred in three stages. In the first stage of the research, we were contacted by a multi-billion dollar US-based technology products company and asked to evaluate their product returns processes. To do this, we recorded detailed observations of their processes while touring their distribution center and conducted in-depth interviews with employees including the logistics director and senior reverse logistics manager.

During the second stage, we reviewed the academic literature to identify theoretical insights that aligned with the product returns process at the technology products company. We found that existing research describing the steps in the product returns process did not fully match those of the technology products company, and we therefore used CAS theory as a theoretical framework to better understand the company’s processes. In addition, we also constructed a case study protocol (see Table I) that included broad discussion points related to components of the reverse supply chain of interest (e.g. software used to process returns), but carefully avoided making any direct or indirect references to CAS theory, so we did not “lead” respondents to discuss complexity (Edmondson and McManus, 2007; Yin, 2018). Instead, interview protocol questions focused on understanding the full breadth and depth of informants’ experiences with product returns. Prior to each site visit, these questions were reviewed by two academics to identify ambiguous wording or topical omissions.

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<tr>
<td><strong>Table I.</strong></td>
<td>Case study protocol questions</td>
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<tr>
<td>1.</td>
<td>What systems and processes do you use to manage returns?</td>
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<td>2.</td>
<td>What are the different end-life options for returned products?</td>
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<tr>
<td>3.</td>
<td>How many vendors/customers do you accept returns from?</td>
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<td>4.</td>
<td>What similarities in your returns process exist across most of your vendors? Unique to each vendor?</td>
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<tr>
<td>5.</td>
<td>How do you try to reduce returns?</td>
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<tr>
<td>6.</td>
<td>Who is involved in reducing returns? (Functions? Supply chain partners?)</td>
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<td>7.</td>
<td>Walk me through what happens to products/components that are returned.</td>
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<tr>
<td>8.</td>
<td>How important is [the returns process] to your organization?</td>
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<td>9.</td>
<td>How are return initiatives developed? Who helps develop them? What areas of your business do these initiatives help?</td>
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<tr>
<td>10.</td>
<td>What kind of software do you use to manage your returns?</td>
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<td>11.</td>
<td>What are the key functionalities of this software?</td>
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<tr>
<td>12.</td>
<td>What are the drivers and motivators for product return activities? Why are they important?</td>
</tr>
<tr>
<td>13.</td>
<td>What are the outcomes of product return activities? Why are they important?</td>
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</table>
Exploring the processing of product returns

3.2 Overview of research setting
The technology products company, which served as the starting point for this multiple-case study, is an American-based multinational distributor of IT products and services with over $25bn in sales annually. This firm processes approximately 2m returned products each year, and has the opportunity to act as a third-party returns processor for several potential clients. In addition, four other national or multinational companies that sell different types of products were included in this multiple-case study to allow for the identification of generalizable and specific properties (Kovacs and Spens, 2005). The four other companies were purposively selected for inclusion in our research based upon the type of product sold and their position in the supply chain to maximize variation in our informants. Table II summarizes the case companies included in the multiple-case study and contains descriptions of their products, primary selling location, sales and return volume.

3.3 Data collection
Data collection started in 2014 and ended in 2015. We conducted six semi-structured interviews with employees from five different types of companies. All five companies were visited in person. Site visits began with a tour of the distribution facilities, during which direct observations were hand-recorded by a member of the research team in a small notebook. Following the tours, we conducted the in-depth interviews. The audio of all interviews was recorded on a tape recorder. Table III details the profile of each informant, including their pseudonyms, titles and background information.

3.4 Data analysis
All interviews (lasting 20–120 min) were digitally recorded and professionally transcribed. Immediately following the visit, all direct observations from site visits were typed out based on the research team's handwritten notes. To conduct our data analysis, we adopted a theoretical orientation and utilized insights from CAS to organize our analysis (Yin, 2018). All interview and direct observation documents from each case were coded and analyzed in the NVivo 10 software (QSR International, 2012). The analysis was conducted after each site visit in order to deepen the research team's understanding of the data and identify any interview protocol refinements that should be made based upon emerging themes or issues (Chakkol et al., 2014). Results of the analysis were then shared with each case organization, and each informant verified the accuracy of our records and interpretations to ensure the

<table>
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<tr>
<th>Case</th>
<th>Product</th>
<th>Location</th>
<th>Customer type</th>
<th>Sales</th>
<th>Annual return volume</th>
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<tbody>
<tr>
<td>A</td>
<td>Technology products</td>
<td>US based</td>
<td>Multinational</td>
<td>$25bn</td>
<td>2m pieces</td>
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<td>B</td>
<td>Apparel</td>
<td>US based</td>
<td>Multinational</td>
<td>$12bn</td>
<td>150,000 pieces</td>
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<td>C</td>
<td>Automotive parts</td>
<td>US based</td>
<td>Multinational</td>
<td>$9bn</td>
<td>5m pieces</td>
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<tr>
<td>D</td>
<td>Furniture</td>
<td>US based</td>
<td>National</td>
<td>$2bn</td>
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<td>E</td>
<td>Laboratory equipment</td>
<td>Internationally based</td>
<td>Multinational</td>
<td>$350m</td>
<td>200 pieces</td>
</tr>
</tbody>
</table>

Table II. Summary of case companies
<table>
<thead>
<tr>
<th>Industry</th>
<th>Position in supply chain</th>
<th>Types of returns</th>
<th>Informant name</th>
<th>Informant job title</th>
<th>Informant description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case A – Technology products company</td>
<td>Technology products Distributor/manufacturer</td>
<td>Devices, parts</td>
<td>Belle</td>
<td>Senior Logistics Manager of Reverse Logistics</td>
<td>With 8 years in the industry, 8 years at the company, and 1 year in her current position, Belle is responsible for overseeing reverse logistics teams and taking care of their administrative duties</td>
</tr>
<tr>
<td>Case B – Apparel</td>
<td>Manufacturer</td>
<td>Clothing items</td>
<td>John</td>
<td>Director of Distribution</td>
<td>With 13 years' experience in logistics, 5 years at the company, and 1.5 years in his current position, John is responsible for the financial and service aspects of all in-bound and out-bound shipments</td>
</tr>
<tr>
<td>Case C – Automotive parts</td>
<td>Distributor/retailer</td>
<td>Machinery, parts</td>
<td>Mike</td>
<td>Out-bound Operations Manager</td>
<td>With 4 years in the industry, 4 years at the company, and 1.5 years in his current position, Mike is responsible for selection, replenishment and shipping</td>
</tr>
<tr>
<td>Case D – Furniture</td>
<td>Retailer</td>
<td>Furniture</td>
<td>Elliot</td>
<td>Regional Manager of Distribution</td>
<td>With 25 years in the industry, 9 years at the company, and 3 years in his current position, Elliot is responsible for overseeing the distribution of three facilities and outlet stores</td>
</tr>
<tr>
<td>Case E – Laboratory equipment</td>
<td>Retailer</td>
<td>Machinery, parts</td>
<td>Nick</td>
<td>Operations Manager</td>
<td>With 9 years' experience in logistics, 2 years at the company and 2 years in his current position, Nick is responsible for out-bound shipping, returns, and facility management</td>
</tr>
</tbody>
</table>

**Note:** Names are pseudonyms to protect the anonymity of informants.
validity of our data (Yin, 2018). The next section describes the within-case patterns observed at each company, followed by a discussion of the cross-case patterns observed across all of the case companies.

4. Within-case findings
This section details the results for each case without discussing generalizable patterns across the cases, which will be done in Section 5. The case results proceed as follows:

- description of agents and resources;
- description of agent interactions and organization;
- description of agent schema and learning; and
- description of emergent adaptations.

4.1 Case A – processing technology product returns
Processing product returns at the technology products company involves several agents of varying influence, including the customer, customer service representative, front-line return processors, exception specialists and the senior manager of reverse logistics. Of these human agents, the front-line and exception processors make the key decisions, and therefore have the most influence, on the returns process. The primary resources include the returned products and information system.

To mitigate the risk of customer deviance, product returns are processed in one of two tracks: a "normal track" and an "exception track." Direct researcher observations reveal that all returned products begin processing when they arrive at the distribution center and are sorted by date of arrival on pallets. Front-line processors begin to interact with the returned products by moving the pallets to their workstation and inspecting the product actually returned to determine if it matches the returns authorization. If the product and returns authorization match, the returned product enters the "normal track" and the front-line processor will make a disposition decision based upon the condition of the product.

Products that do not match the returns authorization enter the "exception track" and are sent to an exception specialist for extra processing. Exception specialists have additional training beyond front-line processors, and are particularly adept at handling problematic returns. Dave (see Table III) describes exception processing at the technology products company as more interactive, requiring back and forth communication between the exception specialist, customer service representative and the customer:

And that communication [about the product’s identity] is essentially a back-and-forth communication between us at our site – because we are hands on and we can visually see what we have – versus the decision makers at [customer service], who have to determine whether or not we issue the credit to the customer. (Dave, Logistics Director, Technology products company)

Human agents at the technology products company interact frequently with the reverse supply chain’s information system to access information required to process each return, including customer transaction data. However, this information system operates on a unique programming language developed in-house (termed legacy system going forward), and does not communicate well with the newer enterprise resource planning (ERP) system used to manage forward logistics. The legacy system has a significant impact on processing product returns, requiring front-line processors to go through at least five to ten extra screens to process a single return and update the salable stock database.

As they process product returns, front-line and exception processors at the technology products company rely on specialized schema that house information about the different types of products sold, common issues with those products, and potential fixes for each product.
Processors use their schema when evaluating a returned product’s identity and condition, and often assume a detective role to look for hidden clues (e.g., incorrect product box used to return an item) to determine the legitimacy of a return. Front-line processors handle a broad variety of returns that require different amounts and types of knowledge. Processors learn new information through resources available online—typically a vendor’s website for product descriptions or Google for pictures of the product.

Dave asks employees to share ideas they come up with from their day-to-day job responsibilities with the rest of the department. While Dave’s leadership style has generated some best practices to improve the usage of recyclable materials in outbound shipments, few ideas have been generated to improve the processing of product returns. Managers at the technology products company are acutely aware of their need to improve their legacy system, but struggle with generating ideas on how to adapt the information system:

As we are taking on new types of business that are a little bit outside of our norm, we’re finding that we are trying to have to manipulate this archaic system to a tremendous amount, and it is increasing a lot of steps—extra steps and things like that—that we’re not accustomed to doing with our normal business, that has made it very difficult to adapt to new business opportunities.

(Dave, Logistics Director, Technology products company)

4.2 Case B—processing apparel returns

Agents involved in the processing of returned products at the apparel company include the customer, customer service representative, processors, and the reverse logistics manager. The processors have the most influence. Resources include the product, information system and product offering catalogs.

Processing returns at the apparel company is a research-intensive, highly manual process which begins when returned clothing items arrive at the distribution center and enter the returns area:

So, typically in the returns process, if it’s coming from a retailer, they’ve got to reach out to customer service […] let us know what they are planning on returning […] whether it was a defective item, whether or not we made an agreement from an inventory standpoint that they can return stuff that they didn’t sell, or for other purposes. So, they reach out to customer service, customer service will generate a returns authorization and then that will allow them to start shipping the product back to us. (John, Director of Distribution, Apparel company)

Processors check the returns authorization in the information system, but must visually identify each product returned because the apparel company screen prints and distributes for numerous retailers and does not put their own SKU information on each finished clothing item. Instead, processors work backwards from the description of the items on the returns authorization and what the items look like to determine the style of shirt and locate the correct SKU to reenter into inventory. For popular styles, this process takes only a few minutes. If the style is difficult to locate, processing one item could take up to a few hours. In a typical month, the apparel company has 40,000 to 50,000 active SKUs eligible to be returned, which includes SKUs for blank clothing items (i.e., no team or player printed on the clothing item) and customized blanks for 30+ teams and/or players across several sports leagues. Once the correct SKU is located, processors decide whether the clothing item can be re-sold, recycled or donated.

Processors at the apparel company develop highly specialized schema through experience researching the different apparel items sold in company catalogs or online. Therefore, during high volume periods, it is easy for a backlog of returns to pile up since labor cannot be easily reassigned from pickers and packers of outbound shipments:

So, I end up having to use my packing capacity, cross-training people there to help do returns. Returns associates tend to have specialized knowledge, so outbound associates cannot easily fill in or help with returns. (John, Director of Distribution, Apparel company)
Processors must also be knowledgeable about sports seasons, player trades, team logo/color changes and time-sensitive game schedules when making a disposition decision about returned items.

John has visions of what an ideal information system should function like for processing apparel returns:

Well, we’d love to just be able to take a picture of the shirt. and have it automatically look up and tell you what style it was. If we were going to start from scratch. If Apple was designing the system. so, you could take your iTouch or your iPhone or iPad […] you’d take a picture and it would tell you exactly what it is. (John, Director of Distribution, Apparel company)

However, John and his team face challenges associated with the technological shortcomings of the legacy system, and the internal processes required to adapt the system to meet business needs:

When you have old legacy systems, it becomes very difficult and sometimes painful to get changes approved. So, there’s two different ways we’ve created. One way is to come up with a creative way to work around the system to get what you want, or a creative way to change the system that doesn’t require extensive amounts of resources. [The second way], if we want a process change is we will go to the systems group and say, “currently the system does this, and we want it to do that.” They’ll say, “okay, based on what you want, your specifications, it will take us 700 programming hours.” We know we can’t afford that, so how do we modify that and maybe change it up a little bit, so we can get the hours down to an affordable amount, so there will be a payback on the process […] So, you have to prioritize what changes are the most important to get us the biggest bang for our buck, and how do you make sure that we’re not investing too much money into those legacy systems? (John, Director of Distribution, Apparel company)

Many processors at the apparel company have worked there for years, so even changes that do ultimately get implemented still need to gather agent buy-in to be successful.

4.3 Case C – processing automotive part returns

Agents involved in the processing of automotive part returns include the company’s retail stores, processors, and the in-bound goods manager. Processors have the most influence on the processing of returned products. However, the retail stores have some power because they decide what returns to accept, and the processors often feel obligated to keep the stores happy. The primary resources include product returns and the information system.

Returns processing at the automotive parts company begins at the store level, and ideally each store will sort the products being returned into different categories (e.g. overstock, defective parts) on different pallets. However, in practice, the stores rarely sort the returned products and this adds additional processing steps at the distribution center:

If [the pallet] is really mixed, what happens is we need to have a person kind of separate it out. And then process everything that way. And then once everything is separated out, it goes into the avenues that it needs to go into […] There’s an authorization to return that is there. they will scan that. The system will cross-reference that authorization to return number with what type of SKU the store said they were going to send back […] If everything matches up, the system will then say, “okay, it’s received, put it in a container that they set up for put away.” And basically, our put away is zoned out. Every location in our building is zoned out. So, it will say, “you already have a container set up for zone 87” and if they receive something into inventory that is for zone 87, it will say, “put it in this container.” (Mike, Out-bound operations manager, Automotive parts company)

The automotive parts company has been able to use a popular application-developed IBM DOS-based system to manage returns for 20+ years because they can easily find programmers
versed in the universal programming language of DOS. In-house programmers are available to make necessary changes to the information system, which has resulted in a quick, efficient routine for processors to interact with:

Yeah, it is actually one of the fastest systems you could use because the overhead is so small on a DOS-based system [...] You know, if you are a cost making facility like we are - we are basically a money sink, this building – that’s what it is. Speed is the key. (Mike, Out-bound operations manager, Automotive parts company)

Processor interactions during the returns process are fairly limited by automation, and errors occur frequently because most returned parts have multiple identification numbers attached to them. Processor schema of the different types of parts is the primary defense against these types of errors. Processors learn new product information through experience, and also can join specialized groups (e.g. slotting group) to learn additional information (e.g. how products are slotted in the warehouse):

Every SKU has a couple identification numbers. For us in the building, the SKU is the master number. But, we also have a parameter ID number [...] and then we have a part number [...] just the nature of having three numbers to identify one product, you can see we could have multiple numbers to scan and one number that identifies two different things [...] our team members have to be smart enough, that when they are receiving back an engine- for some reason, it happens a lot with engines maybe because of how long a sales life of an engine lasts- you don’t want to give store credit for a hose. And the store will be like “oh, hey you shorted me like $3000” and if you look back, the team member scanned the SKU, but didn’t realize that there were two options. And that they were supposed to pick the engine part. (Mike, Out-bound operations manager, Automotive parts company)

Overall, the automotive parts company has attempted to streamline the analysis of product returns as much as possible, with the goal of one day completely eliminating the need for a reclamation department. To accomplish this goal, the automotive parts company acts on innovation ideas that emerge from processors or managers:

But one of the things that we did [...] is a module or a conveyor for reclamation. As you can see there is a lot of sorting that needs to be done. To me, it’s no different than selecting for a store [...] I don’t see why we can’t have a conveyor that will sort out each [returned] product by the zones in which it goes in the building, and then for us to put it away, instead of it being such a manual process.

4.4 Case D – processing furniture returns

Several types of agents are involved in the processing of furniture returns, including the customer, customer service representative, line processors, shop processors, quality control processors and the distribution manager. Shop processors and quality control processors have the most influence. The primary resources include product returns and the information system.

Product returns arrive at the distribution center primarily on company delivery trucks and are stored in “yard-dogs” (“yard-dogs” are semi-trailers used for storage in cargo yards or warehouse facilities) until the line processors are ready for them. Each processing bay in the returns department has two conveyor lines in it – a large line used for big furniture pieces and mattresses, and a second slender line used for mirrors and headboards. Line processors first match the furniture pieces to the return manifests, and then send the pieces to the quality department for a safety inspection and to determine the best disposition option for the pieces:

When a piece comes back, it’s inspected by our quality department. If a piece is deemed that it’s perfect, we will just box it back up or wrap it back up and put it back on the shelves or in the racks.
If the piece has some damage, it will be repaired. If it can be repaired to new, it will be put back in the racks, if it can be repaired and sold as is, then that piece will go over to our clearance area to be shipped out to one of our clearance stores and be sold. If a piece is damaged beyond repair and cannot be sold because it’s a liability if we did sell it because the chair might not be strong enough, we just total loss that piece, where we will take a hit on it in terms of inventory. If the piece is in between, then we will use liquidators and they’ll buy the product and sell it. (Elliot, Regional Manager of Distribution, Furniture company)

The furniture company utilizes a customized, legacy system to store customer transaction data, returns manifests, and track inventory. Elliot cited the ability to take ideas from processors and customize their legacy system as key to the facility’s success in processing returns. To make modifications to the information system, the furniture company has an established chain of command that starts with an approval from the Vice President of Distribution before being sent to the in-house programmers who will actually make the requested modifications.

An agent’s established schema is of paramount importance in the quality and shop departments, as it is the primary line of defense in protecting customers and ensuring all returned furniture pieces are safe enough to be resold:

Just because the customer said that one problem, we have to make sure that every inch of that piece is still good. So [the quality control processor] will go and inspect it, and based on that inspection and the years he has been here, and knowing what can and can’t be fixed, it will go to the shop and [the shop processor] will decide whether he can fix it 100% so it can be sold as new, or what the next step would be, on down the line to either clearance or salvage. (Elliot, Regional Manager of Distribution, Furniture company)

Because of the amount of knowledge required to work in the quality or shop departments, the furniture company does not hire people directly into these job positions, but instead promotes employees from within other areas of the company who have developed a well-rounded schema. This promotional process ensures that quality and shop agents are adept at learning new product information, as well as learning from other agents:

The jobs that are most technical are shop and are quality control just in terms of the knowledge you need to have in terms of how to fix things properly so [the furniture piece] wears correctly. So those promotional positions-most people don’t come in in a shop position, they grow into it based on learning the rest of the business. So, in order to get that job, you have to pass a test in terms of knowing how to repair things and how to do things. But then you’re continuously taught and given tests to make sure that you haven’t lost the ability to do certain things because maybe you say you’re fixing something, but you’re not fixing something properly. (Elliot, Regional Manager of Distribution, Furniture company)

The furniture company relies on insights generated from the day-to-day processing of returns in the shop and quality departments to identify furniture pieces that are repeatedly returned:

So, when [processors] see pieces coming back and they see a problem they might take a whole dresser apart. They might take an upholstered sofa apart just to look at how it was actually built. And then if they find a problem, that’s when pictures are taken and communicated back to the buyer so changes can be made. (Elliot, Regional Manager of Distribution, Furniture company)

The furniture company routinely shares insights generated from agents to other distribution centers through videos, and encourages the agents who came up with the idea to create the videos.

4.5 Case E – processing laboratory equipment returns

Agents involved in the processing of laboratory equipment returns include the customer, customer service representative, sales representative, in-bound processor, and service
center processor. The reason for a product return has the most influence on the returns process, so the customer service representatives actually have the most influence. Resources include the product and information system.

Because of the lower volume and potential costs of product returns to the laboratory equipment company, returned items are screened extensively on the reason for the return:

So, we look at the reason that drives [the return]. So, either the product is defective – whether it’s an out of box failure or it’s some type of warranty issue. The incorrect application was developed, so the sales guys go out there and determine what the needs of the companies are. Sometimes they don’t always get it right. So, the type of application will vary what type of instruments they need – do they need wet chemistry, dry chemistry in that field? So, if the sales guy gets that wrong, it’s an acknowledgement that the sales guy got that wrong, we will bring that product back. We’re probably going to get another product that will soothe their needs […] There’s also some customer driven reasons. So, the customer made a mistake ordering the product. They change their mind and they no longer want it. Or the damage was caused in transit, but they provided the transportation, instead of us providing the transportation. (Nick, Operations Manager, Laboratory equipment company)

Once the reason for the return is determined, either an onsite fix will be attempted, or a return merchandise authorization is generated and the product is shipped back to the warehouse to be repaired:

So, the process then is that [the salespeople] try to do an onsite fix if they can. If they can’t, then they go back through their chain of command to get permission to get the out-of-box failure authorized. So, then customer service gets contacted, they do a no charge order, which generates a movement for me to ship out a replacement item and for [them] to return the broken one. The [sales] guy on site will repackage that and ship it back to us. (Nick, Operations Manager, Laboratory equipment company)

Once shipped back to the warehouse, in-bound processors reenter returned items in new condition into inventory or send out-of-box failure equipment to the service center to be fixed. Opened returned items or irreparable out-of-box failure equipment cannot be resold and are typically scrapped or returned to the manufacturer.

The main role processor schemas play during the analysis of returned products at the laboratory equipment company is to determine whether a returned item is in new condition or determining if an instrument can be repaired. Processors learn information related to product condition by looking it up in the company’s database, but may reach out to product managers involved in product design with specific repair questions:

The person that works in receiving has a decision to make- is it in new condition? So, new condition means it’s originally packaged, it’s sealed, and can go right back on the shelf. If it’s been opened, because of the nature of our products, because chemistry gets ran through and chemicals get ran through it, it goes right to scrap if it’s consumable. Versus the instruments will go through the service center, and they will look at them. (Nick, Operations Manager, Laboratory equipment company)

The laboratory equipment company uses a return materials authorization procedure within a Sage ERP system to store transaction data, track the movement of returned items within their warehouse and issue credit to the customer. This information system and the product returns process was only a year old at the time of the site visit. Prior to that, processing and analyzing returns was messy and riddled with inaccurate information about what a customer was authorized to return:

We changed our customer returns process about a year ago. So, what we did was we flowcharted everything out. And by using the different departments, we kind of brainstormed together to come up with, well what’s the best answer? Because we didn’t have a great answer at the time, everything that we’re talking about now has been active for about a year. So, before there was a lot of
miscommunication between customer service and what was authorized to be returned- what was the dollar amount, who was authorizing it? So, it changed because we didn’t have a good solid policy. (Nick, Operations Manager, Laboratory equipment company)

5. Cross-case findings
This section analyzes the data from each case company jointly with the goal of synthesizing cross-case patterns (Yin, 2018), of agent interactions and organization, schema and learning and emergent adaptations. Table IV summarizes the key cross-case CAS findings by company.

5.1 Agent interactions and organization
In CAS, agents interact and make decisions based on imperfect information and their intuition, which impacts other parts of the system and creates feedback loops (Chan, 2001; Holland, 2014; Wysick et al., 2008). Our data indicates all five case companies have some type of customer service, front-line processing, and manager agents involved in processing product returns, however, customer service and manager agents play a background role during the actual inspection and analysis of returned products. The following discussion focuses on the processing agents. Cases A, D and E have more than one level of processing agents, and the more senior processing agents (e.g. exception specialists in Case A) possess greater training and experience.

Each case company took a different approach to structuring agent interactions and organization:

• In Case A, agent interactions are limited by design to reduce risk, and returns requiring more intensive interactions are routed to an exception specialist. The ability of individual agents to self-organize is constrained by the rigid separation of processing agents into specialized levels.

• In Case B, agent interactions follow a general process of looking up products, but each agent is afforded autonomy in determining the best way to process a return. Agents are given the freedom to self-organize, however, many prefer not to due to their tenure and wanting to stick with the status quo.

• In Case C, agent interactions are automated as much as possible to conserve agent capabilities for problematic returns that arise. Agents are encouraged to self-organize and join company-sponsored groups around topics that interest them.

• In Case D, agent interactions and decisions are split across several different agents, so that agents with the most experience make the more important decisions. Agents self-organize and are encouraged to share ideas with other agents and management.

• In Case E, agent interactions depend on the reason for the return, but all must follow the newly implemented company-wide policy. Agents can self-organize to process out of box failures, but otherwise may not, due to the low volume of returns.

Looking across these cases, informants utilize different types of processing agents – some have only a single type of agent while others have two or more different types. Cases B and C have only one general type of processing agent, while Cases A and E have two types of processing agents, and Case D has three types of processing agents. The required level of agent specialization appears to be correlated with the risk and/or costs associated with the returns. Product returns in Cases A, D and E can often be of expensive items, so maintaining general and more specialized processing agents can help to minimize the financial risk of these returns. Returns in Case D require a third type of processing agent due to the additional risk of serious injury associated with reselling a defective piece of furniture.
<table>
<thead>
<tr>
<th>Case: return category</th>
<th>Agent interactions</th>
<th>Agent organization</th>
<th>Agent schema</th>
<th>Agent learning</th>
<th>Emergence</th>
<th>Adaptations</th>
<th>Adaptation examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: technology products</td>
<td>Interactions limited to reduce risk</td>
<td>Limited self-organization allowed</td>
<td>Covers products, common issues and potential fixes</td>
<td>First-order only</td>
<td>Non-Existent</td>
<td>Unable to adapt</td>
<td>n/a</td>
</tr>
<tr>
<td>B: apparel</td>
<td>Interactions not limited</td>
<td>Self-organization allowed, but agents may avoid due to effort required</td>
<td>Include product-related and sports-related knowledge</td>
<td>First-order primarily</td>
<td>Ideas emerge from agents</td>
<td>Agents often resist adapting</td>
<td>n/a</td>
</tr>
<tr>
<td>C: automotive parts</td>
<td>Interactions encouraged</td>
<td>Self-organization encouraged</td>
<td>General knowledge of parts and condition</td>
<td>First order and second order</td>
<td>Relies on agent-generated emergent ideas</td>
<td>Agents adapt successfully</td>
<td>Conveyor system for putting returns away</td>
</tr>
<tr>
<td>D: furniture</td>
<td>Interactions separated across 3 types of agents based on experience</td>
<td>Self-organization is encouraged</td>
<td>Covers types of furniture, materials, common issues, potential fixes, and wear patterns split amongst different agents</td>
<td>First order and second order</td>
<td>Relies on agent-generated emergent ideas</td>
<td>Agents adapt successfully</td>
<td>Relying on agents to identify frequently returned pieces and deconstructing them to identify the source of the problem(s)</td>
</tr>
<tr>
<td>E: laboratory equipment</td>
<td>Interactions guided by new company policy</td>
<td>Self-organization can occur with some returns, but often does not due to low return volume</td>
<td>Covers product condition and potential fixes</td>
<td>First-order primarily</td>
<td>Ideas emerge from agents</td>
<td>Agents unmotivated to adapt until absolutely necessary</td>
<td>Overhauling the product returns process and educating employees company-wide</td>
</tr>
</tbody>
</table>
When it comes to how agents interact, agents in Cases B, C and D follow a general processing pattern, but are allowed to self-organize and learn from other agents when analyzing a returned item. Agents in Cases A and E have less autonomy and are more restricted in how they interact and organize due to rigid track structures and low return rates, respectively.

5.2 Agent schema and learning

In CAS, agents evaluate interactions they participate in to identify relevant portions of their existing schema to apply when making routine decisions or identifying novel situation-specific solutions (Dooley, 1997; Holland, 2014). Agents can also learn new solutions from other agents (Schon, 1975). Across the five case examples, different depths of agent schema and amounts of agent learning were described:

- In Case A, agent schema cover types of products, common issues, and potential fixes. Agents often encounter new products and rely on first-order learning via the company’s website or Google to gather new information.
- In Case B, agent schema include both product-related and sports-related nodes of information. Agents rely on first-order learning via printed catalogs to learn new product information.
- In Case C, agent schema consist of general knowledge of the types of car parts and their condition. Agents access new information through first-order learning with the information system or second-order learning by joining specialized company groups.
- In Case D, agent schema cover types of furniture, materials, common quality issues, potential fixes, and future wear patterns. Agents acquire new information through first-order learning by working in different parts of the warehouse and through second-order learning from other agents throughout the company.
- In Case E, agent schema include product condition and potential fixes. Agents learn new information primarily through first-order learning via the company’s database, but occasionally through second-order learning with other agents.

Looking across these cases, agent schemas are smaller and possession of important information is split amongst different types of agents in Cases A, D and E. Cases A, D and E all have agents with shallower schemas do the initial screening of product returns. These agents are able to process simple returns, but more complicated returns are handled by agents with more developed schema. Agents in Cases B and C must handle all types of returns, regardless of the development of their schema. This is not an issue for agents in Case C due to the sophisticated automation of the information system, but did contribute to bogging down the processing of product returns during peak volume times in Case B.

When it comes to how agents learn, agents in Cases A, B and E learn primarily through first-order learning and company resources, while agents in Cases C and D encourage agents to learn primarily through second-order learning in agent-to-agent interactions. Learning in interactions appears to occur more quickly and effectively than through resources, since managers in Cases C and D were better able to reassign labor from other parts of their warehouse to help out with processing product returns during high volume. Managers in Cases A and B typically do not reassign labor, and instead let processing agents work through the backlog as quickly as they can.

5.3 Emergent adaptations

Varied agent schema, self-organization and non-linearity allow new emergent ideas to develop in CAS that are super-additive in nature, which enable agents to adapt their
behaviors to better match their surrounding environment (Choi et al., 2001; Holland, 2014; Surana et al., 2005). Comparing the five cases reveals informants possess different abilities to generate product-return-focused emergent ideas, and different success rates of agents implementing new adaptations:

- In Case A, the company has successfully implemented agent-generated ideas in out-bound shipments, but has been unable to generate product-return-focused ideas. Without emergent ideas, agents are unable to adapt.
- In Case B, the company relies on agents to generate emergent ideas, but often settles for incremental changes due to a lack of resources. Here, emergent ideas are generated, but the success rate of agent adaptations is low because agents often resist adapting and prefer to stick with the status quo.
- In Case C, the company relies on agent-generated emergent ideas as the primary means for identifying cost savings. The success rate of agent adaptations is high, since sufficient resources and support are available to help agents adapt. One of the most successful adaptations was the development of a conveyor system for putting away returned products.
- In Case D, the company has established pathways for collecting, evaluating, and implementing agent-generated emergent ideas. The success rate of agent adaptations is high, since adaptation is rewarded and shared with other distribution centers. One of the most successful adaptations is leveraging processing agents to identify and solve quality control issues associated with frequently returned furniture pieces.
- In Case E, the company is open to agent-generated emergent ideas, but often waits to implement them until problems become painful and change must occur. While overhauling the reclamation process was a successful adaptation, agents often lack the motivation to adapt unless absolutely necessary.

Looking across the cases, Cases C and D stood out in their ability to generate emergent ideas and implement adaptations. Case A could not generate or implement product-return-focused emergent ideas at all, and Cases B and E were able to generate emergent ideas, but often fell short when it came to motivating agents to implement them.

Connecting these findings with the findings in Sections 5.1 and 5.2 helps to explain the differences observed across informants. In Cases C and D, the company grants processing agents more autonomy to self-organize, make decisions and encourages second-order learning, resulting in an internal culture where processing agents feel comfortable enough to adapt and generate new ideas. In contrast, processing agents rely on first-order learning only and are given very little autonomy to self-organize and make decisions in Case A. While the company states they are open to emergent ideas, the rigid structure embedded in the product returns department inhibits emergent ideas and adaptations from forming because they are viewed as risky. Cases B and E fall in between Cases C/D and A, and show some ability to generate emergent ideas and adapt. In Cases B and E, processing agents primarily rely on first-order learning and have some autonomy to self-organize and make decisions, although agents often are unmotivated to generate emergent ideas and adapt.

6. Discussion and conclusions

The current research explores the processing of product returns from a CAS perspective across five different companies. The cross-case insights indicate that companies who encourage agent autonomy in interactions, decision making, and learning are better able to generate emergent ideas and adapt. These findings are consistent with previous CAS research (e.g. Choi et al., 2001) that revealed the critical role human and social behaviors play in forward
supply chains. However, the current research uniquely demonstrates that the tenants of CAS theory also apply to the processing of product returns. The academic and managerial implications of these findings are discussed in greater detail in the following section.

6.1 Implications
For scholars, the current research builds on the work of Hazen et al. (2012) and Tan and Kumar (2006) by revealing how the behaviors of agents at key decision points in the returns process create adaptability in the reverse supply chain. From a theoretical perspective, we extend previous work (e.g. Choi et al., 2001; Surana et al., 2005) demonstrating how the dimensions of CAS theory are relevant in understanding key aspects of the supply chain, and extend this work specifically into the realm of processing product returns. Thus, through the exploration of product returns processing at five different companies, the current research contributes to the reverse logistics, supply chain management and CAS literatures by beginning to fill in a gap in our understanding of the complex adaptive mechanics inherent in product return processes.

Supply chain and reverse logistics managers can use the results of this research to inform how they manage processing agents on a day-to-day basis. Managers need to begin by evaluating the cost, risk, and return rate associated with their returned products. If returned products are high cost, high risk and/or have a high return rate, managers need to seriously consider developing different types of processing agents or sophisticated automated systems to boost the adaptability of the reverse supply chain. Whether managers prefer to develop new types of agents or automated systems, the goal of both approaches is to decrease the depth of mental schema each processing agent is required to possess. Decreasing the depth of processing agents’ mental schema gives managers more flexibility with reassigning labor from shipping outbound orders. Reassigned processing agents can do the initial screening of returns as long as they are familiar with the types of products sold. Managers can then dedicate the experience of full-time processing agents to the more “difficult” returns, without overstressing or fatiguing experienced processing agents. During normal volume seasons, decreasing the depth of agents’ mental schema also boosts the adaptability of the reverse supply chain because processing agents are not overburdened with maintaining too much information in their schema.

Instead, processing agents have the capacity to experiment with ideas, interact and share information with other agents. While managers need to ensure processing agents have access to appropriate company resources, agent-to-agent interactions may be the most efficient way to create new and invaluable firm-specific insight. In interactions, agents not only learn factual information about products, but also get a sense of the past experiences and heuristic information other agents possess about specific products (e.g. blue jerseys with short sleeves have NFL teams printed on them, while long sleeve jerseys have NHL teams printed on them). It is important to note, however, that processing agent interactions will likely need to be encouraged and/or incentivized initially, to motivate agents to interact and break long-standing agent habits. Firm-wide initiatives such as departmental social outings and formalized mentor/mentee programs may be beneficial in achieving this objective.

The biggest insight of the current research for managers echoes the tenets of CAS theory – in order to truly nurture the adaptability of the reverse supply chain and generate emergent ideas, managers need to promote processing–agent interactions, allow self-organization, optimize the depth of processing-agent schema and encourage second-order learning. As Cases A, B and E showed, supporting only a portion of these behaviors will limit the ability of processing agents to generate emergent ideas and/or adapt. Cases C and D demonstrated that in order to boost the adaptability of the reverse supply chain, managers need to craft a dynamic environment that encourages processing agents to self-organize based upon their diverse schema and intuition, to anticipate problems, and brainstorm solutions.
Once set up, managers need to resist the urge to create rigid guidelines or policies to “control” the processing of product returns, as these desires will “choke” the organic adaptability of the system. Instead, managers will need to take a step back and look to the ideas that emerge from processing-agent interactions and self-organization.

6.2 Limitations and directions for future research

The current research is not without limitations which provide opportunities for future research. The first limitation revolves around the context of the research. Informants at five companies, selling a variety of products were interviewed to deepen our understanding of the processing of product returns. However, the findings may not be generalizable to companies selling different types of products not included in the current research. Exploring the types of agents, agent interactions, and agent schema present in other reverse supply chains can further expand upon the patterns present in the five case companies. Additionally, future research might seek to validate and extend our findings by including employees holding more varied positions within the supply chain (i.e. front-line and executive level) to help us further understand how agents form decision-making rules and approach interactions with other agents.

Second, the current research explores the importance of types of agents, agent interactions, and agent schema in the processing of product returns, but cannot evaluate the relative quantitative importance of these components in a product returns system. Future deductive, quantitative research is needed to better understand the relative importance of different types of agents, agent interactions and the depth of agent schema in the processing of product returns.

Understanding how human-agent behaviors impact the processing of product returns remains a relatively unexplored avenue for future research. Little is known about how human limitations (e.g. mental fatigue, pressure, or conflict) color the analysis of product returns. While giving processing agents more autonomy to decide how to process product returns has the potential for incidents of human error to occur, it also allows managers to tap into the innate creativity and innovation these agents possess both individually and collectively. With additional research, we hope managers will no longer view product returns as a problem to optimize away, but as a valuable source of information and adaptation that can revolutionize their current product returns paradigm.

References


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Unveiling the potentials of circular economy values in logistics and supply chain management

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Abstract

Purpose – The purpose of this paper is to unveil the circular economy (CE) values with an ultimate goal to provide tenets in a format or structure that can potentially be used for designing a circular, closed-loop supply chain and reverse logistics.

Design/methodology/approach – This is desk-based research whose data were collected from relevant publication databases and other scientific resources, using a wide range of keywords and phrases associated with CE, reverse logistics, product recovery and other relevant terms. There are five main steps in the reformulation of CE principles: literature filtering, literature analysis, thematic analysis, value definition and value mapping.

Findings – In total, 15 CE values have been identified according to their fundamental concepts, behaviours, characteristics and theories. The values are grouped into principles, intrinsic attributes and enablers. These values can be embedded into the design process of product recovery management, reverse logistics and closed-loop supply chain.

Research limitations/implications – The paper contributes to the redefinition, identification and implementation of the CE values, as a basis for the transformation from a traditional to a more circular supply chain. The reformulation of the CE values will potentially affect the way supply chain and logistics systems considering the imperatives of circularity may be designed in the future.

Originality/value – The reformulation principles, intrinsic attributes and enablers of CE in this paper is considered innovative in terms of improving a better understanding of the notion of CE and how CE can be applied in the context of modern logistics and supply chain management.

Keywords Sustainability, Literature review, Reverse logistics

Paper type Literature review

1. Introduction

The circular economy (CE) is defined as a global economic model to minimise the consumption of finite resources, which focuses on the intelligent design of materials, product and systems (EMF, 2013a). It also supports separating treatment between technical and biological materials to maximise the design for reuse, to return to the biosphere and retain value through innovations across fields (Webster, 2015; Lacy and Rutqvist, 2015). Transitioning from the linear to a CE not only requires a fine-tuning that reduces the negative impacts of the linear economy, but also a whole system approach that builds upon a number of guiding principles. These principles allow resilience to be built into the CE system, ensuring the long-term generation of economic opportunities and at the same time offering societal and environmental benefits.

CE principles have been elaborated by several researchers in various manners and from various viewpoints: Feng (2004) in Yuan et al. (2006), Pintér (2006), Yuan et al. (2006), Yong (2007), Geng et al. (2012), EMF (2013a, 2015), Stahel (2013) and Pan et al. (2015). Principles, in theory, can support the understanding of a concept; however, principles alone are often insufficient to support the practicality of that concept. This paper therefore aims to reformulate the existing CE principles into CE values (or tenets) in a format or structure that supports the design of a circular, closed-loop supply chain and reverse logistics. In this paper, CE principles were reformulated through five steps: data filtering, literature analysis, thematic analysis, CE values definition and CE values mapping.
The paper begins with a brief introduction to some key concepts in CE which also cover the fundamentals of CE principles. This is followed by a description of the research approach adopted to collect the data and review existing contributions before presenting the analysis and synthesis. Finally, the implications for research and practice are discussed along the direction for future research.

2. Related research

2.1 Circular economy

The idea of CE was coined by Boulding (1966) who expressed it as a “cyclical ecological system which is capable of continuous reproduction of material form even though it cannot escape having inputs of energy”. Kneese et al. (1970) in Andersen (2007) mentioned CE from an environmental economic perspective based on a mass balance principle that all material flows can be accounted for; however, it will be the economic values, not the physical flows that guide their management.

Pearce and Turner (1990) divided CE into four functions: amenity values, a resource base for the economy, a sink for residual flows and a life support system. Hu et al. (2011) expressed the basic philosophy in the CE approach as being to enhance the emergence of an industrial and economic system that relies on cooperation among actors and matter and energy flow management, in which they can use each other’s waste material and energy as resources and in this way minimise the system’s virgin material and energy input. EMF (2013) defined CE as an industrial system that supports a restorative concept through the intelligent design of materials, products and systems and the business model. Preston (2012) interpreted it as redesigning global production and consumption systems, which are a combination of environmental, resources, technology and consumer demand. The concept encourages business activities to optimise products, components and materials at the highest utility and value at all times, distinguishing between technical and biological cycles.

The EMF (2013) divided CE into two types of circle: technical materials and biological materials circles, both of which have similar reverse processes. The circle of technical materials consists of maintaining, reusing/distributing, refurbishing/remanufacturing and recycling. In the circle of biological materials, specific treatments, such as extraction of biochemical feedstock and anaerobic digestion/composting, are required before the biological materials can be safely released to the biosphere. In both circles, leakage must be minimised so as to maximise the amount of materials to be reprocessed hence re-circulated back to the point of use.

2.2 Circular economy principles

A “principle” is generally intended as a fundamental truth that serves as the foundation of a system. The CE principles can therefore be seen as the fundamental truth about the CE, representing the whole concept of CE, and by understanding the principles, it should provide a better understanding of the CE itself. CE principles have been identified by numerous researchers in different contexts. Huamao and Fengqi (2007) and Yuan et al. (2006) summarised the CE principles in “3R”, which stands for reduction, reuse and recycling of materials/energy. Hu et al. (2011) expressed the basic philosophy of CE as enhancing the emergence of an industrial and economic system, relying on cooperation among actors and matter and using waste material and energy as resources to minimise the system’s virgin material and energy input. Stahel (2013) emphasised the importance of CE principles in the implementation of the CE concept. He mentioned CE principles as including economics and profit maximisation; material and resource sufficiency and efficiency; an intelligent use of human labour; and caring. Additionally, he expressed the rules of CE principles as: profitable and resource efficient; value maintained; circular flow; cost efficient; reuse, repair and remanufacture; and needs functioning markets.
EMF (2013) conveyed several guiding principles in their report which include: design out waste, meaning that when a product is designed, the designer needs to consider the biological or technical material cycle that can be reprocessed; build resilience through diversity, meaning that there is a need to build a system resilience covering several aspects within the CE; work towards using energy from renewable sources, meaning that energy usage per unit of output needs to be reduced and the shift to renewable energy needs to be accelerated by design, i.e. treating the economy as a valuable resource; think in system, meaning a set of components or objects that interact with each other to achieve the goals in real-world, non-linear, feedback-rich systems, particularly living systems; and think in cascades, meaning maximising the retaining value of a product that can contribute optimally before going back to the biosphere or continuing loops. In 2015 EMF described CE principles through other views, which are preserving enhanced natural capital, optimising resource yields, and fostering system effectiveness.

3. Research programme
3.1 Aim, objectives and approach
The aim of this paper is to unveil the CE values with an ultimate goal to provide tenets in a format or structure that can potentially be used for designing a circular, closed-loop supply chain and reverse logistics. To achieve the aim, the following objectives have been set to identify the existing principles of CE and then redefine and reformulate these into the CE values.

3.2 Search strategy
The approach adopted was mainly through a systematic literature review whose data were collected from relevant publication databases and other scientific resources, using a wide range of keywords and phrases associated with CE, and other related keywords, for instance principle, reverse logistics, product recovery, repair, refurbishment, remanufacturing and cannibalisation. These were then combined with the publicly available materials and various media (case studies, videos, seminars, presentations). All phrases were determined to have a strong association with the core of this research.

The process began by identifying the papers from the relevant databases including Google Scholar, Scopus, IEEE and EBSCO using a combination of keywords, as shown in Table I, resulting in 941 journal and 509 conference papers being extracted. During the searching process, some books such as “A New Dynamic Effective Business in a Circular Economy” by Webster et al. (2013), technical reports, such as “Towards the circular economy” by EMF (2013), and briefing papers such as “A Global Redesign? Shaping the Circular Economy” by Preston (2012) were also identified as useful resources, and hence are included in the analysis.

The literature in Table I was identified by reading the title. If the titles met this research purpose, they were collected and stored. The next process was to read the abstract and keywords. In this process the literature was classified based on its similar purpose and keywords. Reading the full paper was necessary in order to analyse CE characteristics, principles, values, concepts, case studies and other relevant research results more deeply. Within the selection process of the literature, some filtering criteria, such as types of document (journal and conference papers) and language (English), were applied.

The principle string is important as it is the main purpose of this reformulation. The search string also combines the CE keyword with other keywords such as Reverse Logistics, Product Recovery, Repair, Refurbishment, Remanufacturing, and Cannibalisation. Furthermore, in Table I, the results columns show the number of journals and conference papers found. The results have indicated that the “circular economy” string provided the dominant result, whereas the others are relatively small, even zero; for instance, “circular economy AND repair” in all of the databases.

There are six steps that were adopted: data collection, data filtering, literature analysis, thematic analysis, CE values definition and mapping of CE value (see Figure 1).
Table 1. Summary of literature search strategy for CE principles

<table>
<thead>
<tr>
<th>Search string</th>
<th>Google Scholar</th>
<th></th>
<th>Scopus</th>
<th></th>
<th>IEEE Xplore</th>
<th></th>
<th>EBSO</th>
<th></th>
</tr>
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<tr>
<td>Circular economy</td>
<td>574</td>
<td>131</td>
<td>139</td>
<td>250</td>
<td>0</td>
<td>101</td>
<td>213</td>
<td>–</td>
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<tr>
<td>Circular economy and Principle</td>
<td>4</td>
<td>9</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Circular economy and Reverse logistics</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>Circular economy and Product Recovery</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>Circular economy and Repair</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>Circular economy and Refurbishment</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>Circular economy and Remanufacturing</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Circular economy and Cannibalisation</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>Total</td>
<td>580</td>
<td>142</td>
<td>141</td>
<td>261</td>
<td>0</td>
<td>106</td>
<td>220</td>
<td>0</td>
</tr>
</tbody>
</table>
4. Results

4.1 Reformulation of CE principles

4.1.1 Data filtering. All potential sources of papers were filtered by various processes: reading the title, abstract, keywords and full paper filtering; those filtering processes resulted in 51 papers (Table II). Filtering criteria, for instance language (English), type of document (journal and conference paper), and article title, were rigorously applied. The 51 papers that were identified at the end of the filtering process include journal papers, conference papers, textbooks, white papers, technical reports and online articles.

4.1.2 Literature analysis. The 51 papers were then analysed to obtain various essential themes (such as from the intersection of definitions, characteristics, principles, or other information across the authors). For example, Pearce and Turner (1990), EMF (2013) and Lacy and Rutqvist (2015) conveyed CE definitions; they explained the similar terms (such as those about the economy, environment, circularity, etc.). The analysis continued by mapping the relevant information provided by each author (see Figure 2 which illustrates the 51 authors). After the analysis process and regrouping, those keys with a similar meaning will be grouped within one representative key. The results of regrouping are shown in Table III. In this process, 12 themes were found: economy, environment, circularity, system thinking, cascades, reverse cycle, collaboration, recovery, market, technology, innovation and waste.

4.1.3 Thematic analysis. The information in Table III was analysed to produce the CE principles, while the values describe the specific usefulness of the concept. In this stage, a deeper analysis was required, in which each theme above will be defined in order to find the consistency of the theme. Through this stage, the CE values will be reformulated. In fact, one theme can produce one or more values and one theme possibly can overlap others as well. Basically, those themes shown above were reformulated to find the suitable CE values. For example, the “economy” theme will be analysed based on all information surrounding the theme, such as the position of the economy in this concept, in what way the economic extension will influence the implementing process, and how to implement this aspect, etc. The information discovered was elaborated to represent the CE value from the “economy” aspect.

Through the analysis, 15 CE values, i.e. system thinking, circularity, innovation, built-in resilience, cascades orientation, waste elimination, technology-driven, market availability, optimisation of change, economic optimisation, maximisation of retained value, leakage minimisation, collaborated network, shift to the renewable energy, and environmental consciousness, have been reformulated. Some values, e.g. leakage minimisation, maximisation of retained value, shift to renewable energy, built-in resilience and optimisation of change, are not directly related to the themes but do have an indirect link to them. Leakage minimisation
<table>
<thead>
<tr>
<th>No.</th>
<th>Author</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>J01</td>
<td>Ekins (1989)</td>
<td>Environmental Conservation</td>
</tr>
<tr>
<td>J03</td>
<td>Yuan et al. (2006)</td>
<td>Journal of Industrial Ecology</td>
</tr>
<tr>
<td>J09</td>
<td>Chen (2009)</td>
<td>System Research and Behavioral Science</td>
</tr>
<tr>
<td>J10</td>
<td>Park et al. (2010)</td>
<td>Journal of Cleaner Production</td>
</tr>
<tr>
<td>J12</td>
<td>Hu et al. (2011)</td>
<td>Journal of Cleaner Production</td>
</tr>
<tr>
<td>J14</td>
<td>Geng et al. (2012)</td>
<td>Journal of Cleaner Production</td>
</tr>
<tr>
<td>J15</td>
<td>Su et al. (2013)</td>
<td>Journal of Cleaner Production</td>
</tr>
<tr>
<td>J16</td>
<td>Ma et al. (2014)</td>
<td>Journal of Cleaner Production</td>
</tr>
<tr>
<td>J17</td>
<td>Ma et al. (2015)</td>
<td>Journal of Cleaner Production</td>
</tr>
<tr>
<td>J18</td>
<td>Li and Ma (2015)</td>
<td>Journal of Cleaner Production</td>
</tr>
<tr>
<td>J19</td>
<td>Pan et al. (2015)</td>
<td>Journal of Cleaner Production</td>
</tr>
<tr>
<td>C01</td>
<td>Li et al. (2009)</td>
<td>Second Asia-Pacific Conference on Computational Intelligence and Industrial Applications BMEI</td>
</tr>
<tr>
<td>C02</td>
<td>Yang (2011)</td>
<td>ICEED</td>
</tr>
<tr>
<td>C03</td>
<td>Xuan et al. (2011)</td>
<td>International Conference on Solid State Devices and Materials Science</td>
</tr>
<tr>
<td>C04</td>
<td>Ying and Li-jun (2012)</td>
<td>International Asia Conference on Industrial Engineering and Management Innovation</td>
</tr>
<tr>
<td>C06</td>
<td>Jawahir and Bradley (2016)</td>
<td></td>
</tr>
<tr>
<td>B01</td>
<td>Boulding (1966)</td>
<td>The Economics of the Coming Spaceship Earth</td>
</tr>
<tr>
<td>B03</td>
<td>Pearce and Turner (1990)</td>
<td>Economics of Natural Resources and the Environment</td>
</tr>
<tr>
<td>B05</td>
<td>Stahel (2013)</td>
<td>A New Dynamic Effective Business in a Circular Economy</td>
</tr>
<tr>
<td>B06</td>
<td>Tuppen (2013)</td>
<td>A New Dynamic Effective Business in a Circular Economy</td>
</tr>
<tr>
<td>B08</td>
<td>Mulhall and Braungart (2013)</td>
<td>A New Dynamic Effective Business in a Circular Economy</td>
</tr>
<tr>
<td>B09</td>
<td>Pinjing et al. (2013)</td>
<td>Waste as a Resource</td>
</tr>
</tbody>
</table>

Table II. Selected literature results for CE principles

- White papers, technical reports, online articles
  - O02 Clift and Allwood (2011) [www.ellenmacarthurfoundation.org](http://www.ellenmacarthurfoundation.org)

(continued)
emerges in the reverse cycle theme and can be controlled quantitatively. It can also be implemented differently in other contexts or activities. Maximisation of retained value is closely related to the economy, cascades, reverse cycle and environment themes. Shift to renewable energy has a strong link with the environmental aspect in terms of resources. Built-in resilience and optimisation of change originated from the system thinking theme.

The overall mapping of the CE themes into CE values is illustrated in Figure 3.

4.1.4 Circular economy values definition. The 15 CE values need to be defined; this process has been completed by using all of the information that was collected:

- Value no. 1: systems thinking suggests that CE has to be looked at holistically, and all of the elements/components in the CE have to be considered as a system that integrates and influences one with another. (Chen, 2009; Li et al., 2009; EMF, 2013a).

- Value no. 2: circularity advocates developing a circular process to preserve the value of a product or component or material by keeping it in use longer through, e.g. repair, reuse, remanufacture and recycle (Pintér, 2006; Yong, 2007; Chen, 2009; Mathews and Tan, 2011; Yang, 2011; EMF, 2015; Lacy and Rutqvist, 2015; UNEP, 2015; Webster, 2015; Blomsma and Brennan, 2017; Hollander et al., 2017).

- Value no. 3: innovation enables CE by suggesting the use of new, novel methods and ideas to stimulate redesign and rethink a system in CE to reach the optimum results of its purpose (IMSA, 2013; Sempels, 2013).

- Value no. 4: built-in resilience is related to the internal capacity, robustness and responsiveness of a CE system to recover quickly from various disturbances, e.g. economy, technology, etc. (EMF, 2013a, 2015), hence becoming more resilient.

- Value no. 5: cascades orientation aims to keep the materials, be they products, components or materials or biological nutrients, longer in circulation and for them to be transformed into different types of products or materials (IMSA, 2013; EMF, 2015; Lacy and Rutqvist, 2015; Webster, 2015; Hollander et al., 2017; Kalmykova et al., 2018; Vouvoulis, 2018).

- Value no. 6: waste elimination emphasises that waste must be eliminated from the very beginning of the product design, and systematically considers, at subsequent circulation stages, how waste can be further reduced and eliminated (Geng et al., 2009; Mathews and Tan, 2011; Blomsma and Brennan, 2017; Vouvoulis, 2018).

- Value no. 7: technology-driven, suitable and economically viable technologies may be adopted to enable tracing the materials and products throughout the circulation, particularly in product recovery. The main goal is to achieve efficiency and effectiveness that supports the optimisation of operations (Geng and Doberstein, 2008; Pan et al., 2015).

<table>
<thead>
<tr>
<th>No.</th>
<th>Author</th>
<th>Reference</th>
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Table II.
Value no. 8: market availability, be it a new or existing one, will enable the CE to create new business opportunities, thus encouraging the reusability of products, components or materials (Geng and Doberstein, 2008; Preston, 2012; Stahel, 2013; Ma et al., 2015).
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Value no. 9: optimisation of change is essential in the implementation of system or business models affected by the dynamics of problems, and takes into account the environmental, resources, technology, and consumer demand (EMF, 2013a, 2015).

Value no. 10: economic optimisation aims to achieve the production and consumption, service and supply of money, so that a resilient economy can be created, e.g. by improving material productivity, enhancing innovation capabilities, or shifting from mass production to skilled labour (Pintér, 2006; Yong, 2007; Ma et al., 2015; Kalmykova et al., 2018).

Value no. 11: maximisation of retained value aims to retain products or components that, over time, decline in value, by creating a suitable treatment system so that the value can be prolonged (Yuan et al., 2006; Huamao and Fengqi, 2007; Dajian, 2008; Mathews and Tan, 2011).

Value no. 12: leakage minimisation upholds the avoidance of loss of opportunities to maximise the cascaded usage period of biological materials and the inability to incorporate the nutrient back into the biosphere due to contamination, and technical materials that are lost due to loss of materials, energy, components and materials are not (or cannot be) recovered. (EMF, 2013a, 2015).

Value no. 13: collaborative network is needed for the creation of materials’ standards and information flow in the circularity and allows stakeholders to work together within an industry sector or between different sectors to achieve common goals (Geng and Doberstein, 2008; Hu et al., 2011; Preston, 2012).

Value no. 14: shift to renewable energy highlights the ability of the CE to reduce the energy usage per unit of output and accelerates the shift towards renewable energy by design, treating the economy as a valuable resource (Pinjing et al., 2013; Ma et al., 2015; Pan et al., 2015).

Value no. 15: environmental consciousness promotes the conservation of environmental resources and reduction of environmental impacts by adhering to environmental regulations (Hongchun, 2006; Zhu et al., 2010; Pinjing et al., 2013; Su et al., 2013; Hollander et al., 2017).

4.1.5 Mapping the circular economy values. The last stage is mapping/grouping. It is used to evaluate the 15 values of the CE that have been formulated before. The regrouping was done to find the consistency of the definition of CE values reformulation, the sequence between one item and others, and the implementation of the values in specific cases. The 15 items need to be classified with an appropriate name into some layers of the values of the CE. The layers are
classified into: principle, intrinsic attribute, and enabler. The first layer indicates the essential activities/values/rules that should be followed to implement a CE. The second layer describes the internal CE characteristics as natural elements. The third layer is about some external aspects surrounding the CE that will support the practicality, possibility and continuity in the implementation of a CE.

Based on the classifications above, each layer can be explained. The meaning of each layer is taken from dictionary definitions, where a principle is generally intended as a fundamental truth that serves as the foundation of a system, or as a basic idea or rule that explains or controls a system. A CE principle could mean the essential characteristics that should exist when developing, creating, designing, etc., the CE systems. It is also indicated as being impossible to be ignored, as a clear activity, as active action, as an absolute value (measurable). An intrinsic attribute is generally defined as an essential natural element of a concept or system. Through this basic definition, the intrinsic attribute in the context of the CE can be defined as the natural available attribute for use in the implementation of a CE. The attributes will emerge within the natural elements of the system itself. It is indicated by a noun. An enabler is to make a system, operation, etc. possible, practical or easy. It could be a culture, a technology, or an infrastructure, etc. It is indicated by a noun.

Having identified the layers of CE items, the next step was to classify the items into layers based on the above-mentioned definitions and characteristics. To facilitate the classification or grouping into the appropriate layer, the following phrases were applied. The phrases describe the characteristics of each layer:

1. First layer (a principle):
   - (A1) A noun that emphasises reusability.
   - (A2) A noun that relates to the environment.
   - (A3) A noun that relates to the economy.
   - (A4) A noun that can be measured and controlled.
2. Second layer (an intrinsic attribute):
   - (A5) A noun that connects with the nature of the CE.
   - (A6) A noun that mentions an internal, genuine CE characteristic.
   - (A7) A noun that mentions advancement and achievement.
   - (A8) A noun that can motivate the CE implementation.
3. Third layer (an enabler):
   - (A9) A noun that has a role as assistant/facilitator.
   - (A10) A noun as an element from the external environment.
   - (A11) A noun that supports at the operational level.
   - (A12) A noun that describes external facilitation.

Based on the phrases above, the classification was done by analysing both the characteristic and value, then a classification was produced. The first layer consists of six items: maximising retained value, cascades/reverse cycle orientation, economic optimisation, environment consciousness, leakage minimisation and waste elimination. The second layer consists of circularity, built-in resilience, collaborated network, system thinking and optimisation of change. The third layer includes three enablers: technology, innovation and market availability (see Figure 4).
5. Discussion

5.1 Circular economy values

The CE is a concept that has a wide coverage area: economy, ecology, social, technology aspects, etc. Within these areas, there are many activities from flow of raw material to becoming a product and vice versa. Each flow distinguishes the type of material (biological/technical). The flow also consists of some processes such as collection, maintaining, redistributing or cascading. All of the processes are done to support regenerative and restorative determinants that can systematically support the balanced life system. This concept also has the general purpose of contributing to global economic opportunity. The understanding of a concept is needed to be able to implement the concept within the real system. By formulating CE principles in an available format, the adopting and understanding processes of the concept will be made easier. The principle is defined as a fundamental truth that can reveal the basis of this concept.

In this research, 15 CE principles have been reformulated from the literature as the CE values. This paper argues that the values themselves can be further grouped into the intrinsic attributes, enablers as well as principles. Whilst the principles of the CE are referred to as the fundamental truth or basic ideas or rules that explain or control a system, the intrinsic attribute is hereby defined as the natural available attribute for use in the implementation of the CE concept, and the enabler allows a system, an operation, etc., to practically and feasibly exist, and these could be a culture, a technology, an infrastructure, etc.

Pearce and Turner (1990), Kneese et al. (1970) in Andersen (2007), Park et al. (2010), Hu et al. (2011) and EMF (2012, 2013a), to some extent, proposed some principles of the CE but they did not provide a detailed process regarding how CE principles were formulated. Through this available method, the opportunities to discover or modify the new principles/values are wide open as the values are not prescriptive. The adaptability of this method is high because the user does not necessarily need to obtain many CE sources or read the vast amount of information related to the CE concept, as they have been well represented through the reformulated CE values.
The benefits from the reformulation of the CE principles create a readily available format that can easily be implemented in the design of specific cases, such as reverse logistics operations or product recovery. This study found that there are some CE values that are familiar to many researchers, for instance, system thinking. In the process of system development, each aspect will influence the others. Through this value, all aspects must be consistent and committed to both the implementation and the goals. Waste elimination means all the processes in the CE must aim to eliminate the amount of waste. Oriented to cascades/reverses cycle distinguishes the different types of material (biological and technical) and treats end-of-life products properly. Shift to renewable energy promotes the use of renewable energy whereas built-in resilience is related to the robustness a CE system to recover quickly from various disturbances, so it will contribute to the quality of the system being designed. Economic optimisation is a consideration for all aspects within the CE. The term optimisation is carefully chosen to emphasise the fact that maximising profit is not the only goal of CE; other aspects would need to be considered too.

Other values have been indirectly discussed by several authors. Circularity, for instance, means that the consequences of the adoption of the CE concept will create a circularity model naturally. All of the components will undergo circulation by using this model. It will keep the value longer by using suitable treatments, such as reuse, remanufacture, recycle, etc. Innovation, this idea as an important aspect in the CE, and can be present in all the activities of CE. For example, in the design process of an electronic product, such as a laptop, to minimise the amount of waste and increase the functionality of the product, the design of the laptop is made modular. This process can be a standard for all laptop companies. Technology-driven, this value is needed to support the competitiveness of modern needs.

Regarding market availability, a market is needed as a place in which to put the result of the system. Furthermore, concerning leakage minimisation, the possibility of a number of leakages identifies that this value should be exposed as an independent value, even though the activities could embed within other activities, such as in cascades/reverse cycle. Collaborated network, almost all values here need to collaborate with other companies/nodes or across industries, and this value is a control in the implementation of the CE itself. Environmental consciousness, environmental consciousness is the basic goal in implementing the CE, this value needs to be explored in the process of implementing the CE.

In addition, in this research there are two new values that have been discovered as the most prominent: maximisation of retained value and optimisation of change. This discovery may be the most significant contribution in this research. By comparing CE themes and values, it can be stated that those values have not yet been discussed explicitly by researchers. The value maximising retained value, will increase functionally and economically the value of used product before going back to landfill or incineration. The value will also provide some structural processes to increase the value of the product. Optimisation of change provides opportunities to optimise the circle that is concerning on where it could provide another opportunity.

Within the reformulation process of the 15 CE principles, it was found that not all of them could be categorised as principles; some were termed as intrinsic attributes, which were the natural characteristics of the CE; and enablers, which was identified as the operational drive to make a system easy. To cover all of the terms that have been found, another term such as value is needed. The word value was chosen to cover the 15 CE items, including principle, intrinsic attribute, and enabler.

5.2 Implications for logistics and supply chain management

The CE principles reformulation can potentially be used in the supply chain particularly into a more circular, closed-loop supply chain. The closed-loop supply chain has two distinct
flows – forward flows aiming to minimise services and cost, and reverse flows (also known as reverse logistics) to recover the unwanted, broken or end-of-life products from customers for return to the manufacturers. The complexity of products, services, and processes in the closed-loop supply chain increase as the business models of the CE grow. The business models require the supply chain to handle the transition in an agile manner, and in this respect, CE values can support this transition. As the CE focuses on keeping products, components, and materials at their highest utility and value at all times, this will affect the upstream processes in the supply chain, right from the process of manufacturing raw material to become products, until the products are received by customers. As mentioned above, in a closed-loop supply chain, the return management and reverse logistics services play an important role in handling returned or end-of-life products. Product returns have increased in recent years, along with changes in the scope and choice of product and services, and also trade-offs (Weetman, 2017) and therefore the return management and reverse logistics need to be handled properly. This can possibly be done by embedding the CE values into the design of a reverse logistics process that optimises the supply chain operations in general.

Embedding CE values can start by applying system thinking and optimisation of change right from the very beginning of the system design. Those values are an entry point to support the implementation of modern SCM. System thinking can also holistically analyse and consider all of the elements/components in a system. Optimisation of change is thus an important value that is capable of coping with dynamic problems in a system or business. In this way, all of the values of the CE can support the modernisation of SCM towards a circular initiative.

The supply chain operations reference (SCOR) model supports business activities in re-engineering, benchmarking, and measurement of the supply chain (Huang et al., 2005). The model comprises a number of activities, namely plan, source, make, deliver, and return (Stephens, 2001). Those activities need to be linked to one another to satisfy the customer demand. The return activity, in particular, is worth noting because it covers product return and receiving product, and post-delivery customer support. Linked to all of the echelons in the supply chain (suppliers, management and customers), the return activity influences all of the business activities in this model. The return activity, therefore, has an important role, especially in the planning activity.

Logistics management, a critical component in SCM, concerns the physical movement of materials and products in the whole supply chain (Langley, 1986; Lambert and Stock, 1993), whose goals include the provision of rapid response capability; minimum variance; minimum inventory expenses; consolidated shipments; high quality and product life cycle support. Logistics also share the goal of SCM to meet customer requirements. Those aims of logistics are integrated, mutually influential, and share similar challenges to the supply chain in terms of scope and choice of products and services, and trade-offs that affect, for instance, the design of distribution networks. CE principles that support the distribution of network design well are, for example, collaborative network, leakage minimisation, market availability and economic optimisation. Furthermore, one of the goals of logistics is supporting the product life cycle, meaning that logistics management concerns regarding life cycle mode and consequently the circular initiative model in logistics management is required.

As the closed-loop supply chain consists of two flows (forward logistics and reverse logistics), CE values can be embedded into the design of product recovery options (repair/reuse, refurbishment, remanufacturing, cannibalisation and recycling). In the past, reverse logistics only focused on some keys logistics activities/roles, recovery/reuse activities, distribution channels, recapturing values reverse flow and also cost. As the customer demand has increased, however, there is a greater need for the reverse logistics process to maximise the retained value of product/service, thus products will need to be cascaded in order to maintain them at their highest utility and value at all times.
Embedding CE values can help facilitate a better understanding in designing, structuring and evaluation of the supply chain, which are in fact values that the SCOR model aims to achieve. Embedding implies redesigning the business processes by including CE values, for example, circularity, collaborative network, cascades orientation, maximisation of retained value, into the reverse logistics and return management. Return management deals with the return of product and the supporting services for customer post-delivery, which may involve transportation, warehousing, third and fourth party logistics and reverse logistics itself. The circular initiative can be developed through embedding CE principles into these functions.

A robust strategy to plan and manage a supply chain is needed to address the complexity and issues in logistics and the supply chain in the context of the CE. Some of the issues include facility, inventory, transportation, pricing, sourcing, demand forecast, obsolescence management and risks. Facility issues are associated with the role, location and capacity of repair, remanufacture or part harvest activities in each echelon, such as supplier, manufacturer, and customer. These issues are therefore related to several CE principles such as circularity, built-in resilience and collaborative network. In particular, facility location has a strong link with economic optimisation and market availability value. Capacity is another aspect in facility consideration that is closely related to, for instance, economic optimisation and collaborative network values. Inventory issues are related to the availability of spare parts. This means there is a strong need to engage the suppliers and partners within a collaborative network. Transportation is about creating a network to efficiently and effectively collect products from customers. The effectiveness and efficiency of the transport network may be affected by the values of innovation, technology-driven, market availability, collaborative network, and shift to renewable energy. Pricing is related to the product being sold. In determining a pricing strategy in the CE business, one should consider market availability, economic optimisation, and cascade orientation values. Sourcing in-house/outsourced processes to meet actual demand through procurement of goods and services engage the market availability and maximisation of retained values. Demand forecast could mean the management of demand that is based on availability, needs, and markets. This may, therefore, involve innovation, technology-driven and market availability.

Ripanti (2016) described the embedding process of the CE for reverse logistics in six distinct steps: deciding on reverse logistics operation options in order to have product recovery options; identification of reverse logistics activities; considering and reviewing CE values; mapping reverse logistics options based on circular economy values; identification of parameters of product recovery activities based on circular economy values; and analysing parameters and decisions in the mathematical formulation. A similar exercise was also undertaken by Bernon et al. (2018), who embedded CE values into retail reverse logistics; they also found evidence of where reverse logistics practices were aligned with CE principles but had not been recognised as such by organisations.

6. Conclusions

In total, 15 CE principles have been reformulated comprehensively by means of a systematic literature review. During the reformulation process of the CE principles, it was found that not all of them could be categorised as principles; some were termed as intrinsic attributes or the natural characteristics of CE, and enablers, which were identified as the operational drives to facilitate the operationalisation of a CE system. In this paper, the principles, intrinsic attributes and enablers are termed the CE values. The reformulation of CE principles that exist in the body of literature can also facilitate in the implementation of, for example, reverse logistics and closed-loop supply chains. Whilst some researchers previously described the CE principles at a conceptual level, this research has offered more detailed, operationalisation aspects of the CE via the three groups of CE values mentioned above.
The way the CE values have been formulated in this study opens up an opportunity to other researchers to continue to amend the collection of the CE values. Going forward, it is intended to develop a method that describes in detail the embedding process of CE values into product recovery. Imminent challenges in CE will continue to be unravelled, in particular related to the uncertainty aspects in product recovery, especially when the products have a long-life cycle.

References


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Boldly going where firms have gone before? Understanding the evolution of supplier codes of conduct

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Abstract
Purpose – Supplier codes of conduct (CoC) are the primary mechanism companies use to drive corporate social responsibility (CSR) upstream in their supply chains. Companies have traditionally used CoC to tackle systemic social issues (e.g. forced labor, wages and working conditions). More recently, CoC have included environmental concerns (e.g. waste treatment, toxic chemicals and pollution). The purpose of this paper is to analyze how companies have evolved their CoC across four points in time between 1999 and 2017. By evaluating changes in the scope, depth and possible regime of sanctions included in CoC, the authors consider whether companies use CoC as either a leveling or a differentiating mechanism.

Design/methodology/approach – The authors employ a competing-theories approach to examine how companies have employed CoC. Specifically, the authors examine the content of CoC between four data points: 1999, 2005, 2010 and 2017 to determine whether CoC are used to maintain comparative parity (institutional theory) or to achieve a distinctive market presence (awareness—motivation—capability (AMC) framework). The sample includes 36 transnational companies. To enable replication, the authors maintained consistent sampling and coding procedures across the four time periods.

Findings – The authors find a significant harmonization and standardization of CoC over time. Alignment occurs at the lower end of acceptable norms – i.e. a lowest-common-denominator approach. Companies have not chosen to take a more aspirational approach that involves raising the bar on social and environmental performance. That is, companies have not attempted to use CoC to differentiate themselves as CSR standard bearers. Provision specificity dropped for the 2010 sample before rebounding in 2017.

Originality/value – The authors juxtapose the findings with a theoretical framework based on the tenets of institutional theory and the AMC framework. The authors conclude that changes in CoC are largely driven by coercive, normative and mimetic isomorphism as opposed to attempts to leverage CoC to create a distinctive image that could be used for competitive advantage. This finding provides context for how the public, investors and managers should view these documents.

Keywords Sustainability, North America, Europe, Asia, Buyer-supplier relationships, Supplier management, Mixed method, Sourcing and supply

Paper type Research paper

Introduction
Despite recent instances of economic protectionism, the world is as globalized as ever (Stiglitz, 2017). After a serious, but essentially temporary, dent due to the Great Recession of 2008, global trade has grown steadily (WTO, 2017). Transnational corporations based in western markets continue to rely on low-cost inputs from emerging economies to fuel growth. Sourcing labor and natural resources at a fraction of the cost compared to home market costs dramatically improves margins and economic viability (Sindi and Roe, 2017; Tate and Bals, 2017).
However, with the low-cost benefits of global sourcing comes the need to answer to the social and environmental concerns of the affluent and increasingly demanding western consumer (Lins et al., 2017; Shin et al., 2017; Sinkovics et al., 2016; Tate et al., 2010).

While enjoying (if not demanding) low costs of imported goods and services, a growing percentage of western consumers have shown little tolerance for news regarding abusive and exploitative working conditions in the countries of origin of their purchases. Many western consumers may be oblivious to (or actively in denial of) the logic that rock-bottom prices are naturally connected to very low wages for labor-intensive products such as apparel (Barnett, 2014). Yet, they react “allergically” to the cognitive dissonance created by the documentation of child and forced labor, hazardous working conditions and (more recently) gross environmental misconduct (Gardetti and Torres, 2017; McNeill and Moore, 2015; Schäufele and Hamm, 2017).

Table I depicts recent examples of obvious misconduct of apparel companies (or rather their suppliers) in emerging economies and the companies’ responses to the misconduct. The data reveal that transnational companies face a conundrum. They must fulfill the low-price expectations of consumers that they themselves have created—a fact that makes reshoring production to high-cost consumer markets such as the USA or Western Europe difficult (Tate and Bals, 2017). But they also need to purge obvious social and environmental misconduct from their supply chains in order to protect brand image—a potentially difficult and costly endeavor (Minor and Morgan, 2011; Odriozola and Baraibar-Diez, 2017; Shamma, 2012).

Importantly, the proverbial corporate social responsibility (CSR) “buck” does not stop with in-house operations but extends well into the supply chain of transnationals across multiple tiers (Brockhaus et al., 2013; Fawcett et al., 2015; Mena et al., 2013; Seuring and Müller, 2008; Tachizawa and Wong, 2014). In each instance depicted in Table I, the reported misconduct did not occur at the company in question but at the company’s suppliers or its supplier’s supplier. Even so, the transnational company incurred the brand damage. Notably, non-governmental organizations (NGOs) have made it their goal to call out and document corporate misconduct, making sure to attach the blame to the western brand. Their goal is to increase public backlash and raise the cost of “irresponsible” corporate behavior (Graafland, 2018). Thus, transnationals need a way to protect their operations—and brands—from reputational risks. Codes of conduct (CoC) emerged as a tool to promote socially responsible supplier behavior and provide immunization against potentially toxic press (Emmelhainz and Adams, 1999; Magnan et al., 2011; Multaharju et al., 2017).

CoC are legal documents that companies use to communicate and enforce socially responsible standards such as employee rights, working conditions, maximum hours and the minimum age for workers. More recently, some companies have expanded their CoC to include standards for environmental factors such as waste management, use of resources and recycling throughout their upstream supply chain (Erwin, 2011; Seuring and Müller, 2008). In its CoC, a company establishes the “ground rules” suppliers need to abide by in order to do business with the company. Importantly, CoC are a “one-way-street”: they mandate the behavior of the supplier. This means that CoC are the tool of choice to extend CSR programs of companies upstream into their supply chain (Carter and Easton, 2011; Christensen et al., 2007; Multaharju et al., 2017; Seuring, 2011). Thus, an analysis of the changes in CoC provisions over time provides insight into emerging trends in CSR.

Therefore, our goal is to explore the evolution of CoC and provide answers to the following research questions:

RQ1. How have CoC evolved over time?

RQ2. How rigorous are CoC and how have they been implemented by companies?

RQ3. What motivates firms to pursue and evolve their CoC?
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Consequences</th>
<th>Response</th>
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<tbody>
<tr>
<td>1993</td>
<td>A report documenting Nike’s low wages and poor working conditions gets published by labor rights activists</td>
<td>Nike’s share dropped from $2.27 to 1.72 within a week and is down to $1.41 within four months. Their products were boycotted nationwide.</td>
<td>Nike developed codes of conduct and created the “Fair Labor Association” followed by 600 factory audits.</td>
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<td>1996</td>
<td>Kathryn “Kathie” Lee Gifford is accused of using child labor to produce her clothing line</td>
<td>The name Kathie Lee Gifford was now associated with the word “sweatshop” in the popular mind. She had to discontinue her clothing line immediately.</td>
<td>Gifford engaged in the fight against sweatshops to “stop the horrible practices of some of these manufacturers.”</td>
</tr>
<tr>
<td>2000</td>
<td>Indonesian factory workers producing for Adidas are subject to forced overtime, poverty-line wages and physical abuse</td>
<td>Adidas’ share dropped from $18.13 to 12.47 within two months in 2000.</td>
<td>Adidas increased their focus on auditing and developed a binding code of conduct.</td>
</tr>
<tr>
<td>2001</td>
<td>251 female Vietnamese workers were held in American Samoan producing clothes for J.C. Penny, Sears, and Target in a hostile work environment facing overtime and underpayment</td>
<td>The USA placed an embargo on produced goods. Target faced a loss of value in their share from $38.70 to 31.75 in 2001. Sears suffered a decrease in sales of 2.3% in 2001 compared to sales in 2000. J.C. Penny faced a loss of value in their share from $28.44 to 21.72 throughout a three month period.</td>
<td>Call for action to raise awareness of the practices of these companies and their suppliers.</td>
</tr>
<tr>
<td>2010</td>
<td>A fire killed 21 workers and injured 31 in Bangladesh. Due to chained exits and locked doors and windows, the workers were not able to escape; they were mainly producing clothes for H&amp;M</td>
<td>H&amp;M faced a loss from $26.59 to 23.56 in their share throughout a six month period.</td>
<td>Bangladesh Garment Manufacturers and Exporters Association (BGMEA) paid compensation to families of dead workers. Workers demanded an increased respect for national labor laws and improved safety conditions.</td>
</tr>
<tr>
<td>2010</td>
<td>Sweatshop scandal involving Gap, Next and M&amp;S revealing that their Indian suppliers worked more than 16 h per day without noticeable breaks and were paid 25 cents an hour</td>
<td>Gap faced a loss in their share value from $24.73 to 16.89 throughout a four month period. Marks and Spencer’s dividend decreased from 0.27 to 0.20 and their share lost value from $13.63 to 10.78 over a six month period.</td>
<td>The companies started their own investigations related to sweatshop scandal and further enforced standards for working conditions. M&amp;S launched a 5-year ethical training plan.</td>
</tr>
<tr>
<td>2013</td>
<td>The Rana Plaza Building in Bangladesh collapsed, killing 1134 people and injuring 2500 (including at least 800 children). Investigations revealed that the workers were mainly sewing clothes for major American and European companies such as Loblaw, Walmart and Primark</td>
<td>Walmart faced a loss in the value of their share from $77.72 to 74.49 and their share sell volume decreased from 165,085,800 to 13,025,400. Loblaw’s share fell from $47.61 to 45.00 and their share sell volume decreased from 6,700 to 700 within a month.</td>
<td>The Rana Plaza Coordination Committee was formed and the Rana Plaza Arrangement which provides funds to the victims of the disaster was established. Further, an accord on factory and building safety in Bangladesh was created. And an increased adoption of codes of conduct among involved firms was noticeable. Commitment to enforce humane working conditions was developed.</td>
</tr>
<tr>
<td>2014</td>
<td>GAP announced a raise of minimum wages for US employees; however, workers in overseas facilities still faced</td>
<td>GAP’s gross profit decreased from 6,289,000 in 2015 to 5,720,000 in 2016 and 5,840,000 in 2017. Further, their full-year</td>
<td>(continued)</td>
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Given the persistent and pronounced public backlash to incidents over the past 20 years (see Table I), these questions are both timely and relevant. By providing insights into those research questions, our research makes three salient contributions. First, we detail changes in CoC across four points in time for a sample of 36 transnational companies. Second, we use a competing-theories approach to assess the motivations behind the adoption and evolution of CoC within companies. Specifically, we determine that companies have employed CoC as a leveling immunization mechanism rather than as an aspirational tool. Third, we provide evidence that the emerging homogenization of CoC is mostly motivated by risk avoidance. Hence, we explore emerging opportunities for companies to leverage CoC in pursuit of an aspirational image and competitive advantage.

The manuscript is structured as follows. First, we set up a framework of two competing theoretical lenses to ground the analysis. Next, we detail the applied methodology. Then, we present our findings. Following, we provide a detailed discussion of theoretical and managerial implications. In conclusion, the manuscript discusses limitations and suggestions for further research.

Theoretical background: competing theoretical lenses

Chen and Paulraj (2004) highlight the value of applying competing theoretical lenses to build and elaborate theory in supply chain management. Research on strategic motivation and capability development, including on CoC, has been framed in a number of different theoretical perspectives. Two theories – institutional theory (DiMaggio and Powell, 1983; Meyer and Rowan, 1977) and the awareness–motivation–capability (AMC) (Chen and Miller, 2012) perspective – inform the evolution of CoC. Specifically, institutional theory has been employed to explain the impetus for companies to institute CoC in order to comply with societal pressures (e.g. Perez-Batres et al., 2012; Weaver et al., 1999; Wright and Rwabizambu, 2006). Similarly, previous research has taken a capability perspective on CSR (e.g. Arend, 2014; Buyssse and Verbeke, 2003) and CoC in particular (e.g. Arya and Salk, 2006; Buller and McEvoy, 1999; Yu, 2008). These perspectives provide very different interpretations of why companies adopt the COCs that they do. Testing these competing perspectives would clarify how the public, investors and managers should view these documents.

Institutional theory emphasizes the role of societal pressures on companies to pursue CSR efforts (Connelly et al., 2011). Campbell (2007) establishes an institutional theory of CSR
via eight propositions that frame the motivation for companies to engage in socially responsible ways. These propositions are a combination of financial performance (P1), the competitive environment (P2) and different institutional factors such as regulation, governance and outside stakeholders (P3–P8). With respect to the adoption of CoC, institutional theory posits that companies employ CoC as a reaction to outside pressures. The company’s goal is to use CoC to mitigate exposure to reputational risk.

The AMC framework, by contrast, articulates how firms can adopt CoC as a strategic response to the dynamics of inter-firm rivalry (Chen and Miller, 2012). In other words, the AMC provides a theoretical impetus for companies to actively drive CSR practices upstream in their supply chain by using CoC to gain possible competitive advantage over their direct competition. CSR initiatives, including CoC, can be leveraged to upstage rivals, positioning a focal company to build a positive image, unique capabilities and a competitive advantage. Thus, the AMC perspective emphasizes the proactive opportunities for firms to leverage CSR capabilities as a competitive tool.

The following discussion summarizes each competing theoretical perspective and articulates testable hypotheses regarding the adoption and evolution of CoC.

**Institutional theory**

Organizations adapt to their environment. The influence of the environment on an organization leads to changes that internalize external norms; this process is informed by institutional theory (DiMaggio and Powell, 1983; Meyer and Rowan, 1977). The decision-making process in this environment is shaped by the rules of society (Tolbert and Zucker, 1996), and the changes derived from these decisions are described as the institutionalization of the environment within the organization (Meyer and Rowan, 1977). Institutional theory identifies three different types of mechanisms leading to an isomorphic change of an organization: coercive isomorphism, mimetic isomorphism and normative isomorphism (DiMaggio and Powell, 1983).

Coercive isomorphism describes the process when companies are forced to adopt specific behaviors or practices. Governments, for instance, can force regulatory compliance, initiating isomorphism (Jennings and Zandbergen, 1995; Sarkis et al., 2011). The reality is that governments often encourage CSR via regulation (Clemens and Douglas, 2006; Connelly et al., 2011). Campbell (2007) specifically proposes that strong and well-enforced regulation motivates companies to act in socially responsible ways; in these situations the regulatory mandate becomes the motivation. Many governments in developing economies have, for example, codified a minimum age for workers. The failure to comply can lead to fines or other punishment.

However, just because a regulation is imposed, it does not guarantee that it will be enforced effectively (Healy and Iles, 2002; Teubner, 2017). Thus, Campbell (2007) argues that the power of a government to coerce companies into institutionalizing social or environmental norms is more often limited by their capability to police compliance and sanction misbehavior. Hence, from a coercive isomorphism perspective, we would expect to see a strong congruence between relevant regulation and CoC provisions in circumstances where laws are enforceable and compliance is easily observable.

Mimetic isomorphism describes the process in which companies imitate the behaviors and practices of industry peers (Aerts et al., 2006). Social norms are institutionalized via the establishment of benchmarked practices (Tolbert and Zucker, 1996). Campbell (2007) emphasizes the role of self-governance with respect to companies’ reactions to both regulation as well as emerging industry standards that are observable in the CSR context. Regarding CoC, institutional theory predicts that companies operating in an environment attentive to CSR will mimic the behavior of the majority of their peers, and common practices will be institutionalized into the norm (Amran and Haniffa, 2011; Martínez-Ferrero and García-Sánchez, 2017).
Normative isomorphism refers to the process of institutionalizing societal expectations (Connelly et al., 2011; DiMaggio and Powell, 1983). Societal norms and expectations will cause organizations to assimilate good behavior over time and abandon “frowned upon” behaviors; the influence of the “court of public opinion” is all that is required to initiate institutionalization. Since sustainability has emerged as a socially constructed norm (Brockhaus, 2013), companies have implemented social and environmental practices to conform to these normative pressures (Perez-Batres et al., 2011).

NGOs are a main driver of normative isomorphism (Escobar and Vredenburg, 2011; Habisch and Wegner, 2005). To persuade companies to engage in CSR practices, NGOs publicly endorse good behavior as well as “shame” firms for misconduct (Sarkis et al., 2011). For instance, shortly after the early 1990s reports that Nike’s supply chain employed child labor and poor working conditions, NGOs leveraged the power of the media in conjunction with rising stakeholder demands for CSR to persuade Nike to adopt its first CoC in 1991 (Nisen, 2013). However, enforcement was weak and negative press for Nike continually surfaced throughout the rest of the decade (Lutz, 2015). Facing a building wave of public backlash and declining sales (Banjo, 2014), Nike stepped up to the plate in 1998 and made a comprehensive effort to drive real change up its supply chain. By 2005, the company had finally managed to turn the tide, earning recognition as an industry leader in effective CSR (Egels-Zandén and Lindholm, 2015).

Importantly, Campbell (2007) emphasizes that the institutional theory perspective predicts a focus on a “minimum behavioral standard.” Companies are motivated to take the required steps to purge unacceptable behavior from their supply chains in order to minimize reputational risk. That is, since increasing the rigor of CoC provisions is inherently costly (e.g. Graafland, 2018; Lins et al., 2017), standards will harmonize at a level equivalent to the lowest acceptable common denominator.

Based on institutional theory, P1 states: “Coercive, mimetic and normative isomorphic pressures lead companies to adopt CoC in which provisions harmonize over time and gravitate toward the lowest standard accepted by society or mandated by regulations.”

The awareness–motivation–capability perspective
As stakeholders increasingly self-identify as being socially and environmentally conscious, managers may view CSR initiatives as an opportunity to create distinctive value (Lourenço et al., 2012). From this perspective, routines that enable a company to act in a socially and environmentally responsible manner may be viewed as a valued dynamic capability (e.g. Barreto, 2010; Eisenhardt and Martin, 2000; Teece, 2007). That is, since CSR emerged as an important societal goal in the mid-1990s, companies may choose to become socially responsible first movers, leveraging CSR capabilities for an improved corporate image. This translates into competitive advantage and enhanced financial performance (Lins et al., 2017; McWilliams and Siegel, 2001). The inherent “rightness” and social desirability of CSR reinforce this notion (Brockhaus et al., 2017).

The AMC perspective focuses on the dynamics of competitive rivalry (Chen and Miller, 2012) and explicates why companies may proactively engage in CSR as opposed to merely reacting to institutional pressures. Figure 1 depicts AMC dynamics. Essentially, competitive tension among rivals motivates capability development. As a close rival makes a strategic investment, other firms are forced to respond – or risk competitive disadvantage. Critically, awareness of rival’s strategic moves triggers a motivation to respond, which leads the focal firm to invest in comparable capabilities. The goal is to close competitive gaps that rivals create. Naturally, the focal firm may have a desire, or sense an opportunity, to proactively create a positive gap between itself and rivals. This back-and-forth tension may lead to a strategic arms race. A higher threat level, which is related to the closeness of the rivalry, intensifies both motivation and investments in capabilities (Chen, 2017; Porter, 1980).
Awareness is a scanning skill – and a prerequisite to building dynamic capabilities. Awareness refers to a company’s ability to “read” the market to identify threats and opportunities. Companies keep a close eye on rivals even as they assess opportunities to tap into current consumer sentiment and cater to targeted audiences. Companies may also track relevant trends in other industries, a form of non-competitive benchmarking. The goal is to identify a way to “beat” the competition (or at least not lose to rivals) (Baum and Korn, 1999). As consumers have become more attuned to CSR, their expectations regarding CSR practices have elevated. Managers, who are acutely aware of the socially responsible voice, may thus perceive CSR as an opportunity to differentiate themselves from rivals (Schaltegger and Burritt, 2015).

As publicly available documents, CoC are an obvious target for scanning. A thorough analysis of a rival’s CoC is a rational awareness behavior. Importantly, consumer experiences in one industry often increase expectations across all interactions, regardless of industry (Oliver, 1980). Recognizing this reality, heightened awareness may thus lead managers to track not just rivals’ capabilities but also cross-industry initiatives, looking for CSR best practices. If they observe a positively recognized CSR effort from a high-profile firm from a different industry codified in that company’s CoC, managers will likely consider revisiting their own standards. Proactive awareness activities provide a more comprehensive overview of emerging CSR trends, potentially identifying opportunities to be recognized as leaders (Esty and Winston, 2009).

Motivation derives from the emerging threats and opportunities that managers identify to outpace rivals (Ferrier, 2001). Managers may be motivated to develop CSR initiatives to keep up with rivals – or even expand or elevate such initiatives to outpace rivals (Closs et al., 2010). The AMC framework implies that managers are motivated to close negative gaps and create positive gaps. From this perspective, managers may proactively seek out opportunities to lead in their industry by developing state-of-the-art CoC to drive CSR best practice up their supply chain in search of competitive advantage. Importantly, as noted above, we propose that in the case of CoC, although the impetus to stand out derives the competitive tension with rivals, the ideas about how to stand out may come from observable trends both within and across industries.

Capabilities refer to the company’s ability to reconfigure and deploy resources to obtain competitive advantage (Chen et al., 2007). Thus, the third and final step in the AMC sequence

Figure 1. Awareness, motivation and capability dynamics
relates to a firm’s ability to pursue CSR initiatives as part of its corporate strategy and increase customer loyalty (Brockhaus et al., 2017). Leading-edge capabilities are required to put forward an authentic CSR message to convince customers that a company is acting in congruence with its communicated value system (Harter, 2002; Ménard and Brunet, 2011). Such leading-edge capabilities are required by the AMC to derive competitive advantage.

Patagonia, for instance, uses aggressive sustainability messaging (O’Donnell, 2015) to establish its brand as a CSR leader. This enables Patagonia to dominate its niche market at a premium price point. After scanning the market potential (awareness), Patagonia drafted an aspirational sustainability strategy (motivation) (Chouinard and Stanley, 2012; Leonard, 2014). Patagonia subsequently invested heavily in CSR to establish a leading-edge capability to move the needle regarding “sustainable consumption” (Patagonia, 2014). Importantly, and as previously mentioned, such a capability is required to be perceived as authentic and to help the company translate a CSR strategy into a competitive advantage.

The AMC perspective provides the grounding for P2: “Some companies will use CoC provisions to distinguish themselves from rivals, leveraging a CSR capability for distinctive advantage. Among industry leaders, dynamic changes and increasing rigor will lead to divergence rather than harmonization of CoC provisions over time.”

Methodology
Data collection
To gain insight into the evolution of supplier CoC, we replicate the approach used by Emmelhainz and Adams (1999) and Magnan et al. (2011). Replication validates and elaborates previous academic inquiry (Goldsby and Autry, 2011). Thus, it is important to understand the foundational works. Specifically, Emmelhainz and Adams evaluated the CoC of 27 progressive retailers and manufacturers identified by the US Department of Labor as “The Trendsetters.” The Trendsetter list is based on “information provided by the companies related to their voluntary efforts to ensure that their goods are made in compliance with labor laws.” Emmelhainz and Adams categorized the content of the codes into five areas:

1. general provisions of the codes (monitoring, penalties, worker rights and conditions);
2. definition of underage workers (none, law of the land, under 14, etc.);
3. working hours (days off and maximum hours per week);
4. employee rights (corporal punishment, right to collective bargaining, due process, etc.); and
5. enforcement if out of compliance (payment, legal action, cancel orders, terminate, etc.).

Magnan et al. (2011) replicated the work of Emmelhainz and Adams (1999). However, since the Trendsetter list no longer existed, they relied on other identifiers of social responsibility, namely the Business Ethics 100 Best Corporate Citizens and the Social Responsibility metric from Fortune’s Most Admired Companies list (Figlewicz and Szwajkowski, 2002; Roberts and Dowling, 2002). The Magnan et al. (2011) sample included 36 firms, 20 apparel firms and 16 firms dominated by manufacturers and retailers. Like Emmelhainz and Adams, Magnan et al.’s goal was to provide an overview of the CoC’s content and scope. Magnan et al. (2011) found that CoC had become a commonly used tool in setting CSR standards for the upstream supply chain. Furthermore, CoC had been broadening the scope of covered issues and had become more explicit in detailing possible transgressions.

Our research builds on those studies, replicating their data collection and analysis mechanisms, and providing a theoretically grounded perspective of CoC evolution. That is, we used the 1999 data from Emmelhainz and Adams as a baseline, borrowed the 2005 data
from Magnan et al., and then collected data from 2010 and 2017. The research reported here covers both the original apparel category as well as a separate analysis of the non-apparel companies. To maintain consistency, we followed the methodological approach of the previous studies as closely as possible.

Table II shares a basic demographic overview of the sampled companies (based on the October 2017 collection). Information was collected from publicly available official company

<table>
<thead>
<tr>
<th>Company</th>
<th>Industry</th>
<th>Company Headquarters</th>
<th>Number of Employees</th>
<th>Annual revenue (in US$ or otherwise specified)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Liz Claiborne – Kate Spade</td>
<td>Apparel</td>
<td>USA</td>
<td>6,800</td>
<td>1.3bn</td>
</tr>
<tr>
<td>2 Nike</td>
<td>Apparel</td>
<td>USA</td>
<td>74,400</td>
<td>34.35bn</td>
</tr>
<tr>
<td>3 Reebok International</td>
<td>Apparel</td>
<td>USA</td>
<td>7,400</td>
<td>1.5bn</td>
</tr>
<tr>
<td>4 VF</td>
<td>Apparel</td>
<td>USA</td>
<td>76,000</td>
<td>11.8bn</td>
</tr>
<tr>
<td>5 Jones Apparel Group – Nine West Holdings</td>
<td>Apparel</td>
<td>USA</td>
<td>6,000</td>
<td>n/a</td>
</tr>
<tr>
<td>6 Phillips-Van Heusen (PVH)</td>
<td>Apparel</td>
<td>USA</td>
<td>20,000</td>
<td>8.9bn</td>
</tr>
<tr>
<td>7 Kellwood – Sun Capital</td>
<td>Apparel</td>
<td>USA</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>8 Levi Strauss</td>
<td>Apparel</td>
<td>USA</td>
<td>13,800</td>
<td>4.9bn</td>
</tr>
<tr>
<td>9 The Gap</td>
<td>Apparel</td>
<td>USA</td>
<td>135,000</td>
<td>15.53bn</td>
</tr>
<tr>
<td>10 Timberland – VF</td>
<td>Apparel</td>
<td>USA</td>
<td>1,000–5,000</td>
<td>11.8bn (VF)</td>
</tr>
<tr>
<td>11 Russell Corp (Fruit of Loom)</td>
<td>Apparel</td>
<td>USA</td>
<td>32,000</td>
<td>n/a</td>
</tr>
<tr>
<td>12 Tommy Hilfiger – PVH</td>
<td>Apparel</td>
<td>UK (PVH)</td>
<td>15,000</td>
<td>8.9bn (PVH Corp.)</td>
</tr>
<tr>
<td>13 Patagonia</td>
<td>Apparel</td>
<td>USA</td>
<td>2,585</td>
<td>0.3bn</td>
</tr>
<tr>
<td>14 Lands End</td>
<td>Apparel</td>
<td>USA</td>
<td>5,300</td>
<td>1.14bn</td>
</tr>
<tr>
<td>15 Nordstrom</td>
<td>Apparel</td>
<td>USA</td>
<td>76,000</td>
<td>15.4bn</td>
</tr>
<tr>
<td>16 The Limited – Sun Capital</td>
<td>Apparel</td>
<td>USA</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>17 Woolworth’s</td>
<td>Apparel</td>
<td>Australia</td>
<td>202,000</td>
<td>55.5bn (Australian $)</td>
</tr>
<tr>
<td>18 Adidas</td>
<td>Apparel</td>
<td>Germany</td>
<td>56,888</td>
<td>21.28bn</td>
</tr>
<tr>
<td>19 Eddie Bauer</td>
<td>Apparel</td>
<td>USA</td>
<td>8,000</td>
<td>1bn</td>
</tr>
<tr>
<td>20 Columbia Sportswear</td>
<td>Apparel</td>
<td>USA</td>
<td>7,000</td>
<td>2.47bn</td>
</tr>
<tr>
<td>21 Target Corp</td>
<td>Retail</td>
<td>USA</td>
<td>35,000</td>
<td>71.88bn</td>
</tr>
<tr>
<td>22 Pier 1 Imports</td>
<td>Houseware</td>
<td>USA</td>
<td>22,000</td>
<td>1.8bn</td>
</tr>
<tr>
<td>23 McDonalds</td>
<td>Food and Beverages</td>
<td>USA</td>
<td>150,000</td>
<td>22.82bn</td>
</tr>
<tr>
<td>24 Procter &amp; Gamble</td>
<td>CPG</td>
<td>USA</td>
<td>9,5000</td>
<td>16.7bn</td>
</tr>
<tr>
<td>25 Fortune Brands</td>
<td>Home and Security</td>
<td>USA</td>
<td>23,000</td>
<td>5.3bn</td>
</tr>
<tr>
<td>26 Dell</td>
<td>Electronics</td>
<td>USA</td>
<td>108,800</td>
<td>61.6bn</td>
</tr>
<tr>
<td>27 H-P</td>
<td>Electronics</td>
<td>USA</td>
<td>49,000</td>
<td>52bn</td>
</tr>
<tr>
<td>28 Walmart</td>
<td>Retail</td>
<td>USA</td>
<td>2,200,000</td>
<td>117bn</td>
</tr>
<tr>
<td>29 Microsoft</td>
<td>Software and Hardware</td>
<td>USA</td>
<td>131,300</td>
<td>24.5bn</td>
</tr>
<tr>
<td>30 Nokia</td>
<td>Electronics</td>
<td>Finland</td>
<td>102,760</td>
<td>27.8bn</td>
</tr>
<tr>
<td>31 IBM</td>
<td>Software and Hardware</td>
<td>USA</td>
<td>39,7800</td>
<td>71.1bn</td>
</tr>
<tr>
<td>32 Pacific Market International</td>
<td>Houseware</td>
<td>USA</td>
<td>807</td>
<td>0.269bn</td>
</tr>
<tr>
<td>33 Costco</td>
<td>Retail</td>
<td>USA</td>
<td>143,000</td>
<td>129bn</td>
</tr>
<tr>
<td>34 Disney</td>
<td>Entertainment</td>
<td>USA</td>
<td>80,000</td>
<td>15bn</td>
</tr>
<tr>
<td>35 Starbucks</td>
<td>Food and Beverages</td>
<td>USA</td>
<td>277,000</td>
<td>6bn</td>
</tr>
<tr>
<td>36 IKEA</td>
<td>Furniture</td>
<td>Sweden</td>
<td>149,000</td>
<td>€26.9bn</td>
</tr>
</tbody>
</table>

Table II. Companies in the 2005–2017 sample
sources (websites, annual reports, etc.). Some data points are missing as available records are incomplete due to mergers and acquisitions and the fact that some of the companies from the sample are privately held and do not disclose current data on the number of employees or revenue. Ultimately, our sample represents a large cross-section of the relevant players in the apparel industry as well as high-profile firms from retail, electronics and food and beverage industries. In total, the sampled companies employ more than 6m people and earn more than $800bn in turnover. Thus, within the constraints of a replication study, the current sample should capture key CoC trends.

Data analysis
We content analyzed (e.g. Ritala et al., 2018) each CoC, documenting which provisions were included in each time period as well as how the codes may have changed. Because CoC are legal documents that are used in contracts with suppliers, they are designed to be simple, concise and structured (Erwin, 2011). We analyzed each CoC based on a simple two-step process:

1. Rigor: does the CoC contain a provision regarding a specific behavior or issue (binary 0/1 variable)? Again, this is consistent with Emmelhainz and Adams (1999) and Magnan et al. (2011). Because many CoC have added environmental provisions since 2011, we broadened the scope of the analysis to include that category. Thus, the current analysis identifies six categories of provisions: penalties, monitoring, employee rights, underage workers, environment and working conditions.

2. Implementation detail: where applicable, implementation details of each provision were recorded (e.g. “cutoff for ‘underage’ workers” or “maximum hours per week,” etc.). A total of 28 categories summarize the provision details. These data are also binary, largely because of the way CoC are structured. For example, for “underage workers,” CoC define a set standard, i.e. “14 (15, 16) is the minimum worker age.”

Given the legal nature and structure of CoC, this analysis fairly captures the content of the CoC, enabling a longitudinal analysis. For the 2010 and 2017 data, each of the 36 CoC was analyzed based on the guidelines from the Fair Labor Association and the categories established by Emmelhainz and Adams (1999). At least two researchers analyzed the CoC independently – triangulation of investigators (Krefting, 1991) – to ensure unbiased results. Given the crucial importance of enforceability with suppliers in developing economies (Locke et al., 2007), provisions in CoC generally avoid excessive “legalese” and spell details out concisely and explicitly. For example, the Nike 2017 CoC states, “The supplier does not use forced labor, including prison labor, indentured labor, bonded labor or other forms of forced labor.” Clear definitions of terms accompany each provision. Thus, few coding discrepancies occurred. Those discrepancies that did occur were purely semantic in nature (e.g. “at least” vs “not below”). One exception – enforcement action in case of noncompliance – required more meticulous coding.

To code “Enforcement Action in Case of Noncompliance,” we retained the categories established by Emmelhainz and Adams (1999) and Magnan et al. (2011). Their framework fit our data set well – that is, all stated enforcement action fit into one of their established categories (terminate relationship, legal action, etc.). However, details on enforcement action are either specified in the individual provision on a certain topic (e.g. child labor, environmental standards, etc.) or spelled out in a summary paragraph detailing enforcement in general (several CoC use both approaches at the same time). Members of the research team compared notes to ensure that these details were handled consistently. All deviations in coding were minor and were easily rectified in a discussion that included researchers from the previous round of coding as well as a member of the team who had not analyzed the particular provision before in order to avoid any form of bias.
The binary (yes/no) nature of our sample data limited our statistical analysis options. We conducted a $\chi^2$ test, comparing the data from each of the four time periods for the apparel industry as well as the data from the 2005, 2010 and 2017 periods for the “other” companies and the full sample. We compared the count of each provision and the provision’s details and computed the $\chi^2$ statistics to explore if a change in the provisions was significant between time periods relative to the number of companies in the sample. The $p$-values from our analysis are presented in Table III in the findings section below. Values significant below the 5 percent level are highlighted in italic font.

Given the straightforward binary approach to analyzing the provisions described above, the standardized and legal nature of CoC, and the rigorous coding process, we believe that our research meets all of the requirements to provide credible and reliable results as established by Krefting (1991) and Lombard et al. (2002).

**Findings**

A comprehensive overview of our content analysis of the CoC data is presented in Table AI. The data are portrayed both in absolute and relative numbers. We computed relative

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Penalties</td>
<td>0.540</td>
<td>0.525</td>
<td>0.003</td>
<td>0.730</td>
<td>0.010</td>
<td>0.864</td>
<td>0.000</td>
</tr>
<tr>
<td>Monitoring</td>
<td>0.324</td>
<td>0.288</td>
<td>0.004</td>
<td>1</td>
<td>0.144</td>
<td>0.387</td>
<td>0.062</td>
</tr>
<tr>
<td>Employee rights</td>
<td>0.000</td>
<td>0.018</td>
<td>0.004</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Underage workers</td>
<td>0.466</td>
<td>0.548</td>
<td>0.147</td>
<td>1</td>
<td>0.320</td>
<td>0.739</td>
<td>0.083</td>
</tr>
<tr>
<td>Environment</td>
<td>1</td>
<td>0.000</td>
<td>0.072</td>
<td>0.000</td>
<td>0.015</td>
<td>0.000</td>
<td>0.003</td>
</tr>
<tr>
<td>Working conditions</td>
<td>1</td>
<td>0.311</td>
<td>0.311</td>
<td>0.553</td>
<td>0.153</td>
<td>0.552</td>
<td>0.083</td>
</tr>
<tr>
<td>No definition</td>
<td>0.000</td>
<td>1</td>
<td>1</td>
<td>0.500</td>
<td>1</td>
<td>0.559</td>
<td>0.000</td>
</tr>
<tr>
<td>Law of the land</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.024</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Below 16</td>
<td>0.185</td>
<td>1</td>
<td>0.292</td>
<td>1</td>
<td>1</td>
<td>0.416</td>
<td>0.352</td>
</tr>
<tr>
<td>Below 15</td>
<td>0.110</td>
<td>0.204</td>
<td>0.013</td>
<td>0.013</td>
<td>0.694</td>
<td>0.011</td>
<td>0.038</td>
</tr>
<tr>
<td>Below 14</td>
<td>0.164</td>
<td>0.197</td>
<td>0.723</td>
<td>0.476</td>
<td>0.077</td>
<td>0.610</td>
<td>0.157</td>
</tr>
<tr>
<td>1 day off in 7</td>
<td>0.002</td>
<td>0.311</td>
<td>0.002</td>
<td>0.688</td>
<td>0.001</td>
<td>0.610</td>
<td>0.000</td>
</tr>
<tr>
<td>Compensated OT</td>
<td>0.007</td>
<td>0.047</td>
<td>0.001</td>
<td>0.456</td>
<td>0.049</td>
<td>0.052</td>
<td>0.000</td>
</tr>
<tr>
<td>No max. specified</td>
<td>0.104</td>
<td>0.292</td>
<td>0.000</td>
<td>1</td>
<td>1</td>
<td>0.084</td>
<td>0.000</td>
</tr>
<tr>
<td>Max. as specified by law of the land</td>
<td>0.048</td>
<td>0.288</td>
<td>0.000</td>
<td>0.723</td>
<td>0.002</td>
<td>0.596</td>
<td>0.000</td>
</tr>
<tr>
<td>Max. &lt; 60 h/week</td>
<td>0.008</td>
<td>0.519</td>
<td>0.001</td>
<td>0.688</td>
<td>0.012</td>
<td>0.799</td>
<td>0.000</td>
</tr>
<tr>
<td>Corporal punishment</td>
<td>0.012</td>
<td>0.507</td>
<td>0.002</td>
<td>1</td>
<td>0.033</td>
<td>0.645</td>
<td>0.000</td>
</tr>
<tr>
<td>Freedom of association</td>
<td>0.000</td>
<td>0.288</td>
<td>0.004</td>
<td>0.741</td>
<td>0.000</td>
<td>0.667</td>
<td>0.000</td>
</tr>
<tr>
<td>Due process</td>
<td>0.002</td>
<td>0.057</td>
<td>0.000</td>
<td>0.734</td>
<td>0.000</td>
<td>0.107</td>
<td>0.000</td>
</tr>
<tr>
<td>Policy on termination</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Policy on promotion</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Policy on hiring</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>No discrimination T/P/H</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.614</td>
<td>1</td>
<td>0.739</td>
</tr>
<tr>
<td>Forced labor</td>
<td>1</td>
<td>1</td>
<td>0.000</td>
<td>0.047</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>No discrimination</td>
<td>0.004</td>
<td>0.035</td>
<td>0.035</td>
<td>0.138</td>
<td>0.033</td>
<td>0.015</td>
<td>0.003</td>
</tr>
<tr>
<td>Payment to HRO</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Legal action</td>
<td>1</td>
<td>0.000</td>
<td>0.292</td>
<td>1</td>
<td>1</td>
<td>0.739</td>
<td>1</td>
</tr>
<tr>
<td>Strongly object</td>
<td>0</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>1</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Cancel outstanding orders</td>
<td>0.720</td>
<td>0.429</td>
<td>0.705</td>
<td>0.986</td>
<td>0.626</td>
<td>0.568</td>
<td>1</td>
</tr>
<tr>
<td>Corrective action</td>
<td>0.174</td>
<td>0.519</td>
<td>0.000</td>
<td>0.694</td>
<td>0.000</td>
<td>0.799</td>
<td>0.000</td>
</tr>
<tr>
<td>Terminate relationship</td>
<td>0.373</td>
<td>0.752</td>
<td>0.110</td>
<td>0.488</td>
<td>0.465</td>
<td>0.799</td>
<td>0.101</td>
</tr>
<tr>
<td>Cancel individual order</td>
<td>0.018</td>
<td>0.677</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.700</td>
<td>0.209</td>
</tr>
<tr>
<td>Codes of conduct are posted</td>
<td>1</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>No stated action</td>
<td>0.380</td>
<td>0.736</td>
<td>0.000</td>
<td>0.977</td>
<td>0.000</td>
<td>0.789</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table III. Results from $\chi^2$ comparison for year-to-year changes
changes between the sample of apparel companies from one-time period to the next (1999–2017). Finally, we added a similar computation where the totals between all respective time periods from 2005 to 2017 are compared. The 1999 data point is not included in this calculation because only apparel firms were sampled. Table III summarizes the results of our \(\chi^2\) test for statistical difference between the time periods. Significant \(p\)-values below the 5 percent mark are in italic. Many provision details in CoC were changed by a significant number of companies across the time periods. We will cross-reference the data from Table III in our following discussion of the findings to highlight the nature of the change.

Before we dive into the specifics, let us point out some general trends for the full-sample data (2005 vs 2010 vs 2017):

- **Specificity**: specificity of CoC has increased across most categories between 2005 and 2017 – 26 percent of the provisions/details were changed between 2005 and 2010 and 68 percent were changed between 2010 and 2017 by a significant number of companies in the sample (\(p\)-values in Table III).
- **Homogeneity**: CoC have become more homogenous, increasingly relying on the same metrics and common minimum denominators. More than a quarter of the provisions that were altered by a significant number of companies from the sample between 2005 and 2010 were again changed by a significant number of firms between 2010 and 2017. Importantly, as Table A1 reveals, those changes generally harmonized provision details across the sample, suggesting that CoC provision details are driven in the same direction by outside pressures.
- **Grounded in regulation**: CoC draw increasingly on the “law of the land” to establish minimum thresholds for items such as minimum age and maximum working hours.
- **Economic sensitivity**: much of the 2010 data are outliers of the general trend as many of the “less concrete” categories such as policies regarding employees’ rights or overtime compensation decreased in specificity before rebounding in 2017. This counter-intuitive trend is likely due to the 2008 Great Recession.

### Issues covered by CoC provisions

Figure 2 depicts a longitudinal look at the issues covered by CoC provisions. We focus on apparel companies because data were available for all four time periods between 1999 and 2017. All sampled industries between 2005 and 2017 are depicted in Figure A1. All observable trends are concurrent with our analysis of the apparel data. Across all six categories of provisions, both the apparel companies and the complete sample indicate the same trends. Indeed, the data in Figure 2 set the stage for our findings in general:

- **Detail and rigor increased between the 1999 and 2017.**
- **CoC detail and rigor diminished for all but one provision in 2010.**
- **By 2017, 100 percent of the sampled CoC covered monitoring of violations, detailed employee rights, addressed the issue of underage workers, specified working conditions and contained rules pertaining to environmental misconduct. Since environmental provisions were not part Magnan et al’s 2005 data nor the previous work by Emmelhainz and Adams (1999), we observe a change from 0 to 100 percent of CoC for this category.**
- **Details regarding penalties for misconduct decline between 1999 and 2010; however, in 2017 we observe a significant rebound in detail. Magnan et al. (2011) originally suggested that “firms are trending to an era of collaboratively working out out-of-compliance issues, rather than using threats to drive change.” Our current data**
The evolution of supplier codes of conduct

Definition of underage employees
The data regarding the minimum age of workers across the full sample are depicted in Figure 3. A tendency to harmonize CoC is directly apparent from the data. While few firms had no definition of an underage employee in their CoC in 2005 and 2010, all selected companies had a provision defining the minimum worker age in 2017 ($p < 0.05$). A reference to the law of the land jumped to 100 percent by 2017 as an increasing number of countries of
origin passed respective legislation (all changes significant). However, the insightful aspect of our analysis is the specific age companies considered “underage” over time. As many as half of the firms in our sample had set the minimum threshold for age at 14 in 2005. Yet, that percentage dropped below 30 percent by 2017. When we computed the $\chi^2$ statistics for the changes between 2005 and 2017, the data show a marginally significant result ($p = 0.056$). Respectively, we see a drop in CoC that set the minimal worker age at 16 from 14 percent in 2005 to a barely noticeable figure of 3 percent by 2017. The direct comparison between 2005 and 2017 show a marginally significant change ($p = 0.094$). Organizations are normalizing on a minimum age of 15 years, with the percentage passing 80 percent by 2017 (all point-to-point changes are significant). Simply stated, 15 emerges as the “middle-ground” consensus with companies converging from either 14 or 16.

**Hours worked and compensation of overtime**

The results regarding working hours and compensation of overtime (Figure 4) mirror the previous findings. We identify a drop (though none of the changes are statistically significant) in specificity and rigor of CoC in 2010 (with a logical increase on reliance on the law of the land) with a significant (across all five categories) rebound in 2017. By 2017, all CoC contained language regarding the allowable hours of work per week and more than 90 percent mandated a combination of at least one day of leisure in a seven-day work week, compensation for overtime and a limit of working hours to less than 60 per week. The apparel only data between 1999 and 2017 (Figure A2) show the same, if more pronounced, trend (all changes significant). Analogous to the previous analysis of worker age, we find an increasing harmonization of standards in CoC and greater reliance on the law of the land.

**Employee rights**

Although the data regarding employee rights (Figure 5) follow the previously established pattern, several important nuances arise:

- By 2017, all CoC from the sample specifically outlawed corporal punishment, forced labor and any form of discrimination. Furthermore, 100 percent of CoC mandated the freedom of association. The changes in all of those categories are significant between 2010 and 2017 (see Table III).
CoC have shifted from specific policies regarding termination, promotion and hiring (T/P/H) of employees to imposing sanctions for any sort of discrimination for all previous issues. Akin to the development around the minimum age for workers, the number of CoC provisions regarding specific policies have decreased gradually at an insignificant rate, while the number of anti-discrimination provisions (both in general as well as more specific to T/P/H) have grown significantly from year to year. In fact, by 2017, 100 percent of CoC contained language accordingly, while details on the issue specifically were abandoned entirely. We suggest that this represents a shift from a more heterogeneous set of rules to a more homogeneous approach.

The issue of due process stands out. While increasing from more than 40 to over 60 percent between 2005 and 2010 (p < 0.05), due process completely vanishes from CoC between 2010 and 2017 (p = 0.000). We believe that this does not represent the notion that access to an impartial court of law was abandoned by companies in our sample, but rather that governments in the selected countries of origin took control of the issue (as should be expected by western standards) and thus made specific provisions in CoC dispensable.

In summary, with respect to employee rights, we identify a harmonization and standardization of CoC by 2017. While the changes regarding forced labor and policies condemning discrimination regarding T/P/H had already become commonplace by 2010 (significant changes from 2005), corporal punishment and freedom of association policies do not show a significant increase until 2017. The significant increase in anti-discrimination T/P/H policies in lieu of specific rules with respect to those issues especially emphasizes the trend toward standardization.

The resolution of violations
Finally, Figure 6 shows the overview of policies regarding the resolution of violations for the full sample of CoC in the study. Figure A3 demonstrates the same chart for all apparel companies between 1999 and 2017. These data detail how companies hold suppliers accountable for misconduct.

By 2017, all sampled CoC contained provisions regarding sanctions in cases of misconduct (p < 0.05). By contrast, more than 30 percent of CoC did not address this issue previously.
With respect to conflict resolution via payment to a human right organization (HRO), Figure A3 demonstrates that contributions to HROs were considered a way of settling the breach of a CoC in the apparel industry in the late 1990s. However, this “selling of indulgences” approach was already a fringe strategy, and by 2005, HRO payments vanished from CoC. Pursuing legal action fared a similar fate. While marginally considered in the late 1990s, this course of action remains a fringe strategy to date. Companies simply do not perceive legal action as an appropriate or viable enforcement mechanism (e.g. Roth et al., 2008).

By 2005, over half of our sample companies had provisions in their CoC that called for sanctioning compliance violations with letters of objection. However, by 2010 no such provisions were left ($p < 0.05$). We suggest that this trend is due to a sense of frustration by the western brands involved in this study with haphazard compliance on behalf of their suppliers. Interestingly, by 2017, some firms ($p < 0.05$) readopted the strategy to object rather than actively sanction misconduct.

The cancelation of outstanding orders hovers around 20 percent with respect to an infringement of policies codified in CoC (no significant changes across all industries and data points). The cancelation of outstanding orders means that the company suspends all future orders in combination with demanding changes/compliance before ordering is resumed. While not severing ties with the supplier permanently and immediately, the company sends a clear signal that the current inappropriate behavior is not tolerated.

The most pronounced trend is for companies to work actively with suppliers to improve conditions or correct problems. That is, companies engage in supplier development. Importantly, most provisions in this area are quite unspecific and usually only suggest that the company will “work with the supplier” to achieve compliance. Only one-third of CoC contained such a provision in 2005 and 2010. By 2017, however, 100 percent of CoC had respective language ($p < 0.05$ for all samples). The bottom line is that companies are taking a more developmental approach rather than simply “punishing” suppliers for misconduct.

The strategy to terminate relationships with suppliers for noncompliance jumps from around 50 percent in 2005 and 2010 to 70 percent by 2017 ($p = 0.059$ between 2005 and 2017). For suppliers that are unwilling to act more responsibly, a “zero-tolerance” approach is gradually emerging. Companies are including termination of the relationship as a “nuclear option” to signal their seriousness. Yet, in combination with the surge in provisions regarding corrective development action ($p = 0.000$ between 2010 and 2017), companies are signaling that they want to work with suppliers that are willing to act responsibly.
Provisions regarding the cancelation of individual orders to sanction misconduct remain confined to between around 10 and 20 percent of CoC for the full sample between 2005 and 2017. However, when including the apparel sample going back to 1999 (Figure A3), this number is down from half of CoC (significant change from 1999 to 2005 for the apparel sample). Importantly, these specific cancelation policies are not paired with corrective action but rather represent a “slap on the wrist” for the supplier. Companies have moved away from terminating individual orders for two reasons: this reaction may lack authenticity as order cancelation does not represent “zero-tolerance” since the company does not part ways with the supplier for good and as suppliers become more established, relationships are less focused on a single transaction. Hence, companies want to retain the option to do business with the supplier and emphasize development over one-time punishment.

Finally, we tracked if CoC contained provisions that required suppliers to post the CoC for review by their employees. This number jumped significantly from 22 percent in 2010 to just shy of 90 percent by 2017 \((p < 0.05)\). Companies are focused on creating a more transparent environment. This finding aligns with the increase in developmental approaches companies are taking via corrective action.

Conclusions and implications

Theoretical implications

Our analysis of corporate CoC reveals that companies have become more aware – even acutely aware – of the need to address CSR issues. They want to be seen as socially responsible. They also know that in today’s social-media world customers increasingly hold them accountable for what happens upstream in their supply chain. Our primary research question evaluates not just how companies are responding to mounting CSR pressures as they evolve their CoC, but more importantly, the motivations behind the evolution. Specifically, we evaluate two competing propositions derived from the theoretical background:

\[ P1. \text{ Are companies responding to mounting institutional pressures that lead to isomorphism – a leveling strategy?} \]

\[ P2. \text{ Or, are companies striving to differentiate themselves as CSR champions – a leveraging strategy?} \]

Although both strategies promote the adoption of CoC, the underlying motivation promises to deliver a different type of CoC – and a different level of socially responsible authenticity and culture. Our analysis shows an increasing homogeneity of CoC. More importantly, the evolution is characterized by the emergence of the lowest socially acceptable common denominator. In particular, companies have, in a sense, outsourced CoC design to “law of the land” provisions. Companies increasingly rely on regulation rather than aspiration. Institutional pressures are the primary motivator, a finding that supports \( P1 \).

By contrast, we found no evidence that companies are striving to leverage CoC for competitive advantage. That is, there is no evidence that companies are raising the bar or engaging in a CSR arms race. They are not evolving their CoC toward the highest common denominator or evolving in a way that would help them stand out by outpacing rivals as social champions (no support for \( P2 \)). In fact, as we proposed in our theoretical background, the AMC sequence would suggest that managers monitor their direct competitor’s CoC as well as best practices from other industries and swiftly take action to outperform industry rivals or adopt “winning” CSR practices from outside their industry. In our CoC data, this would manifest as dynamic changes in provisions toward best practice. Yet, we see the exact opposite as firms move in lockstep toward the minimally accepted standard. Thus, although our data provide no support for \( P2 \), we find mounting support for \( P1 \) as we will detail in the following paragraphs.
The increasing reliance on the “law of the land” is perhaps the strongest indicator that companies use their CoC to comply with external forces – i.e. emerging legislation – rather than to create a stellar CSR image that can be promoted for competitive advantage (Campbell, 2007). This provides strong support for P1. Similarly, the bidirectional convergence on 15 as the definition of underage employees exemplifies an isomorphic evolution. Slowly, but surely, companies moved the age to 15 – the age that emerged over time as the socially accepted minimum standard – from more stringent (16) and less restrictive (14) standards. Likewise, the trend toward adopting zero-tolerance policies regarding discrimination – even as specific policies regarding hiring, promotion and termination vanished – conforms with an institutional-theory perspective. The harmonization appears to have occurred in lockstep as “No Discrimination T/P/H” provisions show significant period to period increases across all companies evaluated (providing strong support for P1).

The predominance of isomorphic leveling is further supported by the trends in violation resolution. Companies have consistently gravitated to a diversified approach for handling misconduct. Decisive policies to sever ties for consistent non-socially acceptable or toxic behavior (child or forced labor) are now codified in almost 70 percent of CoC. Yet, 100 percent of the companies in our sample offer a “path to redemption” via developmental efforts – a post-2010 occurrence for lesser misconduct. This change evinces an increasing maturity of CoC to support more strategic relationship management. Indeed, when provision details are examined more closely, we see that companies have learned what kind of misconduct actually concerns consumers and have drawn decisive lines in the sand to immunize their reputations from exposure to such toxic misconduct. At the same time, a more collaborative, fix-the-problem, developmental approach has emerged for most issues.

Finally, the reduction in rigor and detail of CoC in 2010 as companies endured the lingering effects of the Great Recession reinforces the influence of isomorphic evolution. The fact that is that nearly all sampled firms relaxed their CoC expectations of suppliers when public scrutiny declined – as many western consumers were more focused on their own economic situation than conditions abroad. This reality overwhelmingly suggests that CoC specification is driven by the desire to fit in rather than the desire to stand out.

Managerial implications

From a managerial perspective, one key question drives the design of CoC: what are we trying to achieve? Firms can adopt CoC to mitigate the risk of being “caught red handed” in cases of misconduct. In this case, CoC are a form of insurance (a strategy colloquially referred to as a “CYA strategy”). Alternatively, firms may pursue competitive advantage by building a reputation as a true believer, that is, an authentic CSR champion (Fawcett et al., 2015).

The data clearly show a tendency for companies to “follow the lead” of other significant industry players. The main goal is to immunize the brand against public reports of misconduct in their supply chain. This is a logical and cost-effective response. In essence, companies behave as efficiency optimizers (Fawcett et al., 2015). That is, they want access to low-cost resources, especially labor. But they do not want to risk tarnishing their corporate image. CoC provide low-cost image protection, offering companies an opportunity to gain resources access with minimal risk. This strategy is not particularly authentic, but it seems to be working. The lack of authenticity presents an opportunity for companies to go above and beyond the lowest-acceptable-common-denominator mindset. The space exists for companies to use CoC to outpace rivals. For example, companies could consistently set the minimum worker age to 16 or 18, introduce a 40-hour work week, or establish a “living-wage” above the current pay-scale. The question is, “Does a large enough, affluent enough CSR audience exist to earn the premium margin required to support such a leveraging strategy?” (e.g. Batte et al., 2007; Liu et al., 2017; Roth et al., 2008). Patagonia has
shown this is possible with sustainability. But the question remains: can a company reset expectations on the social side of CSR, forcing other companies to respond? To date, the data say, “Companies are not even trying.”

**Limitations, future research and conclusions**

*Limitations and future research*

While drawing on a diverse sample across four points in time, the sample of this study is limited. We selected companies that were originally identified as “trendsetters” in apparel in 1995 and expanded the list to peers Magnan et al. (2011) saw from non-apparel markets. In order to maintain longitudinal consistency, we did not expand our sample further. Although we believe that our current study captures the noticeable trends in CoC evolution, a broader set of firms may provide additional clarity or expose further nuances. In particular, our current sample consists of well-established brands, mainly based in the USA and Western Europe. Taking a look at more-recently-established players, such as Under Armor on the apparel side or Fairphone on the technology side, may yield new insights. Additionally, a look at companies headquartered in Asia, Latin America and other emerging economies may reveal whether the use of CoC is spreading to those consumer markets (as opposed to being just countries of origin) as social and ecological awareness in those countries is on the rise (e.g. Pojani and Stead, 2015; Shekdar, 2009).

Further, our current study does not allow us to derive conclusive insights into how social and environmental issues are “pushed” by focal companies beyond first-tier suppliers. Some CoC contain vague language that suggests second-tier suppliers are to be held to the same standards. But the language neither details suitable enforcement suggestions nor discusses possible repercussions in case a first-tier supplier fails to drive socially responsible behavior upstream. We propose that a study focusing on this issue would be valuable.

The unit of analysis for the current study was publicly available CoC documents. Thus, we cannot speak to the efforts around CSR that companies may be pursuing that involve their upstream supply chain but do not manifest in their CoC. For example, firms may be engaged in initiatives to limit the negative environmental impact of their supply base (e.g. Gong et al., 2018) or improve the sustainability performance of their products with the help of their suppliers (e.g. Petersen and Brockhaus, 2017) without ever considering a codification in their CoC. Indeed, the inclusion of environmental issues in CoC is a relatively new phenomenon. Therefore, we suggest that an application of the theoretical framework from this study to efforts beyond CoC may be beneficial.

**Conclusions**

To start with the bad news, CoC have become a tool to control and tone-down, if not silence, the public conversation about the social and ecological behaviors and performance of established Western brands who rely heavily on sourcing from low-wage countries. To a large degree, CoC appear to be the instrument of choice to immunize Western brands against the fallout of reports on “dirty” insights into the mostly-concealed realities of their supply chain – thus pursuing a homogenization of CoC rather than turning awareness into a motivation to build distinctive capabilities. We find that CoC have shown a tendency of making the lowest acceptable common denominator the established norm rather than setting aspirational goals. On the bright side, we see a shift from simply penalizing suppliers for misconduct to developing companies in countries of origin to be able to achieve compliance and beyond. Importantly, this opens up the market for firms to pursue competitive advantages via superior social and ecological standards.

We identify a decline in CoC rigor and detail in 2010 before levels (more than) rebounded by our 2017 data point. This “dent” was a surprising finding. Although we suggest that a reduction in the levels of focus on social and environmental issues could be expected in a
drastic economic downturn such as the Great Recession (Brockhaus et al., 2017; Hayward et al., 2013; Millen and McGowan, 2013; Strand, 2014), one would expect declining levels of policing of misconduct, which would then result in lower levels of compliance. However, the magnitude of this trend in the actual rigor and detail of the publicly available CoC was unexpected. We conclude that this is strong evidence that CoC capture the focus of industry with respect to social and environmental concerns accurately, as both increases and decreases in public interest and consumer importance are reflected.

Although CoC are currently a road much traveled, going to places many companies have ventured before, our findings invite companies to use their CoC to set aspirational goals, propelling industry forward as the next decade approaches.

References


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<th>Apparel 2010 (n = 20) (%)</th>
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<th>Apparel 1999 (n = 27) (%)</th>
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**Definition of underage employees**

| No definition                              | 15                         | 0                          | 13                        | -15                       | 0                         | 6                         | -3                        | 0                                            | 0                                            | -3                                            |
| Law of the land                            | 26                         | 0                          | 13                        | -26                       | 40                        | 50                        | 38                        | 40                                           | 100                                           | 100                                           |
| Below 16                                   | 4                          | 15                         | 13                        | 11                        | 15                        | 0                         | -6                        | 0                                            | 5                                            | 0                                             |
| Below 15                                   | 15                         | 35                         | 25                        | 20                        | 55                        | 69                        | 30                        | 20                                           | 90                                            | 75                                            |
| Below 14                                   | 15                         | 35                         | 25                        | 20                        | 55                        | 69                        | 30                        | 20                                           | 90                                            | 75                                            |

**Working hours**

| 1 day off in 7                             | 26                         | 75                         | 31                        | 49                        | 60                        | 38                        | -6                        | -15                                          | 100                                           | 94                                            |
| Compensated OT                             | 41                         | 80                         | 69                        | 39                        | 50                        | 56                        | -22                       | -30                                          | 95                                            | 88                                            |
| No max. specified                          | 22                         | 5                          | 0                         | -17                       | 15                        | 13                        | 11                        | 10                                           | 0                                            | 0                                             |
| Max. as specified by law of the land       | 48                         | 20                         | 50                        | -28                       | 35                        | 44                        | 6                         | 15                                           | 100                                           | 94                                            |
| Max. < 60 h/week                           | 26                         | 65                         | 31                        | 39                        | 55                        | 38                        | -3                        | -10                                          | 100                                           | 81                                            |

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The evolution of supplier codes of conduct

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<td>30</td>
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<td>11</td>
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<td>5</td>
<td>0</td>
<td>0</td>
<td>−36</td>
<td>−33</td>
</tr>
</tbody>
</table>

Table AI.
Figure A1. All companies – full spectrum of issues

Figure A2. Hours and compensation across the apparel sample 1999–2017
The evolution of supplier codes of conduct

Figure A3. Violation resolution apparel sample 1999–2017

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Freedom of Association</td>
<td>70%</td>
<td>80%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Disc Process</td>
<td>4%</td>
<td>9%</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Policy on Promotion</td>
<td>4%</td>
<td>9%</td>
<td>4%</td>
<td>4%</td>
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<tr>
<td>No discrimination</td>
<td>70%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
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<tr>
<td>No Discrimination</td>
<td>35%</td>
<td>65%</td>
<td>70%</td>
<td>70%</td>
</tr>
</tbody>
</table>

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Measuring customer-oriented product returns service performance

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Abstract
Purpose – The purpose of this paper is to conceptualise customer-oriented product returns service (COPRS) performance, and develop and validate its measure.
Design/methodology/approach – This study uses qualitative consumer interviews and a quantitative survey to conceptualise, operationalise and validate the measure of COPRS performance.
Findings – The findings indicate 12 components with 46 measurable items for COPRS performance, including assurance, compensation, convenience, empathy, employee empowerment, explanation, feedback, information availability, reliability, responsiveness, tangibles and timeliness.
Research limitations/implications – The measure could facilitate future empirical studies in the product returns service area. Future research could apply the COPRS performance measure across industries or in different settings such as cross-cultural or other retailing contexts.
Practical implications – Managers could evaluate their existing returns service performance in different key aspects based on the COPRS performance metrics and then improve their returns offerings accordingly. It also alerts practitioners to pay more attention to functional integration in designing returns service strategies to enhance customer satisfaction.
Originality/value – The study is one of the first to develop a new measure that substantiates the notion of an integrated marketing and reverse logistics interface, which is an underrepresented body of knowledge in the marketing and operations management disciplines.

Keywords Asia, Structural equation modelling, Reverse logistics, Customer service, Performance measurements

Paper type Research paper

Introduction
Product returns management emerged as a significant management challenge over the last few decades. Returns account for 5–50 per cent of products sold, depending on the business sector (Daugherty et al., 2001; Genchev, 2007). Previous research indicates that managing product returns effectively could enhance customer satisfaction, reduce costs, improve profitability (Stock et al., 2006), build positive referrals and customer reviews (Minnema et al., 2018), and lead to long-term customer relationships (Petersen and Kumar, 2010).

Although the fundamental processes of the backward flow of products starts from unhappy customers (Potdar, 2009) and this process is one of post-purchase customer support (The Supply Chain Council, 2001), existing literature in product returns management focuses mainly on the firm’s process and economic operations (e.g. Agrawal et al., 2014, 2018; Scariotto, 2003) instead of a customer-based and relational approach. It is important to note that end customers initiate returns requests and customer returns are legitimate (Anderson et al., 2009). All customers have reasons to return a
product, and firms must provide a satisfactory returns service experience for customer satisfaction and retention.

Notably, prior studies typically refer to reverse logistics when they examine product returns (Stock et al., 2002; Stock and Mulki, 2009). Huscroft, Hazen, Hall, Skipper, and Hanna (2013) argue that the existing research in reverse logistics does not provide a good understanding of the key factors in customer needs in a reverse logistics process. Past research into product returns and reverse logistics may not incorporate marketing concepts (Bernon et al., 2013; Ferguson et al., 2006), though they emphasise coordination between marketing and logistics efforts to improve product returns systems.

To manage product returns successfully, this study proposes an integrated interface for marketing and reverse logistics. Accordingly, the study applies the marketing perspectives of service-dominant (S-D) logic, customer orientation, customer expectations, service recovery, and service quality to product returns management to propose a conceptualisation and performance measure for customer-oriented product returns service (COPRS). Prior works largely ignore metrics for reverse logistics focusing on customer satisfaction or an effective returns process (Huscroft, Hazen, Hall, Skipper, and Hanna, 2013).

Unlike other services in traditional forward logistics, product returns service starts from the point of destination (customers) and ends at the point of origin (suppliers). The key issue in the product returns process and management is, therefore, the customer. Hence, the specific performance measure of product returns service should be developed from customer expectations or co-created by customers to enhance their satisfaction. Accordingly, the purpose of the current study is to conceptualise COPRS performance, and develop and validate its measure. Thus, this study addresses the following research question:

**RQ1. How can CORPS performance be developed, measured and validated?**

To answer the research question, the scope of product returns service in this study focuses on services offered by a mobile company that receives returns from customers. The mobile industry was chosen because Thailand’s mobile industry has been one of the fastest growing industries in recent decades. There were 97.68m mobile subscribers, accounting for 146 per cent of the total population in Thailand at the end of 2014 (NBTC, 2015). The mobile industry remains robust due to the continuing technology development of wireless communications, the improvement in mobile devices in terms of quality and variety, and the government’s digital economy policies to develop broadband infrastructure across the country (Ninkitsaranont, 2018). The mobile industry is a dominant industry that faces product returns problems. Firms should focus more on improving returns service performance to build superior competitive advantage amid intensified domestic competition.

**Literature review and theoretical background**

*Product returns and reverse logistics*

The literature contains several definitions for product returns, but Rogers and Tibben-Lembke (1998, p. 2) provide the most popular definition (Bernon et al., 2013): “the process of planning, implementing and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing or creating value or proper disposal”. This definition originally described reverse logistics. When scholars study product returns they often refer to reverse logistics (Stock et al., 2002; Stock and Mulki, 2009). In other words, prior works often use both terms interchangeably. In this study, the term “product returns” refers to the service operations of returns.

Specifically, this study focuses on the largest category of returns (Rogers et al., 2002) – the consumer returns that customers initiate. According to Rogers et al. (2002), a return with a
direct effect on the consumer needs the best procedure to handle it because it could affect consumers’ long-term perception of the firm.

The literature on product returns management and reverse logistic focuses on aspects such as designing a product return policy (Janakiraman et al., 2016; Yang et al., 2017), forecasting product returns (Agrawal et al., 2014; Potdar, 2009), reducing product returns (Hess et al., 1996; Scarfotti, 2003) and optimising product returns (Anderson et al., 2009; Srivastava and Srivastava, 2006). However, most studies concentrate on firm-oriented and economic operations.

Implications of marketing initiatives for product returns

Service-dominant (S-D) logic of marketing. Vargo and Lusch’s (2004) S-D logic received increasing attention in services marketing in recent decades. The paradigm shifts from a goods-centred view to a service-centred view, where all goods are distribution mechanisms of services and consumers are co-creators of value (Vargo and Lusch, 2004, 2008). In the co-creation process, the service provider and the customer mutually create value-in-use; that is, value emerges when the service is consumed (Gummesson, 1998). Accordingly, the user has to develop the value (Vargo and Lusch, 2008).

The study extends this service perspective to the product returns process. Customers know what they want from consuming returns services. They could actively provide ideas to improve the service, which has traditionally been viewed as firm activities (Karpen et al., 2015). Product flow in the reverse process involves not only the physical goods, but also intangible features such as customer knowledge and experiences before, during and after product usage, as well as relational exchanges with the firm. According to Lambert and Enz (2017), firms should exploit customer knowledge to manage returns. Hence, firms need to use information or knowledge strategically to make value offerings for the returns processes.

Product returns service is unique because it involves a marketing and reverse logistics interface. A returns service is remarkably different from the service in traditional forward logistics, which starts from the point of origin (firms) to the point of destination (customers). Notably, a purchased product is in a backward flow as a customer returns it for some reason. Potdar (2009) states that the returns process normally starts from customer dissatisfaction. When customers initiate returns requests, firms receive a second chance to make customers feel happy again (Cassill, 2013). Consumers will consider a low-quality returns service as a double fault.

Therefore, the unique features of product returns service include: a service requiring marketing and logistics integration, service offerings in the reverse flow and the process starts mainly from customer dissatisfaction. Accordingly, the focal point in improving product returns service within the returns process is the customer. In this regard, this study proposes marketing concepts to manage product returns.

Customer orientation. A customer orientation implies that an organisation can develop a sustainable competitive advantage by understanding and meeting the needs of their customers (Deshpande et al., 1993). In Vargo and Lusch’s (2004) service-centred view, the focus shifts from the firm to the consumer and emphasises customer-orientation and relationships. Russo et al. (2017) attempted to clarify the link between customers’ purchase behaviour and product returns management in the business-to-business (B2B) industry sector. In the business-to-consumer (B2C) context, Mollenkopf et al. (2011) suggest the notion of an operations-marketing interface in managing returns. Ahsan and Rahman (2016) explore returns service determinants in the retail industry. However, the methods and findings of these studies were based on managers’ perceptions rather than customers’ views. Further, prior studies (Jeong and Hong, 2007; Tien et al., 2009) demonstrate that a
returns service should be customer-oriented. For example, prior logistics research indicates that for third-party logistics providers, customer orientation (consisting of service variety, information availability, timeliness and continuous improvement) has a positive impact on customer-firm logistics improvement (Tien et al., 2009). Consequently, the current study adopts the customer orientation concept as putting customer needs first in providing returns offerings in a B2C setting. Although some argue that cases of opportunistic returns might exist, this study asserts that each consumer return is legitimate (Anderson et al., 2009) and the providers must offer a satisfactory returns experience for long-term relationships.

**Customer expectations.** Chang (2007) refers to customer expectations as the customers’ anticipation of the firm’s performance in providing services. An expectation-disconfirmation model (Myers, 1991) asserts that consumers compare between the actual performance of the firm’s offerings and their expectations (Oliver, 1980). From a literature review in marketing and reverse logistics, few studies focus on customer expectations as the reference point to manage product returns.

**Service recovery.** Grönroos (1988) defines service recovery as “the actions a service provider takes in response to a service failure”. The top five reasons, or approximately 84 per cent, for product returns, which include customer dissatisfaction, defective merchandise, incorrect item received, repairs needed and damage (Daugherty et al., 2001) are due to the failure of firm’s offerings. Accordingly, from the customer’s perspective, service failure happens. Hence, managing product returns as managing service recovery are the firm’s actions to respond to service failure. Past studies show that successful service recovery involves assurance (Chang, 2008), explanation (Krishna et al., 2011), employee empowerment, reliability and responsiveness (Gilbert and Wong, 2003).

**Service quality.** Considering product returns as service offerings in a reverse channel should include a consideration of the quality of the service delivery. Parasuraman et al. (1985, 1988) define service quality as a comparison between customer expectations for what a firm should offer and the firm’s actual service performance. Brown and Bitner (2006) indicate that measuring service quality is a basis for excellent service-driven firms. Nevertheless, there are no specific tools to measure product returns service, especially from the customer perspective. Prior works do not apply existing service performance measures such as SERVQUAL (Parasuraman et al., 1985, 1988) or SERVPERF (Cronin and Taylor, 1992) in this context, and either may provide inadequate measures of the product returns service due to the distinctive features of returns services. However, a new measure would consider the existing service quality dimensions, including assurance, empathy, reliability, responsiveness and tangibles.

**Product returns service performance measurement**

Neely et al. (1995) describe performance measurement as “the process of quantifying the efficiency and effectiveness of action”. Skapa and Klapalova (2012) state that efficiency measures how economically a firm exploits its resources to meet customer needs. Classic efficiency measures are costs, time and quality. Effectiveness measures whether the firm meets the customer’s requirements. A typical effectiveness measure is customer satisfaction. Hayes and Abernathy (1980) assert that traditional financial (economic) performance measures encourage managers to adopt a short-term perspective. On the contrary, customer satisfaction measures result in long-term benefits to the company (Petersen and Kumar, 2010).

Most studies of reverse logistics and product returns performance measurement focus on economic performance (e.g. Stock and Mulki, 2009; Daugherty et al., 2001; Yellepeddi, 2006) with scales developed from the firm’s perspective (Table I). Although some studies (Autry et al., 2001; Richey et al., 2005; Huscroft, 2010) refer to the effectiveness of the process or customer service metrics, these measures are derived from the literature and the logistician’s perspective rather than in terms of customer requirements.
<table>
<thead>
<tr>
<th>Authors</th>
<th>Literature</th>
<th>Measures/scales</th>
<th>Economic performance (Efficiency)</th>
<th>Service quality performance (Effectiveness)</th>
<th>Measure development sources</th>
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</thead>
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<tr>
<td>Autry et al. (2001)</td>
<td>Reverse logistics</td>
<td>Environmental regulatory compliance, improved customer relations, asset recovery, cost containment, improved profitability, reduced inventory investment and satisfaction</td>
<td>/</td>
<td>/</td>
<td>Literature review and interviews with logistics practitioners</td>
</tr>
<tr>
<td>Daugherty et al. (2001)</td>
<td>Reverse logistics</td>
<td>Financial-oriented items: cost containment, improved profitability, recovery of assets, and reduced inventory investments; service-oriented items: environmental regulatory compliance and improved customer relations</td>
<td>/</td>
<td>/</td>
<td>Literature review</td>
</tr>
<tr>
<td>Huscroft (2010)</td>
<td>Reverse logistics</td>
<td>Customer wait time, return rates, scrap rates, scrap value, return cycle time, returned product inventory value, customer satisfaction, account processing time, velocity, return rate by supplier, inventory levels, credit processing, and cost of returned goods</td>
<td>/</td>
<td>/</td>
<td>Logistics practitioners using grounded theory</td>
</tr>
<tr>
<td>Huscroft, Hazen, Hall, and Hanna (2013)</td>
<td>Reverse logistics</td>
<td>Reverse logistics cost effectiveness and reverse logistics processing effectiveness</td>
<td>/</td>
<td>/</td>
<td>Existing measures (logistician perspective)</td>
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<tr>
<td>Mollenkopf et al. (2007)</td>
<td>Product returns logistics</td>
<td>Previous service experience, recovery responsiveness, contact and compensation, site ease, and customer effort</td>
<td>/</td>
<td>/</td>
<td>Existing measures of e-service</td>
</tr>
<tr>
<td>Richey et al. (2005)</td>
<td>Reverse logistics</td>
<td>Strategic performance, operational responsiveness: operational service quality</td>
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<td>/</td>
<td>Existing measures (logistician perspective)</td>
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<td>Stock and Mulki (2009)</td>
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<td>Productivity, utilisation, and performance metrics</td>
<td>/</td>
<td>/</td>
<td>Literature review and practitioner survey</td>
</tr>
<tr>
<td>Yellepeddi (2006)</td>
<td>Reverse logistics</td>
<td>Value of returns entering RSC per unit time, gate-keeping effectiveness, warehousing effectiveness, environmental conformance effectiveness, carrying cost, percentage of returns in a CRC per unit time, recovery efficiency, recovery rate, overall vehicle effectiveness, and return good total transit time</td>
<td>/</td>
<td>/</td>
<td>Literature review, specific industry practices, and mathematical formulation</td>
</tr>
</tbody>
</table>
Further, some research in forward logistics management address customer service and develop logistics service quality scales, that is, physical distribution service quality or PDSQ (Bienstock et al., 1997) and logistics service quality or the LSQ scale (Mentzer et al., 1999). However, most of these attributes of forward logistics do not apply directly to the needs, procedures and activities of the reverse channel.

Importantly, Huscroft, Hazen, Hall, Skipper, and Hanna (2013) find few studies into reverse logistics metrics, particularly in terms of customer satisfaction. Empirical studies in the Czech Republic (Skapa and Klapalova, 2012) and the USA (Hall et al., 2013) also find that performance metrics designed to achieve customer service were rarely applied. These scholars suggest that future research should focus more on understanding customer expectations for reverse logistics and devise proper reverse logistics metrics.

This literature review therefore indicates several theoretical gaps (Table II) to fill in order to manage product returns more efficiently.

**Methodology**

Employing qualitative consumer interviews and a large quantitative survey, the authors conceptualise and operationalise the construct of COPRS performance, and validate its measure.

**Measure development**

*Constructing a new measure of product returns service performance.* To conceptualise and operationalise the new construct, the study followed the procedure for developing a measure by Ambulkar et al. (2015), Churchill (1979), Karpen et al. (2015), Mentzer et al. (1999) and Parasuraman et al. (1988, 2005) described in Figure 1.

From Figure 1, the meaning and domain of the COPRS performance construct were developed based on a review of the related marketing and reverse logistics literature and validated by academic experts, practitioners and customers using a substantive validity test (Step 1). Next, qualitative interviews were used to generate measurement items and

<table>
<thead>
<tr>
<th>Theoretical gaps</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gap 1: prior studies on product returns do not incorporate marketing concepts, whereas some scholars suggest coordination between marketing and operations management efforts to improve product returns systems</td>
<td>Bernon et al. (2013), Ferguson et al. (2006), Lambert and Enz (2017), Mollenkopf et al. (2011)</td>
</tr>
<tr>
<td>Gap 2: product returns management is mainly firm-oriented, while the reverse flow starts from customers</td>
<td>Agrawal et al. (2014, 2018), Anderson et al. (2009), Daugherty et al. (2001), Hess et al. (1996), Janakiraman et al. (2016), Potdar (2009), Scariotta (2003), Srivastava and Srivastava (2006), Stock and Mulki (2009), Yellepeddi (2006)</td>
</tr>
<tr>
<td>Gap 4: prior research largely ignores measures of customer service or the effectiveness of the returns process</td>
<td>Hall et al. (2013), Huscroft, Hazen, Hall, Skipper, and Hanna (2013), Skapa and Klapalova (2012)</td>
</tr>
<tr>
<td>Gap 5: existing measures do not apply directly due to the unique features of the returns service, that is, the service offering exists in the reverse flow, which requires the integration of marketing initiatives and reverse logistics processes</td>
<td>Bienstock et al. (1997), Cronin and Taylor (1992), Parasuraman et al. (1985, 1989), Mentzer et al. (1999)</td>
</tr>
<tr>
<td>Gap 6: existing measures of product returns and reverse logistics were not developed from actual customer expectations or co-created by customers</td>
<td>Ahsun and Rahman (2016), Autry et al. (2001), Huscroft (2010), Mollenkopf et al. (2007), Richey et al. (2005)</td>
</tr>
</tbody>
</table>

Table II. Theoretical gaps in the related literature.
ascertain the resulting dimensions of the new measure derived from the literature review (Step 2). Then, the initial scale items were developed based on the literature review, in-depth interviews, and expert/customer validation (Step 3), followed by a pretest (Step 4) and a large survey with customers to purify and validate the scale (Step 5). The authors also assessed construct reliability and validity (Step 6).

**Developing the definition and domain of the new construct**

Consistent with Churchill's (1979) procedure to develop better marketing measures, the initial stage was conceptualising the construct. The study followed the process to develop a construct definition in Ambulkar et al. (2015) and Gilliam and Voss (2013). Those steps were described in Figure 2.

First, based on an extensive review of the related literature, the authors developed a preliminary definition of COPRS, COPRS performance and its dimensions (Step 1.1). Next, to specify the domain of the new measure (Step 1.2), the authors referred to the product returns/reverse logistics and marketing literature (Table III). The 12 dimensions include assurance, compensation, convenience, empathy, employee empowerment, explanation, feedback, information availability, reliability, responsiveness, timeliness and tangibles.

Assurance relates to employees’ knowledge to perform the service and ability to encourage customer trust (Parasuraman et al., 1988). According to Lai et al. (2007), assurance is one of the most important factors influencing consumer service evaluation. In the product returns context, customers should expect knowledgeable front line employees to solve their product problems and that these problems will not occur again. This dimension corresponds to the service recovery (Chang, 2008) and service quality (Parasuraman et al., 1985, 1988) literature. Compensation means that the company provides compensation when problems occur (Genchev, 2007; Parasuraman et al., 2005). In accordance with the service recovery
### Literature review Proposed dimensions of the new measure

<table>
<thead>
<tr>
<th>Literature review</th>
<th>Proposed dimensions of the new measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product returns</strong></td>
<td>Compensation (Ahsan and Rahman, 2016)</td>
</tr>
<tr>
<td></td>
<td>Convenience (Bueh and Boyd, 2014; Janakiraman et al., 2016; Minnema et al., 2018; Mollenkopf et al., 2007; Pei et al., 2014; Petersen and Kumar, 2010)</td>
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<tr>
<td></td>
<td>Empathy (Ahsan and Rahman, 2016)</td>
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<td></td>
<td>Feedback (Ahsan and Rahman, 2016)</td>
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<tr>
<td></td>
<td>Information availability (Ahsan and Rahman, 2016)</td>
</tr>
<tr>
<td><strong>Reverse logistics</strong></td>
<td>Compensation (Autry et al., 2001; Richey et al., 2005)</td>
</tr>
<tr>
<td></td>
<td>Convenience (Autry et al., 2001; Richey et al., 2005)</td>
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<tr>
<td></td>
<td>Timeliness (Autry et al., 2001; Day, 1998; Richey et al., 2005; Yellepeddi, 2006)</td>
</tr>
<tr>
<td><strong>Customer orientation</strong></td>
<td>Empathy (Bowen et al., 1989; Deshpande et al., 1993; Jack et al., 2005; Jeong and Hong, 2007)</td>
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<td></td>
<td>Feedback (Jeong and Hong, 2007)</td>
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<tr>
<td></td>
<td>Information availability (Jeong and Hong, 2007; Tien et al., 2009)</td>
</tr>
<tr>
<td></td>
<td>Responsiveness (Deshpande et al., 1993; Jeong and Hong, 2007)</td>
</tr>
<tr>
<td></td>
<td>Timeliness (Tien et al., 2009)</td>
</tr>
<tr>
<td><strong>Service recovery</strong></td>
<td>Assurance (Barlow and Moller, 1996; Chang, 2008)</td>
</tr>
<tr>
<td></td>
<td>Compensation (Ok, 2004; Parasuraman et al., 2005; Tax et al., 1998)</td>
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<td></td>
<td>Convenience (Tax et al., 1998)</td>
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<td></td>
<td>Empathy (Krishna et al., 2011; Tax et al., 1998)</td>
</tr>
<tr>
<td></td>
<td>Empowerment (Boshoff, 1997, 2005; Krishna et al., 2011)</td>
</tr>
<tr>
<td></td>
<td>Explanation (Boshoff, 1997, 2005; Krishna et al., 2011; Tax et al., 1998)</td>
</tr>
<tr>
<td></td>
<td>Feedback (Boshoff, 2005)</td>
</tr>
<tr>
<td></td>
<td>Information availability (Krishna et al., 2011)</td>
</tr>
<tr>
<td></td>
<td>Reliability (Gilbert and Wong, 2003)</td>
</tr>
<tr>
<td></td>
<td>Responsiveness (Boshoff, 1997; Gilbert and Wong, 2003; Krishna et al., 2011; Parasuraman et al., 2005)</td>
</tr>
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<td></td>
<td>Tangibles (Boshoff, 2005)</td>
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<td></td>
<td>Timeliness (Mostafa et al., 2014; Tax et al., 1998)</td>
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<td><strong>Service quality</strong></td>
<td>Assurance (Parasuraman et al., 1985, 1988)</td>
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<td></td>
<td>Convenience (Mentzer et al., 1999)</td>
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<td></td>
<td>Empathy (Lai et al., 2007; Parasuraman et al., 1985; 1988)</td>
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<td></td>
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<td>Responsiveness (Parasuraman et al., 1985, 1988)</td>
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<td>Tangibles (Parasuraman et al., 1985, 1988)</td>
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<tr>
<td></td>
<td>Timeliness (Bienstock et al., 1997; Davis, 2006; Mentzer et al., 1999)</td>
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**Table III.** Proposed dimensions of the product returns service performance measure

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**Figure 2.**
Steps employed in developing the meaning and domain of the new construct
literature (Parasuraman et al., 2005; Tax et al., 1998), a product problem is a service failure from the customer's point of view. Thus, firms should provide recovery. Returns service performance includes a convenient process, meaning that the returns process is flexible and easy to access in a convenient manner (Tax et al., 1998). According to Lai et al. (2007) and Mentzer et al. (1999), the convenience factor is important in assessing service performance. This element is in line with the literature on product returns (e.g. Minnema et al., 2018; Mollenkopf et al., 2007), reverse logistics (Autry et al., 2001; Richey et al., 2005), service recovery (Tax et al., 1998) and service quality (Mentzer et al., 1999). Empathy or understanding customers' problems from their standpoint (Krishna et al., 2011) is essential in providing returns service. Personal treatment by service employees to solve a customer's problems corresponds to the service recovery (Krishna et al., 2011; Tax et al., 1998) and service quality (Lai et al., 2007; Parasuraman et al., 1985, 1988) concepts.

Employee empowerment means that the firm empowers front line employees to respond to customers' needs (Krishna et al., 2011). In the product returns setting, customers expect that the service employee can help them solve product problems and do not pass their requests to others (Boshoff, 2005). Explanation means that the customer receives an explanation of the problem and what was done to solve it (Boshoff, 2005). The authors include the explanation dimension to evaluate returns service performance, as customers should expect a specific explanation of why the product problems occurred and how the firm will solve the problem for them.

The feedback dimension represents the firm's attempt to keep in touch with customers (Jeong and Hong, 2007). In many cases, processing the returns requests takes a substantial amount of time; therefore, customers would expect feedback about the progress. Likewise, firms must ensure information availability or information accessibility (Mentzer et al., 2001) to provide a product returns service. This dimension corresponds to the customer orientation literature, as this dimension allows customers to access information about returns services according to their needs (Jeong and Hong, 2007; Tien et al., 2009).

Reliability relates to the firm's ability to provide services accurately and reliably (Parasuraman et al., 1985). It is essential for a product returns service, as it ensures stable service quality and accurate returns functions (Ladhari, 2009). Responsiveness, or the employees' readiness and willingness to provide prompt services (Parasuraman et al., 1985), is recognised in assessing service quality. Accordingly, immediately solving problems related to the product is important in returns service offerings (Parasuraman et al., 2005).

Corresponding to the reverse logistics literature (e.g. Autry et al., 2001; Yellepeddi, 2006), timeliness is a critical factor in product returns management, as customers expect that the company should keep its promises about a scheduled return delivery (Tien et al., 2009). The tangibles include facilities, equipment and service personnel (Boshoff, 2005; Parasuraman et al., 1985, 1988). Since the contact point at the service centre becomes a starting point for the returns process, these physical aspects could influence overall service evaluation (Bitner, 1992).

For Step 1.3 in Figure 2, the authors presented the dimensions and their definitions to five experts: a marketing specialist, a logistics scholar, two practitioners and an English expert for face validity. They were asked to evaluate the proposed definitions and consider each dimension’s relevance to the construct of COPRS performance. The authors then calculated a substantive validity coefficient, which indicates how well each measurement item is linked theoretically to the proposed construct (Anderson and Gerbing, 1991).

The formula for the substantive validity coefficient (Ambulkar et al., 2015; Anderson and Gerbing, 1991) is $C_{sv} = \frac{(n_r - n_i)}{N}$ where $n_r$ is the number of experts rating the relevance of a dimension to COPRS performance, $n_i$ is the number of experts rating a dimension as irrelevant to COPRS performance, and $N$ is the number of experts. Large positive values of $C_{sv}$ demonstrate greater substantive validity and vice versa. The acceptable threshold is
0.50 (Anderson and Gerbing, 1991). The five experts agreed with the proposed definitions of COPRS, COPRS performance, and its dimensions with minor adjustments. The values of $C_{vi}$ for each dimension were 1.00, indicating high substantive validity.

In addition, since the proposed construct emphasises customer orientation, the authors asked a convenience sample of 100 customers with returns experience to rate the relevance of each of the 12 dimensions to COPRS performance (Step 1.4). The $C_{vi}$ values of all dimensions were greater than 0.50 (0.58–0.92), supporting substantive validity based on the customer perspective.

For the last step, based on the substantive validity results, the authors redefined the COPRS construct as service offerings provided by firms to end consumers in the product returns process based on putting customers' needs first to enhance customer satisfaction. To measure returns service, the authors developed and conceptualised the construct of COPRS performance as the firm's performance in providing service in the product returns process to end consumers based on putting customers' needs first to enhance customer satisfaction.

COPRS performance is a second-order factor containing two layers of latent constructs (Hair et al., 2006) representing a series of first-order latent dimensions with reflective indicators. These 12 first-order factors are themselves reflective indicators of the COPRS performance construct.

The authors followed the five steps in Figure 2 to develop the meaning and domain of the new construct. Thus, Step 1 in Figure 1 was completed. Next, the authors moved on to Step 2: conducting the qualitative study.

Qualitative study
To develop the new measure based on actual customer expectations, the authors employed a qualitative approach. Adopting qualitative interviews corresponds to the concept of customer value co-creation in that customers would describe their returns experience as a source to develop a new measure. This step highlights the notion of customer involvement or a customer active paradigm that views customers as experts on their own consumption of services. Customers then become the co-creators of a returns service.

The scope of product returns service in this study includes services offered by the mobile company in receiving returns from customers, exchanging the whole product or some parts due to defects, requesting repair and maintenance, or any other customer requirements in the reverse channel (Autry et al., 2001). The current study specifically examined the returns process through a direct store that the mobile service provider firm controls completely. This is crucial because the firm under evaluation should control the performance measurement (Globerson, 1985; Neely et al., 2005) so the firm can adopt strategies to improve service quality.

The authors conducted in-depth interviews to gain insights into customer expectations of returns service in each step of the returns process from the customer perspective. The authors conducted semi-structured interviews to gain customer insights in consuming returns services by asking guided questions to cover all issues related to the literature. However, customers' actual experiences and their expectations were discussed using open-ended questions. The qualitative findings were used to develop a quantitative survey. The interviewees included 20 customers with experience in returning or exchanging products or contacting the mobile firm's service centres regarding product problems in the past one year. Guest et al. (2006) state that the smallest acceptable sample for a qualitative study is 15; thus, a sample of 20 is sufficient to develop meaningful patterns and subsequent interpretations.

Responses collected from qualitative interviews were analysed following Marshall and Rossman (2006). To generate themes and code the data, the authors used qualitative content analysis, which is a common method to identify patterns in a text (Hsieh and Shannon, 2005). Based on an analysis by three individual judges (marketing scholars), the qualitative items were matched with the initial COPRS dimensions. In this regard, the authors
measured inter-judge reliability to determine whether different judges group the same patterns into the same categories (Latham and Saari, 1984). The inter-judge reliability value of 0.95 was satisfactory, exceeding the cut-off criteria of 0.8 (Latham and Saari, 1984).

Based on the qualitative findings, there were no additional dimensions of returns service performance measurement. Notably, some passages the interviewees described were not addressed in the extant literature. For example, a participant expected that the service employee would explain clearly what happened with his device, as well as the cost and time information about repairing or exchanging the device for a new one. Other participants noted that during the process, the employee should provide updates on the progress periodically and that the company should provide a second mobile for them, similar to a car repair service. Furthermore, some interviewees required that when they picked up the product, the service employee would explain what was done with the device and provide them with suggestions on product usage. Importantly, the product’s functions must perform accurately as usual and the same product problems should not occur after completing the process. Consequently, the authors used the key outcomes of the interviews to develop measurement items for further questionnaire surveys.

Preliminary measure
The authors discussed the qualitative findings and the COPRS performance definition with three experts, including academics and practitioners in service marketing and logistics. The experts agreed that the developed definition could encompass the qualitative results. To generate a preliminary measure, the same panel of experts validated the items derived from the literature review and consumer interviews. Put differently, each factor consists of the measurement items established from the extant literature and the qualitative results. For instance, the explanation factor was measured by four items. The first two items, “employees provide me with an explanation of why problems occurred” and “the employees deal with provide a satisfactory explanation of why the problem occurred” were adopted from the RECOVSAT scale (Boshoff, 2005). The last two items, “employees provide me with an explanation of what has done with my product” and “employees provide me with suggestions for product usage when pick up the product” were developed based on the qualitative results. Consequently, after expert validation, the authors generated a preliminary COPRS performance measure with 12 dimensions and 56 items.

For Steps 4 and 5, a pretest and a large survey were administered using a quantitative cross-sectional design to purify and validate the COPRS performance measure.

Measurement of variables
The final measurement of COPRS performance consists of the 12 dimensions with 56 items generated in Step 3. All variables are measured on a five-point Likert scale from 1 to 5 ranging from strongly disagree (1) to strongly agree (5), which is a simple, common method in business research to administer and interpret the data (Zikmund et al., 2010).

Sample
The authors determined the sample based on the ratio of observations per variable. According to Hair et al. (2006), such ratio should be at least 5 to 1, while Bentler and Chou (1987) propose that the ratio to number of observed variables of 10:1 is more appropriate. Given the complexity of the model, which consists of 56 observed variables, this study aimed to collect a sample of 1,200 consumers to accommodate respondent refusals to participate. Following Churchill (1995), the refusal rates (percentage of contacted respondents who refused to participate in a survey) was 15–38 per cent. In addition, some returned questionnaires might be unusable. Therefore, to achieve a ratio of observations per observed variables of 10:1 (560 sample units), the authors contacted 1,200 customers.
The authors used quota sampling to ensure that the sample would include each brand proportionately. This technique has the advantage of introducing a stratified population and it does not require a list of the population (Zikmund et al., 2010). To reduce the bias in the classification of subjects, the authors classified the population based on the firm’s market share among mobile companies (NBTC, 2015), and then fixed the quota correspondingly. Therefore, the number of required respondents were adapted for data collection at the service centre of each firm.

Research instruments
A questionnaire was used in the quantitative survey. It was evaluated by customers with experience in returning mobile service providers’ products in Thai markets. In developing the questionnaire, the English version was translated into Thai for data collection. To avoid translation errors, an English language editor was requested to translate the Thai questionnaire into English. The resulting version was then compared to the original English version and revised until the statements reflected the original.

The content validity was validated using the Index of Item-Objective Congruence (IOC) (Rovinelli and Hambleton, 1977) to numerically assess content experts’ evaluations of items in the item validation process. The content specialists consisted of five marketing and logistics academics from four universities and two managerial experts. Based on the IOC results, the instrument with 55 items was used for the pretest. Additionally, some content was adjusted according to the experts’ comments.

Purifying the new measure: pretest. Hair et al. (2006) state that a pretest should be conducted to purify scale measures prior to a confirmatory test. The authors conducted the pretest with 100 respondents to assess the instrument’s preliminary validity and to check the clarity of the statements and other technical issues such as completion time and ease of use. The sample units were the convenience sample of customers with experience returning mobile devices. The pretest findings indicated preliminary validity based on the factor loadings and p-values using confirmatory factor analysis (CFA).

The results suggested a two-item factor of empowerment component. Although Hair et al. (2006) suggest a minimum of three items per construct, it became apparent that this dimension was best tapped with only two measurable items. This is consistent with previous scale development studies (Boshoff, 2005; Mentzer et al., 1999; Ruekert and Churchill, 1984).

Based on the authors’ examination of preliminary validity and internal consistency, 53 measurable items with 12 dimensions were retained.

Data collection. The final questionnaires were intended for distribution to 1,200 customers. Seven service providers were contacted and a cover letter was used to explain the purpose of the survey, address the importance of the survey to the firm and ask for their cooperation. Further, a brief summary of research results would be offered to the companies after the study was completed. Two companies refused to participate in the survey, leaving five service providers as participants. With the consent of the customer service managers of each firm, customers at the direct stores were randomly asked to evaluate the firm’s performance in providing returns service.

Within three months, the authors collected 969 questionnaires. There were 214 unusable questionnaires due to the lack of returns experience information, the product specified was not a mobile device, missing values and other technical issues. The missing data were corrected and remedied via pairwise deletion (Cooper and Schindler, 2014). The advantages of using pairwise deletion are fewer problems of convergence and factor loadings free of bias. However, when using this technique, $\chi^2$ is biased upward if the number of missing data exceeds 10 per cent (Hair et al., 2006). Therefore, questionnaires with more than 10 per cent missing values were dropped from the study.
Since all item measures use the same rating scale (Likert rating scale), there could be a common method bias. One way to control such bias is to obtain measures of the constructs from different sources (Podsakoff et al., 2003). The study followed this suggestion to reduce potential method variance, as Table III shows.

To screen for non-response bias, the statistical differences between early respondents and late respondents were tested (Armstrong and Overton, 1977). That is, the authors examined the first and last 25 per cent (assumed to be similar to non-respondents) of the sample. Independent $t$-test of mean differences of observable variables indicate no significant differences between the first and fourth quartiles of respondents in this cross-sectional survey. Accordingly, the remaining usable questionnaires were 755.

Analysis and results

Model fit, reliability and validity. Using AMOS version 23, the authors evaluated all 53 items with an iterative CFA item-deletion process (Steenkamp and van Trijp, 1991). That is, a measurable item was a candidate for deletion if it had a combination of an unsatisfactory standardised regression weight ($< 0.70$), a large error variance ($> 0.50$), a low square multiple correlation ($< 0.50$), and/or large modification indices ($> 10$) (Bagozzi and Yi, 2012; Karpen et al., 2015). Items were deleted selectively through nine CFA runs. In each round, the reduction in $\chi^2$ was larger relative to the difference in df between the two consecutive models, and the model difference was significant at $p = 0.05$. The model’s fit was improved after refinement. Hence, items ET1, TB5, TB4, ET6, CS1, RL6 and CP4 were deleted. Consequently, 46 items of 12 factors were retained (Table IV). Each of the 12 dimensions was significant ($p < 0.001$).

With CFA, the COPRS performance measurement model shows a reasonably good fit based on absolute fit indices and incremental fit indices. The overall model $\chi^2$ was 1,150.255 with 847 degrees of freedom. The $p$-value was significant (0.000) using a Type I error of 0.05. However, the $\chi^2$ result behaved as predicted, as the $\chi^2$ statistic would normally be sensitive to a large sample size (755) and model complexity (a second-order construct with 46 observed variables). Other absolute fit indices to assess included $\chi^2/df$, GFI and RMSEA. The ratio of $\chi^2/df$ is 1.36:1, which is below the cut-off criterion of 3:1 (Chau, 1997). The GFI is 0.94, which exceeds the guideline of 0.90 (Hair et al., 2006). The value of RMSEA was 0.02, below the cut-off value of 0.05 (Jöreskog and Sorbom, 1993).

Regarding the two incremental fit indices, CFI and TLI were 0.99 and 0.99, respectively, exceeding the cut-off threshold of 0.90 (Bagozzi and Yi, 2012; Hair et al., 2006). Table V summarises the fit results of the COPRS performance measurement model.

Reliability and validity assessment. Reliability analysis. Table VI shows that the composite reliability values of the new construct and its components have satisfactory composite reliability ($> 0.70$). The coefficient $\alpha$ values of COPRS performance and its dimension are greater than the recommended level of 0.70 (Bagozzi and Yi, 2012), indicating internal consistency. The CITC scores in each dimension were above the acceptable value of 0.50. Regarding the reliability of each indicator, the values of the squared multiple correlations of all items were greater than the cut-off value of 0.50 (Bagozzi and Yi, 2012).

Content validity. The COPRS performance definition and its components were assessed based on a substantive validity analysis (Ambulkar et al., 2015; Anderson and Gerbing, 1991) by five academic and managerial experts. Additionally, 100 customers with returns experience were asked to consider each dimension’s relevance to the concept of COPRS performance. The substantive validity coefficient ($C_{sv}$) values in both cases were greater than 0.50, indicating greater substantive validity.

Convergent and discriminant validity. To test the convergent and discriminant validity of a second-order model, Mentzer et al. (1999) recommends a $\chi^2$ difference test of the models with relaxed restrictive assumptions. Specifically, a more rigorous analysis of a hierarchical order
<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Items</th>
<th>Factor loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangibles (TB)</td>
<td>TB1: the service centre has up-to-date equipment</td>
<td>0.73***</td>
</tr>
<tr>
<td></td>
<td>TR2: physical facilities are visually appealing</td>
<td>0.77***</td>
</tr>
<tr>
<td></td>
<td>TR3: employees work in a tidy, professional environment</td>
<td>0.80***</td>
</tr>
<tr>
<td>Responsiveness (RP)</td>
<td>RP1: employees take care of problems promptly</td>
<td>0.88***</td>
</tr>
<tr>
<td></td>
<td>RP2: employees can promptly respond to your request, even when they are busy</td>
<td>0.73***</td>
</tr>
<tr>
<td></td>
<td>RP3: employees communicate effectively</td>
<td>0.76***</td>
</tr>
<tr>
<td></td>
<td>RP4: employees process your request rapidly</td>
<td>0.79***</td>
</tr>
<tr>
<td>Explanation (EN)</td>
<td>EN1: employees provide me with an explanation of why problems occurred</td>
<td>0.80***</td>
</tr>
<tr>
<td></td>
<td>EN2: the employees I deal with provide a satisfactory explanation of why the problem occurred</td>
<td>0.82***</td>
</tr>
<tr>
<td></td>
<td>EN3: employees provide me with an explanation of what was done with my product</td>
<td>0.83***</td>
</tr>
<tr>
<td>Empathy (ET)</td>
<td>ET2: employees know your specific needs in returning products</td>
<td>0.74***</td>
</tr>
<tr>
<td></td>
<td>ET3: employees have your best interests at heart</td>
<td>0.75***</td>
</tr>
<tr>
<td></td>
<td>ET4: employees show sympathy for you when you have problems</td>
<td>0.78***</td>
</tr>
<tr>
<td>Empowerment (EP)</td>
<td>EP1: the employees I contacted first could solve my returns problem</td>
<td>0.78***</td>
</tr>
<tr>
<td></td>
<td>EP2: one employee could complete the overall process for me</td>
<td>0.82***</td>
</tr>
<tr>
<td>Reliability (RL)</td>
<td>RL1: when promising to do something, Company X does so</td>
<td>0.90***</td>
</tr>
<tr>
<td></td>
<td>RL2: the employees are dependable</td>
<td>0.73***</td>
</tr>
<tr>
<td></td>
<td>RL3: company X keeps accurate statements</td>
<td>0.78***</td>
</tr>
<tr>
<td></td>
<td>RL4: employees’ decisions are reliable</td>
<td>0.79***</td>
</tr>
<tr>
<td></td>
<td>RL5: the product’s functions can perform well and accurately as usual</td>
<td>0.81***</td>
</tr>
<tr>
<td>Timeliness (TL)</td>
<td>TL1: Company X’s processing time is short.</td>
<td>0.86***</td>
</tr>
<tr>
<td></td>
<td>TL2: delivery of returns arrives on the date Company X promised</td>
<td>0.74***</td>
</tr>
<tr>
<td></td>
<td>TL3: Company X handles my returns quickly</td>
<td>0.84***</td>
</tr>
<tr>
<td></td>
<td>TL4: the time to queue is short</td>
<td>0.82***</td>
</tr>
<tr>
<td>Information availability (IA)</td>
<td>IA1: Company X provides information about operating hours and the locations of service centres</td>
<td>0.75***</td>
</tr>
<tr>
<td></td>
<td>IA2: Company X provides information about the choices of solutions to a problem</td>
<td>0.75***</td>
</tr>
<tr>
<td></td>
<td>IA3: Company X provides compensation/returns status information</td>
<td>0.78***</td>
</tr>
<tr>
<td></td>
<td>IA4: employees provide information about the processing time and tentative costs for me</td>
<td>0.72***</td>
</tr>
<tr>
<td>Assurance (AS)</td>
<td>AS1: employees can be trusted</td>
<td>0.74***</td>
</tr>
<tr>
<td></td>
<td>AS2: you have confidence in the product return process of Company X</td>
<td>0.75***</td>
</tr>
<tr>
<td></td>
<td>AS3: employees get adequate support from the company to do their jobs well</td>
<td>0.79***</td>
</tr>
<tr>
<td></td>
<td>AS4: Company X provides a follow-up after the compensation is provided</td>
<td>0.78***</td>
</tr>
<tr>
<td></td>
<td>AS5: the employees I deal with are knowledgeable</td>
<td>0.80***</td>
</tr>
<tr>
<td></td>
<td>AS6: Company X provides a warranty for the return/compensation</td>
<td>0.78***</td>
</tr>
</tbody>
</table>

Table IV. Confirmatory factor analysis of the COPRS performance measure (continued)
model for convergent validity involves comparing the model fit in terms of the \( \chi^2 \) values and df between an independence model with no traits and 46 measurable items (Model 0) with a model comprising one trait (COPRS) and 46 items (Model 1). To assess discriminant validity, the authors compared Model 1 (1 trait COPRS performance and 53 items) with a model with 12 traits and 46 items (Model 2). Figure 3 presents the model comparisons for the convergent and discriminant validity analysis of the COPRS performance measure.

The authors evaluated factor loadings and model fit comparisons to ensure the convergent validity of the COPRS performance measure construct. Accordingly, the standardised loading estimates should be 0.7 or higher and be statistically significant (Hair et al., 2006). From Table IV, all factor loadings ranged from 0.72 to 0.89 and were significant at \( p < 0.001 \), indicating high convergence.

Regarding the model comparison results, Table VII demonstrates that the difference in the \( \chi^2 \) statistic for Model 0 and Model 1 was significant \( (p = 0.000) \), suggesting convergent validity of the COPRS performance measure (Bienstock et al., 1997; Mentzer et al., 1999).

The difference in the \( \chi^2 \) statistic for Models 1 and 2 (the proposed model of 12 traits and 46 items) was also significant \( (p = 0.000) \), demonstrating discriminant validity.
### Construct validity

<table>
<thead>
<tr>
<th>Measure</th>
<th>Criteria</th>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal consistency</td>
<td>Cronbach’s $\alpha$</td>
<td>Above 0.70 (Bagozzi and Yi, 2012)</td>
</tr>
<tr>
<td>Reliability of indicators</td>
<td>Corrected item-to-total correlations</td>
<td>Above 0.50 (Hair et al., 2006)</td>
</tr>
<tr>
<td>Construct reliability</td>
<td>Squared multiple correlations</td>
<td>Above 0.50 (Bagozzi and Yi, 2012)</td>
</tr>
<tr>
<td></td>
<td>Composite reliability (CR)</td>
<td>Above 0.70 (Hair et al., 2006)</td>
</tr>
</tbody>
</table>

- **Content validity**: Substantive validity coefficients ($C_{\text{sv}}$) for the constructs’ definitions and dimensions
- **Convergent validity**: Standardised values of factor loadings
  - $\chi^2$ difference test between Model 0 and Model 1 (Model 0 = Independence Model; Model 1 = 1 trait (COPRS) and 46 items)
  - $\chi^2$ difference test between Model 1 and Model 2 (Model 1: 1 trait (COPRS) and 46 items, Model 2: 12 traits and 46 items)

- **Discriminant validity**: Independent $t$-test analysis between the known groups
- **Criterion validity**: Significance of the difference in $\chi^2$ for Model 0 and Model 1

**Notes:** COPRS, COPRS performance; RS, returns satisfaction; CT, customer trust. *** --- $p < 0.001$

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**Table VI.** Reliability and validity assessment of the COPRS performance measure

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**Figure 3.** Comparisons of models for convergent and discriminant validity analysis of the COPRS performance measure
In addition, Model 2 provided the best overall model fit in terms of the $\chi^2$ statistic. Thus, the results establish convergent validity and discriminant validity for the COPRS performance measure construct.

Criterion validity. The COPRS performance measure was validated for satisfied and dissatisfied customers for the returns service using independent $t$-tests. Therefore, the respondents are classified into two groups based on the median score of returns satisfaction of 3.5, where the satisfied group has a satisfaction score of 3.5 or higher and the dissatisfied group has a score below 3.5. The results indicate that the mean COPRS score of 3.96 for 438 satisfied respondents was significantly higher than the mean score of 3.08 rated by 317 respondents in the dissatisfied group ($t = -22.63, p = 0.000$). Consequently, the COPRS performance measure could discriminate between the two groups, supporting criterion validity (Table VI).

**Discussion and implications**

By integrating marketing and reverse logistics, this study develops a measurement scale for customer service, or effectiveness, which the product returns literature largely ignores. To answer the research question, the study took six steps to develop a COPRS performance measure. It was operationalised and validated by mixed research methods. In-depth interviews with customers were employed to gain insights into the expectations of returns service offerings and highlight the notion of customer involvement in the value co-creating process (Vargo and Lusch, 2004, 2008). Thus, the customer is an input into a service provider’s process and is a temporary member of the organisation (Gummesson, 1996).

Subsequently, a pretest and a large quantitative survey of 755 respondents were conducted to refine the initial measure derived from literature review and qualitative study. With CFA via AMOS, the COPRS performance measurement model showed a reasonably good fit. In terms of reliability, convergent validity, discriminant validity and criterion validity, the new measure met the acceptable criteria, indicating that this measure is reliable and valid.

Accordingly, the proposed two-order measurement model identified 12 dimensions with 46 measurable items. The top five factors with the highest significant factor loadings were information availability (0.96), empathy (0.93), assurance (0.91), reliability (0.90) and responsiveness (0.88). The remaining dimensions were timeliness (0.86), explanation (0.84), convenient process (0.84), feedback (0.81), employee empowerment (0.78) and compensation (0.75). Tangibles had the lowest loading (0.73).

Information availability is the most essential element in providing the return service because the entire process may not end within a day. According to the qualitative interviews, customers needed information such as operating hours, service locations, solution choices, cost, time and service status. Therefore, the service providers should allow their customers to access information related to returns activities according to customer needs (Jeong and Hong, 2007; Tien et al., 2009). The service firm’s information accessibility has significant implications for customer value creation (Mentzer et al., 2001).

<table>
<thead>
<tr>
<th>Model 0 or independence model (no trait and 46 items)</th>
<th>Model 1 (1 trait and 46 items)</th>
<th>Model 2 (12 traits and 46 items)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$</td>
<td>26,387.408</td>
<td>1,796.493</td>
</tr>
<tr>
<td>df</td>
<td>1,035</td>
<td>865</td>
</tr>
</tbody>
</table>

**Comparisons of $\chi^2$ statistics**

| $\chi^2$ (diff) | 26,387.408–1,796.493 = 24,590.915** | 1,796.493–1,150.255 = 646.238** |
| df (diff)       | 1,035–865 = 170                   | 865–847 = 18                  |

**Note:** **$p < 0.05$**
Additionally, the findings complement prior work (Durvasula et al., 1999; Lai et al., 2007) showing that tangibility was the least important dimension in assessing service quality. This evidence confirms that intangible elements of product returns process such as empathy or assurance are more important to customers in consuming returns services.

In view of the dimensionality among the dimensions used to assess returns service performance, while some studies indicate an overlap between responsiveness and assurance (Kim, 2000), responsiveness and empathy (Arasli et al., 2005), responsiveness, empathy and assurance (Cook and Thompson, 2000; Nitecki, 1996), the findings in this study support the distinctive factors among the customer service dimensions.

Unlike other contributions in this research stream, this study claims to be one of the first to develop a performance measurement for a product returns service from the customer perspective. Past research examining product returns or reverse logistics in this context used existing measures or those from logistics practitioners (e.g. Agrawal et al., 2018; Autry et al., 2001; Daugherty et al., 2001; Huscroft, 2010) rather than those from customer data. Therefore, this study contributes to the services marketing and reverse logistics fields, both theoretically and practically.

**Theoretical contributions**

Based on the theoretical gaps identified in the literature review, this study offers six contributions from the theoretical perspective, as Table VIII summarises.

<table>
<thead>
<tr>
<th>Theoretical gaps</th>
<th>The study's theoretical contributions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most research on product returns and reverse logistics do not incorporate marketing concepts, while some scholars suggest coordination between marketing and logistics efforts to improve product returns systems Product returns management is mainly firm-oriented, while the reverse flow starts from the customers</td>
<td>Incorporates marketing concepts into product returns management to facilitate a holistic and cross-disciplinary logistics discipline. The development of a new measure for product returns adopts a customer involvement paradigm, underlining the marketing-logistics interface. This study takes a customer-oriented (value co-creation) view in returns management. In qualitative interviews, customers described their returns service experience, which were used to develop a new measure.</td>
</tr>
<tr>
<td>Product returns management focuses on material transactions based on the operational-efficiency approach</td>
<td>This study moves beyond traditional considerations of efficiency and provides a new perspective of customer involvement and a service-centred view of product returns management. The proposed COPRS performance construct includes interpersonal or people dimensions of responsiveness, empathy, explanation and assurance.</td>
</tr>
<tr>
<td>Prior studies largely ignore measures of customer service or the effectiveness of the returns process</td>
<td>Measures customer service; that is, the COPRS performance measure responds to the call for a performance measurement of the effectiveness of the returns process (Huscroft, Hazen, Hall, Skipper, and Hanna, 2013). The study develops a customer-driven measure possesses with high construct validity to measure product returns performance, thus setting the essential groundwork for future empirical studies of product returns.</td>
</tr>
<tr>
<td>Existing measures do not apply directly due to unique features of returns service, that is, the service occurs in a reverse flow, which requires the integration of marketing initiatives and reverse logistics processes Existing measures of product returns and reverse logistics were not developed from actual customer expectations</td>
<td>The COPRS performance measurement scales are based on actual customer expectations through individual in-depth interviews with customers. The study encourages researchers to develop performance measures from the customer's point of view.</td>
</tr>
</tbody>
</table>

Table VIII. Theoretical gaps and the study's theoretical contributions
Managerial contributions
First, the study alerts practitioners to pay more attention to the marketing and reverse logistics interface in formulating their returns strategies. Second, the developed metrics help practitioners measure and evaluate their returns service offerings based on actual customer expectations. Utilising the results of customer service assessment, managers could analyse their existing returns offerings in key aspects and then determine where to target their improvements. Third, service managers could track the level of returns service performance through an annual examination of COPRS performance metrics, which can help them set priorities while implementing returns service strategies in consecutive years. Finally, the study encourages all service firms to court active customer participation in the value co-creation process for their service offerings.

Mobile industry implications
To illustrate the practical implications of COPRS performance measures in the mobile industry, the authors analysed the returns service performance offered by a participating service provider and provide some suggestions to improve the service. Considering the 12 dimensions of COPRS performance measurement in Table IX, the study shows that the top three factors with above-average scores were assurance (4.00), reliability (3.92) and explanation (3.90). The dimension of feedback had the lowest mean (3.62). The average score of COPRS performance of company 1 was 3.79, indicating a high average score.

Since the dimension of feedback had the lowest score, Service provider 1 might improve its returns service delivery by keeping in touch with customers more by providing periodic feedback on the progress made to solve the problem. The personalised attention the service employees provide to their customers and the time taken to perform the service should be increasingly addressed. Additionally, while the dimension of information availability has the most influence on returns service performance (its factor loading was 0.96), the firm’s mean score on this element (3.80) was moderate compared to the other factors. Hence, Service provider 1 should work on making information related to returns service activities readily available to disseminate to its customers.

However, it should be noted that the firm performs very well on assurance and reliability, which were within the top four ranking factors in terms of factor loadings (0.91 and 0.90, respectively). Therefore, the highest level of firm performance in providing accurate and reliable service could be a competitive advantage for promoting their services. According to the participating customer service managers, the findings of the current study provided a major contribution to their returns service management.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assurance</td>
<td>4.00</td>
<td>1.02</td>
</tr>
<tr>
<td>Reliability</td>
<td>3.92</td>
<td>0.74</td>
</tr>
<tr>
<td>Explanation</td>
<td>3.90</td>
<td>0.79</td>
</tr>
<tr>
<td>Tangibles</td>
<td>3.89</td>
<td>0.83</td>
</tr>
<tr>
<td>Empowerment</td>
<td>3.84</td>
<td>1.30</td>
</tr>
<tr>
<td>Convenient process</td>
<td>3.80</td>
<td>0.93</td>
</tr>
<tr>
<td>Information availability</td>
<td>3.80</td>
<td>0.80</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>3.78</td>
<td>0.98</td>
</tr>
<tr>
<td>Compensation</td>
<td>3.76</td>
<td>1.09</td>
</tr>
<tr>
<td>Empathy</td>
<td>3.72</td>
<td>0.88</td>
</tr>
<tr>
<td>Timeliness</td>
<td>3.71</td>
<td>0.96</td>
</tr>
<tr>
<td>Feedback</td>
<td>3.62</td>
<td>1.00</td>
</tr>
<tr>
<td>COPRS performance</td>
<td>3.79</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Table IX. Mean and standard deviation of COPRS performance and the twelve dimensions for service provider 1.


Additionally, as the COPRS performance construct was developed based on the concepts of customer orientation, co-creation and a service-centred view, such notions could similarly apply to managing product returns in various B2C settings. Other industries that also face substantial problems with product returns include electronics (Agrawal et al., 2018; Yang et al., 2017), technology and automobiles (Espinosa, 2016). These industries could use the 12 dimensions of COPRS performance and their measurement scales. Specifically, the authors suggest that the new measure is not limited to returns performance in the mobile industry.

Nevertheless, this study has some limitations that give room for future research. First, this study focuses on managing returns service from business to end consumers (B2C). Thus, this new construct and its metrics do not apply to product returns management in the business to business (B2B) context. Second, the COPRS scale is utilised to measure returns services at a direct store. Managing product returns for catalogue retailers or e-retailers is beyond the scope of this study. Third, this study examined a particular industry. Future research could apply the COPRS measure beyond the mobile industry. Finally, the study does not involve international returns. A cross-cultural study is also a challenge issue in managing product returns from the customer perspective. Despite these limitations, the present study provides a solid basis for future research on product returns management.

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Supply chain transparency and willingness-to-pay for refurbished products

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Abstract

**Purpose** – Researchers in supply chain transparency have called to expand the boundaries by disclosing various types of information to multiple stakeholders. The purpose of this paper is to explore the effect of transparency about supply chain sustainability on consumers as critical stakeholders and investigate the effectiveness of message characteristics.

**Design/methodology/approach** – This study utilizes two scenario-based experiments grounded in a refurbished goods context: Study 1, which employs a $2 \times 2$ between-subject experiment investigates the effects of product type and sustainable information provision on consumers evaluations, and Study 2, which employs a $2 \times 1$ between-subject experiment examines the effects of sustainable information direction on consumer evaluations. A total of 348 participants were recruited from the Amazon M-Turk platform across the two experiments. Data are analyzed with regression analysis using the PROCESS macro in SPSS and the Johnson–Neyman technique.

**Findings** – Contrary to prior research that assumes that refurbished products are associated with lower quality, quality perceptions are moderated by individuals’ environmental involvement (EI) and the information presented by the firm. More importantly, consumer evaluations are influenced by specific characteristics of sustainable supply chain messages: high EI individuals have higher willingness-to-pay a premium (WTPP) when the message is consistent with original beliefs (pro-attitudinal). In contrast to prior theory, there was no difference in the WTPP of consumers with high EI and low EI for counter-attitudinal messages.

**Practical implications** – The study shows that what to say, how to say it, and to whom, are critical for firms who seek to nudge consumers to support their sustainable practices.

**Originality/value** – The value of communicating information on sustainability has been well established. However, little is known about such association when the information provided trades off environmental benefits and product quality. This research addresses the gap in a refurbished product context. The research studies the effect of sustainable supply chain transparency and message characteristics on stakeholders’ evaluations.

**Keywords** Sustainability, North America, Decision making, Mixed method

**Paper type** Research paper

1. Introduction

In response to increased concern for the environment from both consumers and policymakers (Oglethorpe and Heron, 2010; Winter and Knemeyer, 2013; Wu et al., 2017), firms are placing a greater emphasis on developing a sustainable supply chain (Brockhaus et al., 2013). The sustainable supply chain is defined as “the strategic, transparent integration and achievement of an organization’s social, environmental and economic goals in the systemic coordination of key inter-organization business processes for improving the long-term economic performance of the individual company and its supply chains” (Carter and Rogers, 2008, p. 368). Through building a sustainable supply chain, firms will be able to reduce sustainability-related risk (Multaharju et al., 2017), motivate innovations, improve performance (Dubey et al., 2017) and have opportunities to achieve competitive advantages (Porter and Van der Linde, 1995; Golicic and Smith, 2013).
Achieving a sustainable supply chain requires transparency, which “involves communicating with key stakeholders about the firms’ current activities and incorporates stakeholder feedback for supply chain improvement” (Carter and Rogers, 2008; Carter and Liane Easton, 2011; Morgan et al., 2018, p. 960). Different from supply chain visibility (i.e. the ability for the firms to see across their supply chains) (Bartlett et al., 2007; Somapa et al., 2018) and traceability (i.e. firms’ ability to track goods across their supply chain), transparency shifts its focus from internal supply chain partners to external stakeholders such as consumers, governments and NGOs (Bell et al., 2016). Such inclusion of external stakeholders is of particular importance since they are not only affected by firms’ behaviors but also can influence firms’ decisions and performance through their reactions (Freeman 1984; Kim and Lee, 2012). Responding to the urgent call from stakeholders (e.g. consumers) to build a sustainable supply chain, numerous firms communicate their sustainable practices to external stakeholders, aiming to achieve supply chain transparency (Christmann, 2004; Carter and Liane Easton, 2011; Busse, 2016). Target surveyed 7,500 vendors to develop its Sustainable Product Standard, which is used to disclose sustainability-related information to its consumers. Everlane, an apparel company, designed its radical transparency program and revealed all cost components, supplier and factory information across SKUs to consumers. While such disclosure has become increasingly prevalent, relevant academic research is still in its infancy (Egels-Zandén et al., 2015; Baldassarre and Campo, 2016; Bell et al., 2016; Morgan et al., 2018). For those who strive to achieve supply chain transparency, there is little direction from the academy regarding whether such disclosure is beneficial and how to disclose the sustainable information. Without answering the questions, the firms will struggle to justify the cost of pro-environmental initiatives (The Sustainability Consortium, 2018).

Among the previous studies that have explored consumer reaction toward the communication of information about sustainability, a positive association has been identified in different contexts such as household, food products (Loureiro et al., 2001; Sammer and Wüstenhagen, 2006; Cho, 2015). However, these prior studies have usually been conducted in contexts in which the sustainable information has positive or neutral product quality implications. While scholars have found that sustainable supply chain communication can increase consumers’ purchase intention and willingness-to-pay a premium (WTPP), such labeling often signals intangible characteristics such as quality (Loureiro et al., 2001; Sammer and Wüstenhagen, 2006; Grankvist and Biel, 2007). For instance, when consumers buy organic food, it is not always clear whether they pay a premium because of the sustainable practices of the selling firm, or because of the perception of superior product quality. There is evidence that customer evaluation of a product, based on information about the ethical attributes of the product, is mediated by customer perceived quality (Bodur et al., 2016). Moreover, there is some empirical evidence from previous studies that when the message has no positive implication for product quality (e.g. paper), there is no positive relation between presenting firms’ sustainable information and consumers’ evaluations (Borin et al., 2011). Hence, it is critical to explore the mechanism that underlies the relationship between the sustainable supply chain communication and consumer evaluations. This also gives an understanding as to the robustness, and what boundary conditions may apply to prior findings. Perceived quality could be confound when trying to understand whether the mere disclosure of information about sustainable practices affects consumer evaluations.

Refurbished products may be viewed as favorable to the environment but do not signal high quality (Bodur et al., 2014). Originating from reverse logistics, refurbished products have important implications for recycling and waste reduction (The Sustainability Consortium, 2016). However, prior research has shown that they generate inferior quality perceptions due to high uncertainty and less rigorous standards (Thierry et al., 1995;
Hauser and Lund, 2003; Guide and Li, 2010; Hazen et al., 2011; Subramanian and Subramanyam, 2012; Wang et al., 2013). Hence, the refurbished product context offers us an ideal setting that environmental benefits co-occur with the negative quality implication. This research studies the means whereby sustainable supply chain communication influences consumer behavioral intent. In this way, firms can nudge consumers’ ethical consumption and also support firms’ sustainable practices (Thaler and Sunstein, 2008).

Consumers’ attitudes toward sustainable issues can affect their reactions to information about related practices, and subsequent behavioral intent (Cho, 2015). This research incorporates an individual attribute: environmental involvement (EI) into our model to investigate the impact of sustainable supply chain communication on consumers. This study addresses four primary research questions:

**RQ1.** Do consumers perceive refurbished products (i.e. products from reverse logistics) to have lower quality, and thus lower WTPP than new products?

**RQ2.** Given that refurbished products also have sustainable implications, can such implications lead to positive WTPP?

**RQ3.** For refurbished products, how should firms communicate their sustainable behavior in order to better influence consumers’ WTPP for products?

**RQ4.** What role does EI play in the effectiveness of sustainable supply chain communication?

Therefore, the purpose of this research is to investigate consumer perceptions of sustainable supply chain communication, within a refurbished products context. This research features two experimental studies. Study 1 establishes differences in perceived quality between refurbished products and new products while testing the effect of providing information about firms’ sustainable practices on consumers’ perceived quality and WTPP. Study 2 examines the interaction effect between EI and sustainable messages’ information direction (whether or not the communication is consistent with consumers’ initial position) on consumers’ WTPP.

Different from the findings from prior research that consumers perceive refurbished products to be inferior in product quality (Thierry et al., 1995; Hauser and Lund, 2003; Guide and Li, 2010; Hazen et al., 2011; Subramanian and Subramanyam, 2012; Wang et al., 2013), results from Study 1 show that not all consumers perceive refurbished products to have lower quality than new products. Instead, quality perceptions are influenced by an individual’s EI and the information presented by the firm. Study 2 shows that those with high EI will have higher WTPP when the sustainable message is consistent with consumers’ initial position (i.e. pro-attitudinal). However, interestingly, in contrast to revised social judgment theory (Eagly and Manis, 1966; Pallak and Pittman, 1972; Petty and Cacioppo, 1979), which argues that high EI enhances the negative effect of counter-attitudinal information, we did not identify significant difference in WTPP between high and low EI consumers when messages inconsistent with consumers’ initial attitude are presented.

The present study makes three key contributions. First, we differ from previous research on supply chain visibility and traceability (Stalk et al., 1992; Aviv, 2001, 2002; Cheung and Lee, 2002; Dejonckheere et al., 2004; Zhu et al., 2018). The majority of the prior literature focuses on exploring the effects of sharing operational information to supply chain partners. Rather, we extend the boundary of supply chain transparency by examining how firms’ disclosure of non-operational information related to sustainability practices affects external stakeholders, especially consumers. Moreover, our research context allows us to better understand the effect of sustainable disclosures by isolating the positive product quality effect that is usually associated with sustainable messages. Our work provides evidence that in a context known to be associated with inferior product quality, consumers do generate higher evaluations and WTPP for firms that behave in a socially responsible manner. Second, our work provides
important implications for firms that strive to disclose their sustainable supply chain practices to consumers as the key stakeholders. The results of our study indicate that while such disclosure can lead to positive consumers' evaluations, the manner of disclosure matters. Disclosures are more effective when the messages are consistent with consumers' initial attitudes. This research also shows that the disclosures do not influence all consumers in the same way. The messages do influence consumers, but the effectiveness of the message and its features seem to be only effective for consumers with high EI. Thus, firms might also need to consider to whom they want to communicate with and intentionally target consumers that care about the environment. Third, our study extends theories from social psychology by identifying potential boundary conditions. While prior research found that consumers with high involvement tend to generate more negative evaluations when the messages are counter-attitudinal, our results could not support such negative effects. Our results indicate that the general theories might not be fully applicable to every context, thus offering opportunities for future researchers.

2. Literature review

2.1 Supply chain sustainability transparency and consumers

Supply chain visibility, traceability and transparency are three closely related but distinct terms (Bell et al., 2016; Morgan et al., 2018). Supply chain visibility is defined as “a firms' ability to access information related to operations of the entire supply chain, besides the activities in which they participate” (Tsanos et al., 2014, p. 436) and aims to investigate the effect of operational information disclosure with firms’ supply chain partners (Zhu et al., 2018). For instance, firms can achieve visibility through sharing sales (Stalk et al., 1992; Aviv, 2001, 2002), operational (Cheung and Lee, 2002; Zhu et al., 2018) and inventory-related information (Dejonckheere et al., 2004) with their supply chain partners. Supply chain traceability focuses more on “tracing product movement through the supply chain” (Daugherty et al., 2002; Li, 2013; Morgan et al., 2018). Prior studies in supply chain traceability focus on using advanced technologies to capture, store and transmit sufficient information for product safety, quality and location at any point of the supply chain (Bosona and Gebresenbet, 2013). Different from visibility and traceability, supply chain transparency shifts focus and applies a stakeholder perspective (Bell et al., 2016; Morgan et al., 2018). Specifically, supply chain transparency explores how supply chain related information is communicated to various stakeholders (Morgan et al., 2018). Consistently, current scholars ask for an expansion of the idea of transparency by disclosing non-operational information with external stakeholders rather than supply chain partners (Schnackenberg and Tomlinson, 2016). One relevant study in supply chain transparency comes from Morgan et al. (2018), which focuses on supplier transparency under a B2B context and argues that visibility and traceability are two dimensions of supply chain transparency. Different from most of the prior studies in supply chain transparency, the present study focuses on a B2C context and investigates the effect of sustainable information disclosure. Hence, the emphasis of current study falls on the clarity of communication from firms to outsiders about their sustainable supply chain practices (Bell et al., 2016).

Researchers from other disciplines have identified a relationship between information disclosure and firm performance. Information such as leadership information (Walumbwa et al., 2008), product-related information (Howlett et al., 2009) and firms’ financial information (Jordan et al., 2000) are all factors that influence firm performance. For example, scholars from marketing have explored the effect of transparency regarding disclosing product-related information (e.g. nutrient information) and found the disclosure generated a mixed effect on consumers’ perception, depending on consumers’ expectation (Burton et al., 2009). Management researchers investigated and identified mixed supports of the positive effect of transparency on stakeholders’ trust perception (Akkermans et al., 2004; Williams, 2005; Walumbwa et al., 2008; Pirson and Malhotra, 2011). In the field of supply chain management,
scholars have studied how disclosing stock out information (Peinkofer et al., 2016), carrier and delivery strategy information might impact consumers’ purchase intent (Esper et al., 2003).

Also, of particular significance for the current supply chain transparency is the inclusion of multiple external stakeholders since they are critical entities that affect firms’ decisions and performance (Freeman, 1984). In the realm of sustainability transparency, the disclosed information might be perceived and evaluated differently among different external stakeholders (e.g. governments and consumers). Moreover, within the same stakeholder group, individuals with different attributes (e.g. age, religion) might generate different evaluations (Vitell et al., 1991; Vitell and Paolillo, 2003).

2.2 Sustainable supply chain communication via eco-label
A typical means for firms to achieve supply chain transparency is to disclose their sustainable behaviors through eco-labels (Taufique et al., 2017). Multiple studies have found evidence for the positive association between the sustainable practice communication and consumers’ purchase decisions. However, such positive association is usually attributed to the quality implication of that product, given that the label usually signals product quality credence (Brach et al., 2018). For example, using an eco-label is found to be positively related to consumers’ purchase decisions of washing machines and lightbulbs which may be more energy efficient (Summer and Wüstenhagen, 2006). Similarly, evidence that consumers draw positive quality implications from the information provided by eco-labels has also been found in the food service industry (Loureiro and McCluskey, 2000; Loureiro et al., 2001; Grankvist and Biel, 2007). Loureiro and McCluskey (2000) compare three different food eco-labeling systems and find that consumers’ WTPPP is based on their perceptions that the labeled foods are safer and of higher quality than alternative choices. Grankvist and Biel (2007) find that those who buy eco-labeled food on a regular basis believe that such food has better taste and quality when compared with non-eco-labeled food.

While these and other studies have investigated the connection between firms’ sustainable supply chain communication and consumers’ perceptions, they have been conducted in the context that there could be positive quality implications. Such positive quality implications might have a confounding effect when evaluating whether mere sustainable supply chain communication leads to increased evaluations. The possible confounding effect can be evidenced in a study conducted by Borin et al. (2011). The authors provide sustainable information for different products and test whether consumers generate different evaluations for different products. Those products differ in terms of the degree of their quality/health impact, ranging from high (e.g. apples) to none (e.g. paper). Results are consistent with a weakening of the positive link between environmental information and consumers’ evaluation for products for which the labeling has no positive quality implication. Meanwhile, in the few prior studies that have examined potentially negative associations of pro-environmental communications with product quality, this effect is contextual on product attributes (Gershoff and Frels, 2015; Luchs et al., 2010). Hence, it is not possible however to draw strong conclusions from these results without a controlled study to test the efficacy of the messaging.

2.3 Refurbished products and inferior product quality implications
Refurbished products refer to products originating from reverse logistics that have been manufacturer verified to be as functional as new products (Vorasayan and Ryan, 2006). After going through refurbishment processes, products are often resold on the secondary market at lower prices. In practice, merchants who sell refurbished products usually focus on the products’ price advantage by arguing that “refurbished equipment may offer the best price/performance ratio […]” or “If your IT budget is lean, refurbished can be a better option” (HP business outlet).

Pertinent to the refurbished products context, there are two main streams of studies that can be identified from the previous literature. The first stream studies the association
between refurbishment and remanufacturing practice, and performance (e.g. Guide et al., 2005). The second stream focuses on the effects of pricing strategies on consumers from a marketing perspective (e.g. Hamzaoui Essoussi and Linton, 2010; Gaur et al., 2015; Vorasayan and Ryan, 2006). However, neither of these literature streams examines how firms may communicate their sustainable practices to influence purchases of refurbished products and thereby provide increased economic incentives for these practices. To address this gap in the current literature, in a refurbished products context, we study how messaging and EI play a role in determining consumers’ purchase decisions. We seek insight as to what messaging firms may use to convey their sustainable practices pertaining to recycling e-waste, in order to influence consumer purchases.

Different from new products, refurbished products have a unique sustainable attribute (Bodur et al., 2014), which is due to the reuse and recycle of materials. By taking back e-waste and reusing in manufacturing, refurbished products can not only bring firms additional profits from the secondary market, but also have implications for reduction of pollution and waste. However, one concern about refurbished products is a consensus that such products are inferior in quality in comparison to new products (Thierry et al., 1995; Hazen et al., 2011). There are multiple reasons that account for such inferior quality implication: first, the standards for refurbished products are less rigorous for their new counterparts. By replacing and reassembling approved modules to extend service life, refurbished products tend to have less than average service life in comparison to new products. Second, refurbished products mainly come from returned products, which are subject to high uncertainty and various reasons for return. Such uncertainty regarding the reason for return and the returned product quality tends to erode consumers’ trust in, and impression of the refurbished goods. Lastly, given that refurbished products usually charge lower prices than new products, such pricing strategies usually signal that refurbished goods are inferior in quality. Therefore, we argue that refurbished products are more likely to have lower perceived quality and WTPP in comparison to new products:

\[ HI. \text{ Consumers will perceive lower quality and express lower WTPP for refurbished products than new products.} \]

2.4 Sustainable information provision and EI

With respect to product information disclosure, consumers generally prefer more information (Andrews et al., 1998; Cho, 2015). The information provided allows consumers to make inferences and generalizations, which ultimately influence consumers’ evaluations (Andrews et al., 1998). There is evidence that the preference for information disclosure not only applies to product-related information, but also applies to sustainable information. For instance, Borin et al. (2011) find a strong positive association between sustainable information provision and consumer evaluations.

Though in general consumers prefer more sustainable information over less, the effect of information provision on consumers’ evaluations might also depend on other factors. According to prior studies, one such important individual factor is EI. EI is defined as “the degree of personal relevance and importance associated with the environment” (Petty and Cacioppo, 1990; Cho, 2015).

The reason attributed to the difference in evaluations among consumers with different levels of EI is the information processing mechanism. Consumers with high EI will process information differently when compared with consumers with low EI, which results in different attitudes, intentions and behaviors. Petty et al. (1981) provide some level of evidence that the effect of information provision on attitude and persuasion differs among subjects with different levels of personal involvement (high vs low). They find that attitude and persuasion ratings differ significantly between groups presented with information and
groups not presented with information. Moreover, persuasion was effective when information was presented to subjects with high involvement. Nevertheless, one remaining question pertaining is whether this relationship still holds under a context that both positive (i.e., environmental benefits) and negative (i.e., inferior quality) attributes co-occur. Therefore, we argue that:

H2. EI will amplify the positive effect of sustainable information provision on WTPP.

2.5 Sustainable information direction and EI

Beyond the provision of sustainable supply chain information, we investigate two further issues: whether all types of communications are equally persuasive, and whether the manner in which the information is supported influences the effectiveness of persuasion. Prior literature from social psychology finds that different messages and different means of persuasion can affect consumers with different level of EI dissimilarly. More specifically, one factor researchers identify that can affect consumers’ evaluations is information direction.

Information direction, originated from the revised social judgment theory, refers to whether or not the message is consistent with people’s initial attitude (Eagly and Manis, 1966; Pallak and Pittman, 1972; Petty and Cacioppo, 1979). A message that is consistent with initial attitude is termed pro-attitudinal, while a message inconsistent with initial attitude is termed counter-attitudinal. People with high involvement display enhanced affinity toward the position advocated by a pro-attitudinal message but display increased resistance to the counter-attitudinal messages (Eagly and Manis, 1966; Pallak and Pittman, 1972).

In the context of sustainable supply chain communication for refurbished products, consider a communication about the refurbished product providers’ investments in sustainable initiatives. The majority of consumers express concerns about the environment in general, and furthermore, admit to apprehension about the environmental impact of their own consumption behaviors (Manget et al., 2009; Kalamas et al., 2014). Hence, consistent with this general trend, pro-attitudinal information communicates a firm’s decision to conduct sustainable supply chain activity highlighting the close connection between refurbished products and recycling. In contrast, information describing the refurbished product providers’ decision to reduce investment in conducting sustainable practices given the necessity to reduce costs is counter-attitudinal. We argue that pro-attitudinal information will lead to higher consumers’ evaluations given increased concerns about sustainability and the environmental consequences of consumption, including the disposal of waste. Meanwhile, we argue that the counter-attitudinal information will lead to lower evaluation ratings since the statement implies sacrificing the environment for the interest of the firm. Also, the investment reduction due to cost-cutting might position the firms as irresponsible, which is inconsistent with consumers’ expectation and, therefore, lower evaluations. Following prior studies that show that high EI can enhance the positive (negative) effect of pro-attitudinal (counter-attitudinal) information on evaluations, our third hypothesis tests the effect of messages with pro-attitudinal and counter-attitudinal information directions on consumers with different EI levels:

H3. When assessing a firm’s message about its sustainability investments decisions, EI will interact with information direction to affect consumers’ WTPP for the refurbished product. Specifically, high EI will.

H3a. Enhance the positive relationship between pro-attitudinal information on WTPP for the refurbished product.

H3b. Enhance the negative relationship between counter-attitudinal information on WTPP for the refurbished product.
3. Research methodology

3.1 Overview of studies
To examine the hypotheses, we conducted two separate scenario-based experiments using vignettes (Rungtusanatham et al., 2011). Scenario-based experiments have been used in supply chain research (e.g. Ma, 2017; Mir et al., 2017; Blessley et al., 2018) to isolate effects that are difficult to observe in noisy field environments. In Study 1, we first examined the difference in quality perceptions and WTPP between refurbished products and new products \((H_1)\), and then we compared the effect of information provision on sustainable practices on participants’ WTPP with different EI levels for refurbished products \((H_2)\). In Study 2, we investigated the interaction between transparency information direction and EI by manipulating information direction (pro-attitudinal and counter-attitudinal) while measuring participants’ EI \((H_3)\). Thus, with our specific experimental designs, we could test the effect of communication and further isolate each factor (information provision and information direction) at different levels and test how each specific level of factor influences participants’ evaluation at different levels of EI.

The experimental design for Study 1 was a 2 (product type: refurbished product vs new product) \(\times\) 2 (information provision: information vs no information), between subjects. The design for Study 2 was a 2 (information direction: pro-attitudinal vs counter-attitudinal information) \(\times\) 1, between subjects. EI was a measured factor in all two studies (Savitz and Weber, 2006).

Two independent measures are of interest to test how different ways of communicating sustainable practices can affect consumers’ evaluations. The dependent variables measure included perceived quality (Dodds et al., 1991) in Study 1 and included consumers’ WTPP (Netemeyer et al., 2004) across two studies. We also included social desirability measure as a control variable (Crowne and Marlowe, 1960; Fischer and Fick, 1993; Valentine et al., 2018). See Table A1 for the detail of each measure.

To test our hypotheses, participants were recruited from Amazon Mechanical Turk (M-Turk), with each participant taking 7 min on average to complete the study. As a popular online crowdsourcing market (OCM), the M-Turk platform has been used by researchers in multiple disciplines including supply chain management (Knemeyer and Naylor, 2011; Ma, 2017; Zhu et al., 2018). When compared with student samples from university subject pools, M-Turk has some unique and preferred characteristics. First, the OCM allows scholars to access a more diverse population with regard to culture, occupation, education and age, while student subjects limit the demographic and educational background of the subject pool (Mason and Suri, 2012; Steelman et al., 2014; Kees et al., 2017). Second, Kees et al. (2017) compared data quality (reliability, effect of manipulation, response to attention check and response involvement) among five different samples including M-Turk, students (in-lab and online) and adults (Qualtrics and Lightspeed, professional panels). They provided evidence that M-Turk is a viable data collection platform that allowed researchers to obtain relatively high-quality data.

To further improve the data quality and validity, we employed several approaches to avoid potential concerns regarding using M-Turk for data collection. To avoid potential character misrepresentation, we did not specify demographic characteristics in participant qualification (Wessling et al., 2017). Our between-subject design and subtle manipulation were able to prevent participants from guessing the purpose of the research, reducing the unwanted demand effects (Lonati et al., 2018). Besides, to avoid selective attrition (Zhou and Fishbach, 2016), we asked every participant to formally “Accept” before accessing the study (Goodman and Paolacci, 2017). Also, following the guidelines of prior literature (Peer et al., 2014; Schoenherr et al., 2015), we included attention check question and included a quality filter based on participants prior history on M-Turk. Lastly, we prevented the same individual from entering the same study multiple times by accepting only one participant per IP address (Zhu et al., 2018).
3.2 Study 1

Participants. To test our first two hypotheses about the comparison between refurbished products and new products, as well as the effects of sustainable information provision, we recruited 216 participants from M-Turk. Of the participants, 57 percent were male, 67 percent were white and 91 percent received at least some college education.

Procedure. All participants were first provided the same instructions to consider the purchase of a computer. We first manipulated product type: participants in the refurbished (new) products groups were told to consider purchasing a refurbished (brand new) computer respectively. We also manipulated information provision: for the participants in the information group, besides the basic product information (a picture of a computer and a sentence about the source), they were also provided information about the firm’s sustainable practices including the firm’s decision to invest in sustainability and information about the firm’s e-waste recycling program. However, for the participants in the no-information group, they only saw the basic product information but no information about the firm’s pro-environmental practices. See Appendix 2 for an example of the stimulus for the information group in the refurbished product condition. After seeing the information provided, participants were asked to evaluate their perceived quality and WTPP.

Prior literature has manipulated involvement (Rhine and Severance, 1970; Dean et al., 1971; Petty and Cacioppo, 1979) or treated it as a measured personal trait (Cho, 2015). Given our specific context, we treat EI as an individual personality difference that represents consumers’ feeling of relevance toward environmental sustainability (Cho, 2015). Our EI measure was adapted from Savitz and Weber (2006), a five-item construct that captures consumers’ concern about environmental issues such as pollutant emission, carbon footprint, recycling, water and energy use and product impact.

Results. Table I shows the summary statistics for each variable in Study 1. Before testing, we checked assumptions of linearity, independence (i.e. Durbin–Watson), and homoscedasticity (i.e. Levene Statistics) and found them to be satisfied. The tolerance and variance inflation factors, were well below the recommended threshold, indicating no multicollinearity (Hair et al., 1998). The assessment of the graphical plots supported the normal distribution of the residuals. Therefore, we had no concerns about the assumptions for regression.

H1 predicts that participants will perceive lower quality and have lower WTPP for refurbished products than new products. A one-way ANOVA test did not find a significant difference between refurbished products and new products for both perceived quality

![Table I. Summary statistics for Study 1](https://example.com/table1.png)
We further explored the effect separately on information provision and no-information provision groups by using PROCESS macros in SPSS (Model 1, n = 10,000). Based on ordinary least square regression path analysis, PROCESS allows researchers to test for the mediation, moderation and conditional process analysis (Hayes, 2013). The bootstrapping approach used by PROCESS with repeated sampling results in narrower confidence intervals for estimates and therefore greater asymptotic accuracy. We identified that for the no-information provision group, there was a significant interaction of EI and product type on both perceived quality ($\beta = -0.40$, SE $= 0.17$, $p < 0.05$) and WTPP ($\beta = -0.82$, SE $= 0.18$, $p < 0.01$). Figures 1 and 2 show the interaction plots of product type and EI on perceived quality and WTPP for no-information provision group. High EI participants perceived refurbished products to be superior in quality to new products, while low EI participants perceived refurbished products to be inferior in quality to new products. WTPP for refurbished and new products reflect this quality perception.

**Figure 1.** Study 1: interaction effect between product type and EI on perceived quality for no-information provision group

**Figure 2.** Study 1: interaction effect between product type and EI on WTPP for no-information provision group
However, the interaction effect did not hold for the information provision group. There was no significant interaction between product type and EI in either perceived quality or WTPP. The interaction plots (Figures 3 and 4) show that regardless of the EI level, participants perceived new products to have better quality and have higher WTPP for new products than refurbished products. Such findings were consistent with $H1$, which argues that refurbished products would be associated with lower perceived quality and lead to lower WTPP than new products. Therefore, $H1$ is partially supported, only for the information provision group.

$H2$ predicts that the positive effect of information provision will be stronger for participants with high EI than participants with low EI. To test $H2$, we used Preacher and Hayes’ (2008) bootstrapping method (model 1, $n = 10,000$). We could not find support for the interaction of EI and information provision on WTPP ($\beta = 0.23$, SE = 0.13, $p = ns$).

However, given the differences in perception between refurbished and new products, the effects of information provision might also be different between these two product types. Therefore, we further examined the effect of information provision separately based on...
different product types. For refurbished products, there was no significant interaction of EI and information provision on WTPP ($\beta = -0.27$, SE = 0.20, $p = \text{ns}$) (see Figure 5). However, for new products, there was a significant interaction was found for information provision and EI on WTPP ($\beta = 0.66$, SE = 0.17, $p < 0.01$) (see Figure 6). When the information about firms’ sustainable practices was presented, high EI participants generated significantly higher WTPP than low EI participants. However, without such information, low EI participants indicated higher WTPP than high EI participants. The findings for new products were consistent with our prediction in H2. Hence, H2 is partial supported, only for new products.

3.3 Study 2

Participants. To test our third hypothesis about the interaction between information direction and EI, we designed an experiment with information direction as the between-subject factor
and recruited 132 participants from M-Turk. Approximately 59 percent of the participants were male, and 87 percent of the participants attended at least some college.

Procedure. Participants in Study 2 were provided instructions to consider the purchase of a refurbished computer. Then they were told that while searching online, they saw information about the firm’s investment in a sustainability initiative. Later, after reading the message, the participants were asked about their WTPP for the products. Last, participants were asked about their level of EI and demographic information.

The information regarding the firm’s sustainability initiative investment decision was the information direction manipulation, as either pro-attitudinal or counter-attitudinal. For those who read the pro-attitudinal message, they saw the message “We will make significant investments in driving social and environmental accountability throughout our supply chain,” and for those who assigned to the counter-attitudinal group, the message stated: “We will reduce our investments in driving social and environmental accountability throughout our supply chain and increase our investments in cost reduction measures.” See Appendix 3 for an example of counter-attitudinal information.

Manipulation check. The efficacy of the information direction manipulation was conducted with a separate group of 55 undergraduate students who did not participate in the main study. Following the procedure in Petty and Cacioppo (1979), we compared the attitude measure between subjects who received pro-attitudinal information and counter-attitudinal information. The results of a one-way ANOVA test confirmed the efficacy of the information direction manipulation. Participants’ attitude ratings varied significantly across different information direction conditions ($F(53, 1) = 13.08, p < 0.01$, $M_{pro-attitudinal} = 5.61, M_{counter-attitudinal} = 4.58$).

Results. In Study 2, we manipulated information direction (pro-attitudinal vs counter-attitudinal) while measuring EI as an individual factor. The dependent variable in Study 2 was WTPP for refurbished products, and Table II presents the summary statistics.

We used PROCESS macro (model 1, $n = 10,000$) to test the predicted interaction effect between information direction and EI ($H_3$). $H_3a$ predicts that high EI will enhance the positive effect of pro-attitudinal information on WTPP; $H_3b$ predicts that high EI will strength the negative effect of counter-attitudinal information on WTPP. The results indicated marginally significant interaction on WTPP ($\beta = 0.27, SE = 0.15, p < 0.10$). To better understand the interaction effect, we conducted further analysis using the Johnson–Neyman technique (Johnson and Neyman, 1936). This allows us to identify a range of the moderator variable (EI) in which the effect of the independent variable (information direction) on the dependent variable (WTPP) is significant (Hayes and Matthes, 2009).

For WTPP, as shown by Figure 7, indicates that pro-attitudinal information generated significantly higher WTPP than counter-attitudinal information for participants with EI above 4.83. Moreover, the difference in WTPP between pro-attitudinal information and counter-attitudinal information conditions became larger as participants’ EI increased. Hence, we can conclude that for participants with EI higher than 4.83, EI enhanced the

<table>
<thead>
<tr>
<th>Study 2: information direction</th>
<th>Pro-attitudinal information ($n = 70$)</th>
<th>Counter-attitudinal information ($n = 62$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td>Correlations</td>
<td>Correlations</td>
</tr>
<tr>
<td>1. WTPP</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>2. EI</td>
<td>3.18</td>
<td>1.16</td>
</tr>
<tr>
<td></td>
<td>5.07</td>
<td>1.21</td>
</tr>
</tbody>
</table>

Notes: *$p < 0.05$; **$p < 0.01$
positive effect of pro-attitudinal information as predicted by $H_{3a}$. However, we could not find evidence that EI enhanced the negative effect of counter-attitudinal information on WTPP. Therefore, $H_{3a}$ is supported and $H_{3b}$ was not supported. Table III presents a summary of the results for all studies.

4. Discussion and implications
4.1 Main findings
As firms strive to improve supply chain transparency through communications about their sustainable practices, our study focuses on consumers as the key stakeholders and examines the effectiveness of sustainable supply chain communication in the context of refurbished products. Rooting from reverse logistics, the refurbished goods context allowed us to investigate the effect of the mere fact that the firm was engaging sustainable behavior on consumers’ WTPP. Unexpectedly, not all consumers perceive refurbished products to have inferior quality: the effect of the disclosure of sustainability information on consumers’ quality perceptions was moderated by individuals’ EI, as consumers high in EI perceived refurbished products to be higher quality than new products. In addition, we sought to investigate message attributes and EI on the effectiveness of the message. Drawing on theories from social psychology, our study explores how three factors pertaining to firms’ pro-environmental practices communication about refurbished products, namely, what to say, how to say it and to whom, affect consumers’ WTPP. We found that knowing firms are conducting sustainable practices can still lead to positive consumer WTPP without positive product quality implications. However, such positive WTPP are contingent on the manner

<table>
<thead>
<tr>
<th>Study</th>
<th>Hypothesis</th>
<th>Independent variable</th>
<th>Dependent variable</th>
<th>Support</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>$H_1$</td>
<td>Product type</td>
<td>Perceived quality</td>
<td>Partial supported (only for the information provision group)</td>
</tr>
<tr>
<td></td>
<td>$H_2$</td>
<td>EI × information provision</td>
<td>WTPP</td>
<td>Partial supported (only for the new product type)</td>
</tr>
<tr>
<td></td>
<td>$H_{3a}$</td>
<td>EI × pro-attitudinal information</td>
<td>WTPP</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>$H_{3b}$</td>
<td>EI × counter-attitudinal information</td>
<td>WTPP</td>
<td>No</td>
</tr>
</tbody>
</table>

Table III. Results summary
of communication and the audience; the communications generate stronger positive effect for consumers with high EI and will be more effective only when the messages are consistent with consumers’ initial positions.

4.2 Implications
This study provides both practical insights and theoretical implications. First, our unique research context allows us to investigate consumers’ reaction to firms aiming to achieve supply chain transparency without confounding possible product quality effects. Though prior studies have established a positive relation between firms’ sustainable supply chain communication and consumer evaluations, most of them were conducted in contexts with positive product quality (Loureiro et al., 2001; Sammer and Wüstenhagen, 2006). However, when such quality implication is not a factor, such positive relationship might disappear (Borin et al., 2011). Results of our study provide more robust evidence that supports the positive relation between mere sustainable communications and consumer evaluations.

Second, our study answers the call of supply chain transparency scholars by investigating the role played by consumers. The current research provides guidelines for the firms that are striving to effectively communicate their sustainable practices to consumers. Our results show that consumers react differently to messages with different characteristics. Such different reactions can subsequently result in different purchase behavior and, ultimately, different firm performance. Perhaps, more importantly, both individual difference (EI) and message characteristics (information provision and information direction) affect consumer evaluations. It is important to note that when the messages are aligned with consumers’ initial positions, the communications will be more effective. However, such effects only hold when consumers are concerned about the environment. Merely positioning the firm as “environmentally friendly” or “ethical” without providing further explanation may not generate positive evaluations.

Third, our study extends theories from social psychology by identifying potential boundary conditions. Prior research found that consumers with high involvement tend to generate more negative evaluations when the messages are counter-attitudinal. Nevertheless, our results did not support such negative effects. It is not possible for us to fully explain why we had unexpected findings counter to predictions from revised social judgment theory (Triandis, 1971). In Study 2, there was no difference between high EI consumers and low EI consumers when presenting the counter-attitudinal information. We can, however, speculate that there is some characteristic or characteristics of the environmental context that leads to this anomaly. For example, it is possible that while EI measures the degree of personal relevance and importance associated with the environment (Petty and Cacioppo, 1990; Cho, 2015), a firm abandoning its sustainable supply chain practices will not have an immediate consequence for the individual. In addition, if a single firm discontinues an initiative, the consequences for the environment will be relatively minor when considering the actions of all society. The experiments of Petty and Cacioppo (1979), from which we draw our theoretical rationale, featured tasks in which the consequences to the subjects are personal, immediate and substantial. We are not able to identify in the current research what critical ingredient resulted in the systematic differences from the predictions in Studies 2, but the results indicate that the general theories might not be fully applicable to every context. We hope that our work will spur future researchers to further explore these issues.

5. Limitations and directions for future research
The current study has several limitations and we suggest a number of opportunities for future research. First, the current study focuses on the interplay of two sustainable communication characteristics (i.e. information provision and information direction) and EI on consumer
evaluations. While we have identified significant effects from all factors, other communication characteristics (e.g. argument quality) and individual attributes (e.g. gender, age, education, etc.) might play a role in affecting the effect of sustainable communication as well. Future research can explore the effect from other factors on firms’ sustainable communication. Second, by applying a stakeholder’s perspective, the present study focuses on consumers without taking other external stakeholders (e.g. agency, policy maker, NGO) into account. Hence, to gain a more comprehensive picture of how supply chain transparency affects external stakeholders, future researchers can incorporate other players during investigation. Lastly, we only measured behavioral intention in the form of WTPP in current studies and did not study actual purchase behavior. Thus, further empirical studies in the field are needed in the current context, given the potential intention–behavior gap (Hassan et al., 2016).

6. Conclusion
We extend the supply chain transparency literature by examining the disclosure of non-operational information on sustainable supply chain practices to consumers, one of the key stakeholder groups. In the context of refurbished products, we how information direction (i.e. pro-attitudinal vs counter-attitudinal information), and individual level attributes (i.e. EI) influence consumers’ WTPP for those products. While we provide evidence that firms can benefit from the disclosure of their sustainable practices, the manner of disclosure matters – targeting consumers with high EI and providing information that is consistent with consumers’ beliefs – tend to result in more effective communications. Hence, our research provides important implications and guidance for firms that strive to justify the cost of their sustainable initiatives by nudging consumers’ ethical consumption of their products.

References


Freeman, R.E. (1984), Strategic Management: A Stakeholder Approach, Pitman, Boston, MA.


Further reading

## Appendix 1

<table>
<thead>
<tr>
<th>Measure</th>
<th>Adopted from</th>
<th>Item description</th>
<th>Anchors</th>
<th>( \alpha )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived quality</td>
<td>Dodds et al. (1991)</td>
<td>PQ1: the likelihood that the product would be reliable is&lt;br&gt;PQ2: the workmanship of product would be&lt;br&gt;PQ3: the product should be of&lt;br&gt;PQ4: this product would seem to be durable</td>
<td>1 = very low; 7 = very high; 1 = very low; 7 = very high; 1 = very poor quality; 7 = very good quality; 1 = Strongly disagree; 7 = strongly agree</td>
<td>0.915</td>
</tr>
<tr>
<td>Willingness-to-pay a premium (WTPP)*</td>
<td>Netemeyer et al. (2004)</td>
<td>WTPP1: the price of the new laptop would have to go up quite a bit before I would switch to another company&lt;br&gt;WTPP2: I am willing to pay a higher price for a new laptop than for other comparable laptops from other companies&lt;br&gt;WTPP3: I am willing to pay ______ % more for the new laptop over other comparable new laptops from other companies given the environmental contribution it makes</td>
<td>1 = strongly disagree; 7 = strongly agree; 1 = 0%; 7 = 30%</td>
<td>0.703</td>
</tr>
<tr>
<td>Environmental involvement (EI)</td>
<td>Savitz and Weber (2006)</td>
<td>EI1: I am concerned about pollutants emitted&lt;br&gt;EI2: I am concerned about recycling and reuse&lt;br&gt; EI3: I am concerned about product responsibility&lt;br&gt; EI4: I am concerned about carbon footprint&lt;br&gt; EI5: I am concerned about product impacts</td>
<td>1 = strongly disagree; 7 = strongly agree</td>
<td>0.932</td>
</tr>
<tr>
<td>Social desirability</td>
<td>Fischer and Fick (1993)</td>
<td>SD1: I have never intensely disliked anyone&lt;br&gt;SD2: I sometimes feel resentful when I don’t get my way (Reverse coding)&lt;br&gt;SD3: there have been times when I felt like rebelling against people in authority even though I knew they were right (Reverse coding)&lt;br&gt;SD4: I am always courteous, even to people who are disagreeable&lt;br&gt;SD5: There have been times when I was quite jealous of the good fortune of others (Reverse coding)&lt;br&gt;SD6: I am sometimes irritated by people who ask favors of me (Reverse coding)</td>
<td>1 = strongly disagree; 7 = strongly agree</td>
<td>0.785</td>
</tr>
</tbody>
</table>

**Note:** We modified the WTPP measure by asking about consumers’ perception about a refurbished laptop in Study 2.
Appendix 2. Experimental vignette for Study 1: refurbished product with sustainable information

You are going to buy a refurbished laptop for yourself and decide to do some online search in advance. When you searching through the website for the information on refurbished goods, you see the following information on the company website.

This refurbished laptop comes from our e-waste recycling program.
Appendix 3. Experimental vignette for Study 2: counter-attitudinal information

You are going to buy a refurbished laptop for yourself and decide to do some online search in advance. When you searching through the website for the information on refurbished goods, you see the following information on the company website.

This refurbished laptop comes from our e-waste recycling program.

We will reduce our investments in social and environmental accountability throughout our supply chain because:

- Leading companies in our industry avoid selling refurbished products due to increased handling costs.
- By reducing e-waste recycling we can devote greater attention and resources to innovation.
- Companies with e-waste recycling programs cannot attract the best supply chain partners.
- According to Forbes, the credit ratings agency, Moodys will give the company its highest rating if the cost reduction measures were instituted.

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In pursuit of supply chain fit

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Abstract

Purpose – The purpose of this paper is to develop exploratory propositions and a conceptual framework on the interaction between organisational structure (decision-making centralisation and internal coordination) and the relationship between supply chain fit and firm performance.

Design/methodology/approach – Through a case study, two corporate groups with distinctive organisational structures were examined; both are undergoing a critical moment of changes to their top management and are reshaping their corporate and supply chain strategies. Data on decision-making centralisation, internal coordination mechanisms, supply, demand and innovation uncertainties, and supply chain strategies were collected from key respondents.

Findings – The analysis conducted suggests the need to consider the joint interaction between organisational structure and supply chain fit in offsetting the implications of a potential misfit on firm performance. Furthermore, the context sensitivity of a supply chain is often overlooked, hence simply modifying supply chain strategy does not necessarily lead to a variation in firm performance.

Practical implications – This research is of particular importance to most organisations in the testing times of uncertainty in the global landscape. It guides supply chain practitioners to better understand which elements of the organisational structure interact with the uncertainty of supply, demand and innovation.

Originality/value – This paper is one of the first to investigate the interaction between elements of organisational structure and supply chain fit and identify decision-making centralisation and coordination as the internal uncertainty factors that are most relevant to supply chain fit research. A conceptual framework has been built for future testing, in which the organisational structure moderates the relationship between supply chain fit and firm performance.

Keywords Supply chain fit, Supply chain strategy, Organizational structure, Uncertainty, Abductive reasoning

Paper type Research paper

1. Introduction

The notion of fit became a central theme in supply chain research when Fisher (1997) proposed that superior performance can be achieved by matching innovative products (i.e. high demand uncertainty) with responsive supply chain strategy, and functional products (i.e. low demand uncertainty) with cost-efficient supply chain strategy. Chopra and Meindl (2007) described this type of match as the “zone of strategic fit” (p. 46). Put simply, to achieve higher firm performance, organisations need to decrease environmental uncertainty by aligning their supply chain strategy with their competitive strategy, thus taking uncertainty factors into account in the design of supply chains (Flynn et al., 2010; Defee and Stank, 2005). Therefore, consistency between supply chain strategies and their design with regard to the environment becomes a fundamental idea in achieving supply chain fit (Stock et al., 1998; Wagner et al., 2012).

The cumulative evidence in the supply chain literature suggests that fit is positively related to a firm’s operational performance (Stock et al., 2000; Hallavo, 2015) and financial performance (Wagner et al., 2012; Hallavo, 2015; Gilgör, 2017). Yet, the literature has provided mixed findings on the dichotomy of responsiveness vs efficiency, where the notion of designing purely responsive or cost-efficient supply chains was not supported in the findings of some studies (cf. Selldin and Olhager, 2007; Hallavo, 2015). Furthermore, recent research has pointed to a potential tradeoff between the resources needed to achieve fit vs the expected benefits.
The higher the level of environmental uncertainty, the more challenging it becomes to achieve supply chain fit, hence more costly (Gligor, 2016). The inconclusive results in supply chain fit research can be due to the terminology-heavy literature (Hallavo, 2015, p. 71). Moreover, supply chain strategies result from multidimensional and conflicting uncertainties, which are often not fully investigated in the literature, and therefore, the conceptualisation of supply chain fit can be daunting (Van de Ven et al., 2013, p. 403).

A second and equally important issue is that the supply chain fit literature usually adopts an outward look, which has led to few studies considering the internal environments of firms. Fit studies usually address three main elements: supply chain strategy and design, environmental uncertainties, and firm performance (Fisher, 1997; Lee, 2002). Yet, the environmental uncertainties addressed in supply chain fit research predominantly relate to product or market characteristics. For example, Qi et al. (2011) validated the moderating effects of demand, supply and technological uncertainty on the relationship between competitive and supply chain strategy and firm performance. Hallavo (2015) investigated product demand, supply and technological uncertainty and their impact on organisational and operational performance. Wagner et al. (2012) investigated supply and demand uncertainty and extended the work of Fisher (1997) by introducing the notion of positive and negative misfit to reflect different degrees of the “match”. Gligor (2016, 2017) investigated uncertainties of market and technological dynamism, technical complexity, product diversity and geographic dispersion.

The high research concentration on product uncertainty has left other internal uncertainties, as well as their impact on supply chain fit and firm performance, relatively unexplored. This could be because the notion of supply chain fit in Fisher’s (1997) propositions, while providing ground-breaking insights, overlooks the role of firms’ internal environment (Gligor, 2017; Prajogo et al., 2018). Not surprisingly, the role of organisational structure is also often overlooked in the supply chain fit literature. Organisational structure affects an organisation’s strategic actions (Eva et al., 2018), and therefore investigating organisational structure is even more important in times of uncertainty and organisational change. Another reason is because of its positive impact on firm performance (Buttermann et al., 2008; Zheng et al., 2010; Gambi et al., 2015), particularly financial performance (Qi et al., 2017). Furthermore, firms that are organised in a way that allows them to deal primarily with stable markets may not perform as effectively in high-uncertainty environments, so do their supply chains (Nahm et al., 2003).

The elements of organisational structure have been found to be positively related with developing a supply chain innovation capability (Daugherty et al., 2011) and resilience capability (Treiblmaier, 2018). Similarly, they impact on supply chain performance (Kim, 2007). Furthermore, certain combinations of organisational structure and supply chain strategy will lead to variations in firm performance (De fee and Stank, 2005). In light of this discussion, whilst organisational structure has been investigated in a number of studies in a supply chain and logistics context, however, a comprehensive analysis on the interaction between organisational structure and supply chain strategies, uncertainties and performance is still missing in the literature.

The present research attempts to bridge this gap in the supply chain fit literature by exploring how the level of centralisation of decision making, the internal span of control, lateral relationships, hierarchy and authority interact with supply chain fit and firm performance. Organisational structure usually deals with “how the tasks are allocated among organizational units and how decision-making authority is specified” (Stock et al., 1998, p. 43), as well as internal coordination mechanisms (Parthasarthy and Sethi, 1992). To that end, this research poses the question:

*RQ1.* How do the levels of decision-making centralisation and internal coordination of the organisational structure impact on the relationship between supply chain fit and firm performance?
The research explores the organisational structure of two corporate groups passing through a critical moment of changing their top management. Supply chain fit (demand, supply and innovation uncertainties and supply chain strategies) is also investigated.

This study makes several contributions to supply chain theory and practice. First, the research identifies decision-making centralisation and internal coordination as the most relevant internal uncertainty factors for supply chain fit research, since they help in offsetting the impact of a potential misfit on firm performance. Hence, the paper extends the findings of Gligor (2017) and Prajogo et al. (2018) by addressing the lack of research in the supply chain fit literature on the role of an organisation's internal environment. Second, the research develops a novel conceptual framework that provides a better understanding of the interaction between internal uncertainty factors and supply chain fit and enhancing firm performance. Third, the research applies maximum variation guidelines to the selection of case studies (Patton, 1990; Flyvbjerg, 2011), as well as an abductive approach, which has helped in developing four exploratory propositions that guide supply chain researchers and practitioners in organisations that are experiencing environmental change to consider the potential joint effects of external/internal uncertainties and supply chain strategies on firm performance.

The paper begins with a theoretical background of supply chain fit research and its findings, and examines the links with organisational structure, followed by the research design section. The findings are presented in Section 4, and the propositions and conceptual framework are discussed in Section 5. The theoretical contribution and managerial implications are discussed in the last section.

2. Theoretical background

2.1 Supply chain fit: strategy, design and uncertainty factors

Previous research emphasised the importance of the context sensitivity of a supply chain (Melnyk et al., 2014) and the interplay with its design (e.g. Fisher, 1997; Lee, 2002; Farahani et al., 2014). Fit studies usually involve three variables: environmental uncertainty factors, response actions and performance indicators. Uncertainty factors represent the situational characteristics of the environment to which the firm has to react through response actions. Fit is reflected in the level of performance that results from how a firm’s strategy (and its design) deals with the uncertainty in its environment (Sousa and Voss, 2008).

The elements of supply chain fit that are addressed in the literature include, first, supply chain strategy and design: responsiveness and/or cost-efficiency strategies (Fisher, 1997; Lee, 2002; Selldin and Ohlager, 2007); second, product and/or market-related uncertainties, that is, demand, supply, innovation and complexity uncertainty factors (Qi et al., 2011; Wagner et al., 2012; Hallavo, 2015; Morita et al., 2015; Gligor, 2016, 2017); and third, their impact on firm performance in terms of flexibility, quality and cost (Stock et al., 1998, 2000; Selldin and Ohlager, 2007), financial indicators, such as ROI, ROA and market share (Qi et al., 2011; Wagner et al., 2012; Gligor, 2016, 2017), and operational and organisational performance (Hallavo, 2015). However, some supply chain fit studies do not measure the impact on performance at all (Prajogo et al., 2018). A summary table that includes details on the supply chain fit literature is presented in Table A1.

Early scholarly work on supply chain fit can be seen as comprising two complementary streams – one with a focus on matching both supply chain strategy and design to environmental uncertainty (Fisher, 1997; Lee, 2002; Defee and Stank, 2005), and another focusing on matching supply chain design to its strategy (Stock et al., 1998, 2000). In the second stream, Stock et al. (1998) developed a conceptual framework hypothesising the supply chain as an extended enterprise, and suggested that the right choice of certain combinations of strategy–structure–logistics practices can improve firm performance.

A seminal work by Fisher (1997) suggested that supply chains should be designed by taking into consideration the product’s level of innovativeness. In his research, Fisher
argued that superior firm performance can be attained by matching functional products (characterised by a low degree of innovativeness) with physically efficient supply chain strategies, and by developing a market-responsive supply chain for innovative products so as to overcome high demand uncertainty. Lee (2002) extended Fisher’s work and introduced an “uncertainties framework”, wherein the impact on the supply chain of both supply and demand uncertainties are considered.

Fisher’s research triggered a number of studies on supply chain fit, some of which were supportive of his propositions, whilst others were not. Selldin and Olhager (2007) empirically tested these hypotheses and found that many firms adopt a blended responsiveness–efficiency strategy. They challenged Fisher’s proposition that a particular match leads to superior performance, and argued that there is no empirical evidence to support the notion of purely market responsive or physically efficient supply chain strategies. Hallavo (2015) claimed that supply chain efficiency is not an alternative strategy to responsiveness, but rather a precursor. The findings of Qi et al. (2011) confirmed the contention that organisations do not take decisions on supply chain strategy as an “either–or” choice. They concluded that in high-uncertainty environments, cost leadership and the focus on mainly lean capabilities do not lead to significant benefits in terms of firm performance. Rather, firms with cost leadership need to achieve a balance. Furthermore, they found that environmental uncertainty has a minor influence on decisions regarding supply chain strategy in the case of firms with a differentiation strategy that mainly need to focus on agile capabilities in all situations. This line of thinking was echoed in Gligor (2016), who argued that different levels of environmental uncertainty imply different levels of supply chain fit. As such, the higher the environmental uncertainty the more challenging (and expensive) it becomes to achieve supply chain fit. Hence, when firms operate in high-uncertainty environments, they need to develop agility capabilities in order to achieve supply chain fit.

Wagner et al. (2012) suggested that not all misfit configurations worsen firm performance. They introduced two novel misfit configurations – negative misfit (i.e. responsive supply chains with a low demand uncertainty) and positive misfit (i.e. efficient supply chains with high demand uncertainty). In their framework, firms with a positive misfit have a reasonably better financial performance compared to those with a negative misfit. Hence, if supply chain fit is not attainable or is likely to be very expensive, firms can choose to adopt a design that does not undermine their performance. Gligor (2017) extended the findings of Wagner et al. (2012) and identified the environmental conditions in which firms benefit the most from fit. He found that in high-uncertainty environments, the gains (in terms of firm performance) from supply chain fit can be offset by the costs of the resources needed to maintain the fit. Moreover, he claimed that firms in low-growth industrial sectors benefit least from supply chain fit, and that they benefit more when offering a product with a low level of technical complexity. Rojo et al. (2016) identified ambidextrous environments (the ability to simultaneously explore opportunities and exploit competences) as enabling high supply chain fit (a measure of supply chain flexibility), whereby firms can accumulate valuable capabilities to enhance their performance.

In conclusion, supply chain fit research is becoming a central theme in the supply chain literature (Hallavo, 2015). Product and/or market-related uncertainties (namely demand, supply and innovation) are by and large the main environmental uncertainty factors addressed in supply chain fit studies thus far. The literature has evolved from favouring Fisher’s (1997) propositions (Chopra and Meindl, 2007), or testing them (Selldin and Olhager, 2007; Wagner et al., 2012), to identifying how and when supply chain fit can be achieved, as well as the environmental conditions under which the propositions hold, what the capabilities needed are, and when the fit can be truly beneficial (Qi et al., 2011; Gligor, 2016, 2017).

The literature, meanwhile, has developed from merely focusing on structures (Stock et al., 1998, 2000) to incorporating supply chain environments, structure and strategies. Moreover, supply chain strategies are moving from the continuums mind set to a complementarity of efficiency and responsiveness (Hallavo, 2015), and the configurations are moving from the fit/misfit.
dichotomy to a fit, positive and negative misfits (Wagner et al., 2012). Furthermore, recent studies (e.g. Prajogo et al., 2018) have called for research that considers the internal (i.e. intra-firm) environment in supply chain fit studies, which was overlooked in Fisher’s (1997) model.

The vast majority of supply chain fit publications apply a survey methodology (e.g. Wagner et al., 2012; Gligor, 2016; Rojo et al., 2016). Quantitative approaches offer generalisable findings, but their prevalence has steered the field’s growth in a positivist direction, leading to the acceptance of their findings without questioning their contextual suitability. So far the supply chain fit literature depends mainly on testing theories rather than developing them, this can hinder theory generation of what is essentially a relatively new stream of research (Kovács and Spens, 2005). For this reason, the decision was taken to follow a qualitative approach in the present research.

2.2 The role of the internal environment: organisational structure and supply chains

Organisational structure is an important dimension of an organisation’s environment (Zheng et al., 2010). Investigating organisational structure is particularly important in supply chain fit research because internal structures must be taken into account when developing supply chain strategies (Defee and Stank, 2005). In particular, the centralisation of decision making has been found to support the building of organisational capabilities that strengthen supply chain resilience (Treiblmaier, 2018). Furthermore, certain elements of the organisational structure (namely decision-making centralisation and formalisation) have been found to be positively linked to supply chain innovation capabilities (Daugherty et al., 2011), while internal integration has been found to have a more significant impact on a firm’s financial performance than external supply chain integration (Qi et al., 2017).

Organisational structure usually deals with “the division of tasks, the distribution of decision-making authority and the level of [internal] integration used” (Parthasarthy and Sethi, 1992, p. 98), and with “how the tasks are allocated among organizational units and how decision-making authority is specified” (Stock et al., 1998, p. 43). Essentially, organisational structure is concerned with task allocation, administration, integration and control within the organisation (Child, 1972). Tools such as organisational charts and hierarchies are instrumental in understanding the organisational decision-making process (Christensen and Knudsen, 2010).

As already outlined, organisational structure can be conceptualised in various ways. This study is primarily concerned with the elements of organisational structure that relate to supply chain fit. As such, this paper has identified decision-making centralisation and internal coordination mechanisms for further investigation (Stock et al., 1998, 2000). Centralisation has been selected because it is considered a key environmental factor; the decision-making authority within individual firms influences the success of the entire supply chain (Defee and Stank, 2005; Daugherty et al., 2011). Centralisation is concerned with “the degree to which decision making is concentrated at the upper level of management, with decentralization involving the dispersion of such authority throughout the lower levels of the organization” (Eva et al., 2018, p. 173). The more centralised the decision making, the more it is held at the top levels of management (Treiblmaier, 2018). Hence, employees in highly centralised organisations may have less autonomy to make decisions regarding, for example, supplier selection. Internal coordination has been selected for investigation because in order to address the uncertainty in supply chain strategy and design, organisations need a high level of interaction and coordination, both internally and externally (Stock et al., 1998, 2000), which facilitates information sharing, the deployment of resources and data accessibility across the supply chain (Defee and Stank, 2005).

2.3 The evolution of supply chain fit

As a multidisciplinary field, it is common for supply chain research to extensively borrow theoretical perspectives from various disciplines. The concepts of organisational and
strategic management are, therefore, prevalent, especially contingency and configurational approaches that were introduced to organisational studies in 1965 by Joan Woodward, who investigated enhancing firm performance by examining the firm’s environmental factors. These concepts also appeared in the business network research of Håkansson and Snehota (1989, 2006), who found that organisations are not isolated islands, but are embedded in a web of interrelated structures and networked relationships.

The contingency theory hinges on the proposition that there is no optimal method to design an organisation. Rather, to achieve superior performance, organisational designs should be contingent on the factors that are embedded within their internal and external environments (Fry and Smith, 1987; Doty et al., 1993). The premise of the contingency approach is anchored in establishing a fit between a firm’s structure and its environment (Drazin and Van de Ven, 1985).

The notion of fit in the organisational management literature (e.g. Lawrence and Lorsch, 1967; Khandwalla, 1972; Mintzberg, 1979) emphasises the consistency between an organisation’s environment and its structure that is needed in order to enhance environment-structure fit. Organisations can decide on the configuration/structure that is the most consistent with their environment to sustain improved performance levels. Otherwise, organisations can be forced to tradeoff their situational fit against the internal consistency of their structures. Environment-structure fit research usually investigates the relationships between two variables a bivariate uncertainty factor and a response action and assumes a static situation.

On the other hand, the literature on strategic management considers fit as an alignment or matching of a firm’s strategy to its environment (Miles and Snow 1978). Zajac et al. (2000) argued that environment-strategy fit is a dynamic and multidimensional phenomenon, thus it can be hard to measure or predict, as in complex longitudinal studies. Moreover, investigating the association between multi-independent variables (multivariate) and a dependant variable can complicate data collection and analysis (e.g. investigating how the associations between product innovativeness, firm size and employees skills can impact on firm performance). Figure 1 depicts the outlined differences between structural and strategic fit.

The contingency approach has been subject to multiple revisions in response to the strong criticism it has faced. For example, Drazin and Van de Ven (1985) argued that contingency models are characterised by “instability and confusion”, and that they have

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**Figure 1.**
Different perspectives of fit

Sources: Based on Miles and Snow (1978), Zajac et al. (2000) and Van de Ven et al. (2013)
been studied with an “implicit pool of assumptions”. This confusion is mainly due to the absence of an explicit conceptualisation of fit and the lack of a clear identification of its underlying concepts, which has led to its use in the literature as an axiom. In other words, since one cannot explicitly identify the concept, various assumptions are inevitably made along the research process. Conceptualisation can be even more challenging if the sought-after fit concerns multiple horizontal units, as in the case of a supply chain. A review by Kathuria et al. (2007) found that research on achieving alignment between horizontal units, for example, in the supply chain, is relatively sparse.

Considering the complexity and multi-dimensionality of real-world uncertainties, it is obvious that the absence of a proper conceptualisation of fit creates a challenge in terms of testing it empirically (Van de Ven et al., 2013). To overcome this issue, Van de Ven et al., 1985) put forward three different approaches for identifying and conceptualising fit – selection, interaction and systems. The selection approach suggests matching the environment to structure. Interaction considers the effects of interaction, and is concerned with the effects of pairs of environmental factors and structure on performance. The systems approach, meanwhile, suggests fit as an internal consistency of sets of environmental factors, structure elements and performance.

In response to the criticism, the so-called structural contingency theory was developed, which essentially merged the configurational and contingency approaches. The configurational approach or “multi-contingency perspective” (Miller, 1987) was introduced to mirror the real world by capturing the multiple uncertainties that organisations deal with. The main criticism of configurational contingency approaches when dealing with complex networks and systems is that they do not offer strong empirical evidence of the relationship between fit and performance.

Fit can also be regarded from the lens of institutional theory as an isomorphism phenomenon (DiMaggio and Powell, 1983), wherein organisational forces and institutional pressure between firms result in homogeneity (i.e. organisations start to resemble each other). Isomorphism is considered a constraint to achieving fit, since the inter-organisational pressure can cause organisations to resemble each other regardless of the peculiarities of their environments (Gammeltoft et al., 2012).

The above-outlined different underlying fit rationales in the literature are synthesised in Table I.

3. Methodology
3.1 Research design
Case study research is a powerful methodology for theory testing, generation and elaboration, since it helps in interpreting the concepts in a specific context, instead of examining their intensity or frequency (Ketokivi and Choi, 2014). Furthermore, it provides greater exploratory depth (Meredith, 1998) than other methodologies, and is appropriate for the present paper, given its context-dependent nature (Yin, 2014) that Flyvbjerg (2001) refers to as the “primacy of context”. The case study approach in supply chain research can have certain limitations, in relation to the networks’ complexity and dynamism, which can cause difficulty in identifying boundary settings and cross-examining findings (Halinen and Törnroos, 2005).

The research process for this paper started when an observation emerged from the data analysis of an earlier study of two corporate groups that had distinctively different environments. However, the way they managed and configured their supply chains was similar, and although the previous management of the two groups had not put much effort to achieve supply chain fit, their financial performance levels were high. These observations seemed to be not completely in line with the concepts of contingency theory, and therefore, a decision was made to further investigate this observation by following an abductive research process.
<table>
<thead>
<tr>
<th>Fit scope</th>
<th>Fit rationale</th>
<th>Fit concept</th>
<th>Theoretical lens(es)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>SG, SC</td>
<td>To enhance organisational effectiveness</td>
<td>Establishing a fit between a firm’s structure and its environment. As such, fit is achieved through consistency between internal organisational design elements and the external environment</td>
<td>Contingency theory</td>
<td>Lawrence and Lorsch (1967), Khandwalla (1972), Mintzberg (1979)</td>
</tr>
<tr>
<td></td>
<td>To advance and achieve superior firm performance</td>
<td>There is no optimal way in designing an organisation. Organisational design is contingent on different contextual uncertainty factors embedded within their external and internal environment</td>
<td>Contingency theory</td>
<td>Fry and Smith (1987), Doty et al. (1993)</td>
</tr>
<tr>
<td></td>
<td>To incorporate real-life complex multiple contingencies in organisational studies</td>
<td>Fit is multidimensional and need proper conceptualisation. The multiple contingencies firms deal with should be considered in research</td>
<td>Structural contingency theory</td>
<td>Drazin and van de Ven (1985), Van de Ven et al. (1985, 2013), Miller (1987)</td>
</tr>
<tr>
<td></td>
<td>To align (match) strategy to environment and internal organisational contingencies</td>
<td>Fit is multidimensional and deals with multiple relationships, dynamic and ambiguous phenomenon</td>
<td>Dynamic strategic fit</td>
<td>Miles and Snow (1978), Venkatraman (1989), Zajac et al. (2000)</td>
</tr>
<tr>
<td></td>
<td>To manage institutional pressure</td>
<td>Managing isomorphism institutional pressure which might direct organisations to resemble each other regardless the peculiarities of their environment</td>
<td>Institutional theory</td>
<td>DiMaggio and Powell (1983), Gammeltoft et al. (2012)</td>
</tr>
<tr>
<td></td>
<td>To enhance firms’ competitive position in the market</td>
<td>Business performance depends on the firm’s position in the industrial structure (i.e. external market), dynamics of the relationship and the power structures between the firm and the market</td>
<td>Network theory</td>
<td>Håkansson and Snehota (1989, 2006)</td>
</tr>
</tbody>
</table>

Notes: SG, environment–strategy fit; SC, environment–structure fit
Abduction was developed by Charles Sanders (Santiago) Peirce as an intuitive research approach to theory generation. It starts with unexpected real-life observations that represent an irregularity to the interpretations provided by available theories, and which, therefore, need further investigation. The abductive research process allows researchers to form new theoretical concepts and frameworks (Meyer and Lunnay, 2013), and usually ends with their proposing exploratory hypotheses/propositions that need further testing in a supply chain empirical setting (Kovács and Spens, 2005; Lawrence et al., 2018). As a multifaceted reasoning approach, abduction does not have a single definition it was referred to sometimes as “retroduction” and sometimes as a “hypothesis” in Peirce’s writings. For the sake of simplicity, this paper follows a definition put forward by Peirce himself in 1903, according to which abduction is “[…] the process of forming an exploratory hypothesis” (Rozeboom, 1997).

The present research process embraces the guidelines provided by Kovács and Spens (2005), as depicted in Figure 2. It was apparent early on that there were distinctive organisational structures in use in the corporate groups under study. Therefore, the potential role of organisational structure as an environmental uncertainty factor emerged as an important lead, and this created an opportunity to suggest exploratory propositions regarding supply chain fit and firm performance. It was necessary to return to the literature to review previous studies on organisational structure/decision making and how these factors link to supply chain and firm performance. Subsequently, additional interviews were conducted to generate a complete picture of the corporate groups’ organisational structures, lateral relationships, hierarchy and span of control.

3.2 Case selection criteria
The selection criteria were guided by the need to identify information-rich cases. The main case study incorporated Patton’s (1990) and Flyvbjerg’s (2011) guidelines of maximum variation between cases, i.e., cases displaying great diversity in their characteristics, which usually leads to high-quality descriptions and the identification of patterns of uniqueness. Prior to initiating the abductive research process, the case selection criteria were carefully reviewed so that the cases would be appropriate to capture the elements of supply chain fit.

Figure 2.
Abductive research process
Hence, this study’s selection criteria incorporated Zajac et al.’s (2000) guidelines, according to which the ideal empirical context in which to examine the notion of fit is when the studied organisations face changing environmental conditions that trigger strategic change.

The case selection criteria of the main study were as follows: the organisations should have local and global supply, production and distribution networks, and their environments should reflect a multitude of uncertainty factors (e.g. industrial sectors, product characteristics, company sizes and location). Following Zajac et al.’s (2000) guidelines, a further criterion for this study was put forward, namely that the organisations should be going through a phase of strategic change and should be experiencing changing environmental conditions. Furthermore, to ensure geographical proximity to the research team and direct access to key executive-level respondents, the organisations had to have headquarters in Europe.

Two corporate groups, with a total of ten subsidiaries, were identified using the above-outlined criteria. They are headquartered in Italy and in Sweden, and have substantially different business cultures and organisational structures. The first corporate group (TOOL) is a leading manufacturer of high-technology tools, whilst the second (CARE) is a leader in the healthcare and personal-care sector. The two corporate groups have different environments and organisational structures, which permitted cross-case comparisons. Both corporate groups are undergoing critical top management change, and are reshaping their operational, corporate and supply chain strategies.

3.3 Data collection and analysis

In order to capture supply chain fit, the present research adopted the conceptualisation provided in previous studies (cf. Qi et al., 2011; Wagner et al., 2012). As regard the elements of supply chain strategy, supply chain responsiveness was conceptualised by asking questions regarding delivery modes and reliability, manufacturing and inventory buffers, responses to unpredictable demand, and the rate of new product launches. Supply chain efficiency was conceptualised by asking questions regarding manufacturing process improvements, operational efficiency, product cost reduction and pricing. As regard external uncertainty factors, the questions were about the uncertainty of supply, demand and innovation (product life cycles, variants, forecast accuracy, location and number of sales points, rates of product innovation, rates of customer requirements change, easiness of finding suppliers, suppliers consistently meeting quality and delivery requirements).

As regard internal uncertainty factors, the questions related to organisational structure followed the conceptualisation provided by Parthasarthy and Sethi (1992), Nahm et al. (2003) and Daugherty et al. (2011); as such, they concerned the existence of predefined rules and procedures, the number of layers in the hierarchy, the level of autonomy and locus of decision making, and the level of internal coordination and integration.

Based on the above-outlined conceptualisation, the interview questions and protocol were developed. Embracing the abductive inference process, data were collected through semi-structured interviews in order to allow the respondents to introduce new concepts that could help generate exploratory propositions (Meyer and Lunnay, 2013). Around 6–7 interviews were conducted per organisation (in English) with executive-level respondents, each lasting between 60 and 75 min. The respondents were asked to identify the product families that are the most critical to their financial performance. Three CARE products and one TOOL product family were identified.

In order to ensure knowledgeable views on supply chain strategies and external uncertainties, the criteria for the selection of respondents were guided by the depth of their involvement in strategising and managing supply chains. In order to capture the dynamic environmental change dimension, the selection criteria targeted supply chain executives who had taken their positions prior to the top management changes and were still involved
with the new corporate leadership in strategising the changes. In order to capture the internal uncertainty dimension, the selection criteria targeted senior-level executives who were responsible not only for supply chain management in the subsidiary companies but also for leading group-level projects and the strategizing of supply chains for critical product families. These outlined selection criteria of respondents are in line with the guidelines provided by Aguinis and Solarino (2019) for choosing respondents who have deep knowledge on a firm’s strategies and are able to provide information on the dynamics between the different hierarchy levels in the organisation (termed “elite informants”).

An initial contact was made with the two groups in order to identify potential executive-level respondents (CARE through e-mail correspondence with the head of the supply chain, and TOOL through a face-to-face meeting with the group’s R&D and academic relations general manager). Two key respondents who met the selection criteria were identified CARE’s group supply chain and planning head, and TOOL’s vice president for supply chain management. The interview data were complemented by secondary data on the organisation, and the new leaders’ strategies for change were found from internal documents, annual reports and company websites. The data collection is depicted in Table II.

To ensure qualitative research rigour and reliability, the questions were sent beforehand the interview to the respondents (mentioning the possibility of addressing follow-up questions). The interviews were audio recorded, transcribed and then cross-checked with the respondents. In addition, an external researcher helped verify the transcripts. Follow-up e-mails and/or phone calls were also used to clarify any outstanding issues. Thematic coding using a MS Excel spreadsheet was performed for the data analysis, where verbatim codes were grouped into categories, which helped generate conceptual themes.

### 4. Findings

#### 4.1 CARE: organisational and supply chain overview

CARE is a corporate group with six subsidiaries and is active in the healthcare, childcare and personal-care sectors. The group has recently been experiencing major changes in its business model and management style, leading to a review of its operational and supply chain strategies. Furthermore, the group is undergoing a major restructuring, transitioning from a family-owned group to a publicly listed one. CARE recently deployed an internationalisation plan to penetrate new markets, and established facilities in Mexico, Russia, India and the USA. This expansion has complicated CARE’s supply chain in terms of distribution, inventory management, planning and supply management. Moreover, due to the 2008–2009 economic crisis that severely impacted the Italian market (considered its main market), CARE has been focusing on international markets, especially the USA (its second biggest market after Italy). This international expansion and management

<table>
<thead>
<tr>
<th>CARE</th>
<th>TOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondents</td>
<td>Group Supply Chain and Planning Head</td>
</tr>
<tr>
<td>Location</td>
<td>Italy (HQ) – branches in 24 countries</td>
</tr>
<tr>
<td>No. of subsidiaries</td>
<td>6</td>
</tr>
<tr>
<td>Turnover</td>
<td>€1,415 m</td>
</tr>
<tr>
<td>Sector</td>
<td>Healthcare products</td>
</tr>
<tr>
<td>Number of employees</td>
<td>6,500</td>
</tr>
<tr>
<td>Field visits by researchers</td>
<td>1</td>
</tr>
<tr>
<td>Secondary data used</td>
<td>Financial reports (2015–2016), internal documents and website</td>
</tr>
</tbody>
</table>

*Table II. Data collection*
transition has been accompanied by a change in CARE’s corporate strategies, leading to the initiation of cost reduction and performance improvement projects.

CARE’s new CEO is from another major Italian group. The mission of CARE’s new leadership is to enhance the group’s worldwide presence, build an organisational structure that suits the new business model, and effectively manage the change process, which it hopes will eventually enhance CARE’s competitiveness in the market. The group usually has medium-term contractual agreements with its suppliers and retailers. These dyadic relationships are usually managed by CARE, as a focal actor in the network and one which possesses the strongest bargaining position. CARE continuously negotiates its purchasing policies and inventory visibility with its suppliers, and moves some of its inventory to suppliers’ premises. It reviews supplier performance every three years.

4.2 TOOL: organisational and supply chain overview
TOOL is a publicly listed corporate group comprising four subsidiaries. Over time, it has established a stable management style that is characterised by little hierarchy (i.e. it resembles a flat organisation). TOOL has just experienced changes to its top management, and has recently appointed a new CEO. The group has initiated a business expansion and is aggressively acquiring competing brands. Some of the newly acquired brands remain individually managed, having planning and supply chain processes that are separate from those of the group. Following the completion of the recent acquisitions, TOOL has taken over the international facilities of the acquired brands and has decided to shut down some of its distribution centres in order to save on costs. TOOL regularly hires experts in various fields to help improve business performance, but these experts appear to be working in silos; meanwhile the top management is making efforts to enhance internal coordination.

The design of TOOL’s downstream supply chain depends on the market location. For example, the group serves the European market through direct sales to individual customers, whereas US customers are usually served through external distributors. TOOL depends on external carriers and distributors for product delivery, and the downstream chain is characterised by high responsiveness and fast 24-h delivery. This limits the choice of carriers and thus the possible reconfiguration of the supply chain.

TOOL’s upstream supply chain is internationally extended, including raw material suppliers from Asia (mainly China), as well as the USA and Europe (mainly Sweden). Due to the particular characteristics of its high-tech products, and the criticality of raw material extraction, which requires major long-term investments, TOOL relies on long-term contractual agreements with its suppliers. This results in TOOL having strategic dyadic inter-organisational relationships with the few suppliers that can meet its quality requirements.

4.3 Organisational structure
CARE’s organisational structure, as depicted in Figure 3, is hierarchal and characterised by a high degree of centralisation of decision making, specifically at the level of group CEO, with the decision-making process supported by a team of functional managers who form working sub-functional teams and design cross-functional projects. CARE initiates cross-functional projects involving members from different departments, and this has helped it overcome the challenges of an organisational structure that is characterised by a long chain of command and a narrow span of control. As CARE’s respondent elaborates: “Each product project has a project manager and a project team, a group of people from different functions that are involved”. This approach enhances internal coordination and thus lateral intra-organisational relationships. There is a focus on developing and implementing internal coordination mechanisms as an enabler of the group’s transformation process. The rapid changes and the eagerness to transform the group from a family-owned model to an Anglo-Saxon one (by engaging external investors and starting to sell company shares) have
resulted in a number of improvement projects and have enhanced internal coordination and integration. As elaborated by CARE’s respondent: “For the supply chain, he [the new CEO] asked us to change completely the mind set and to put even more aggressive objectives. So we tried to change our way of doing things”.

Meanwhile, in TOOL’s organisational structure (shown in Figure 4), decision-making spans the CEO and top manager level, with an absence of cross-functional teams and a poor integration between the newly acquired brands and the parent company. TOOL has a rigid horizontal differentiation, and departments often work in silos, which makes the organisation less flexible than it could be and results in a low level of coordination of lateral intra-organisational relationships. As TOOL’s respondent admits: “We are very much in silos”.

In TOOL, which is more inclined towards a Nordic model (egalitarian decision making and small income disparities), the pace of change implementation is slower, with prolonged discussions of matters awaiting conclusive decisions. This was illustrated by the use of the phrase “ongoing discussions” 12 times in just one interview with TOOL’s respondent, in reference to the decision-making situation. TOOL’s decision making tends to be based on internal situational factors, not on the external market or on product-related factors.
Its management style is sporadic at the unit level, but it is more structured at the group level. For example, individual businesses and production units have the flexibility to make their own operational decisions (e.g. about production capacities and scheduling), whereas strategic decisions (e.g. where to produce, how to improve production and new product development) are managed more collectively at the top management level. The organisational structure of each group is summarised in Table III.

### 4.4 Supply chain fit

#### 4.4.1 Supply, demand and innovation uncertainty

Two of the three examined CARE product families have growing market shares, a frequent rate of new product development (“[…] we renew our product range very often”), and a medium product lifecycle. The third product family has a longer lifecycle and fewer new product developments, since it is considered a functional product. Due to the high seasonality of the majority of its innovative products, CARE renews its product range frequently some every year and others every few months with high product variation and differentiation. As CARE’s respondent notes: “We have a big issue in terms of forecasting […] inventory and synchronisation of the warehouses”. Moreover, CARE offers a few functional products whose designs have changed little over the years, except for the external packaging. To add to the challenges, the high seasonality of its products means different timelines in different markets: “Every country has a different requirement […] Now we ask our central warehouse to prepare the goods in a lot of different ways”. This leads to uncertainty in forecasting demand and creates supply-side risks. Therefore, greater supply chain integration is needed to absorb these challenges. CARE has established collaborative mechanisms with its suppliers that have helped it to decrease supply uncertainty: “We analyse and optimise with our suppliers the mean ordering quantity of the raw material”. CARE has also implemented quality procedures to ensure higher-quality products and service. The goal is to reduce product lead time and increase product availability, while reducing the stock of finished products in inventory.

The portfolio of TOOL’s products is broadly functional and in a stable phase in the market. Due to their nature as high-technology engineered tools, TOOL’s products have considerably longer life cycles with low design variation and little change over the years, which entails low innovation uncertainty. This, combined with material and supplier criticality, leads to a low frequency of supplier changes. As explained by TOOL’s respondent: “There are not many suppliers in the market who can provide us with this sort of material compositions”.

TOOL is trying to establish higher degrees of flexibility to enable different products to be manufactured in different plants, which requires more collaboration and synchronisation in production area decision making. However, its products are quite fragmented, as TOOL’s
respondent admits: “[acquired brand] is not really integrated yet [...] they still manage their own production units”. TOOL recruits experts who use sophisticated planning and forecasting techniques, and this has resulted in a decrease in demand uncertainty. Forecasting and planning are performed over a long, five-year horizon, but forecasting is reviewed every month and planning, provisionally, every 18 months. Through a centralised production plan, which is consolidated using data from various production plants, the production plants specify their production capacity for each stock-keeping unit. TOOL uses reversed logistics networks for product recycling, which helps it decrease supply risk by retaining critical raw materials that are used in certain products. TOOL’s policy of go-to-the-market 24-h delivery has led to a solid base of loyal customers, which has helped the group to predict demand.

4.4.2 Supply chain strategy: efficiency and responsiveness. Modifying the supply chain structure and strategy is usually justified when the market is moving. Supply chain strategies are blended, for example, TOOL’s supply chain is designed to be cost-efficient on the upstream side by establishing partnerships with few suppliers, but it is very responsive on the downstream side and offers a 24-h product delivery with high service level.

CARE’s new leadership has concerns regarding efficiency in the logistics, inventory and planning areas. The main objective is to improve the efficiency of inventory management and material/product handling, and to that end, the group is investigating the feasibility of using third-party logistics (3PL). CARE initially owned all its warehouses in Italy, Spain, Portugal, the UK and Brazil. Recently, it has shut some warehouses to reduce distribution costs, and has started using 3PL services and the facilities of its subsidiaries; meanwhile, European distribution has been centralised in two distribution centres in Italy. This situation has presented certain challenges, since customer requirements and behaviour differ across European countries with regard to packaging and product specifications. As a result, CARE has had to acquire knowledge about various logistics activities that it did not conduct before. However, it has recently started reconsidering the offshoring agreements due to the risks associated with the long distance and the difficulty in dealing with foreign suppliers. This situation also limits flexibility because decisions regarding any needed supply chain reconfiguration require often lengthy negotiations.

5. A framework for supply chain fit
The consolidated financial data for CARE show a sales increase of 1.5 per cent as compared to the previous year, and 18 per cent from two years earlier, with a net profit increase of 2.5 per cent (CARE Financial Report, 2016). According to Fisher’s (1997) original work, a business like CARE, with high innovation uncertainty and demand uncertainty, needs a responsive supply chain. However, the group has adopted a cost-efficient upstream and downstream supply chain strategy. This creates a supply chain misfit and should have caused a decline in financial performance, but the data for financial as well as operational performance show consistent improvement over the years.

TOOL with its high supply uncertainty and low innovation uncertainty and demand uncertainty, need a cost-efficient supply chain to achieve fit. However, the group has a blended upstream supply chain strategy and responsive downstream supply chain. This also creates a supply chain misfit and should have affected TOOL’s financial performance. TOOL’s 2016 annual report reveals a 3.5 per cent increase in net profits, as compared to the previous year, despite a drop in revenue of 5 per cent. Table IV depicts the findings in terms of supply chain strategy and supply, demand and innovation uncertainty levels.

Based on the outlined analyses, the following section discusses four exploratory propositions developed to interpret the relationships between supply chain strategy, supply, demand and innovation uncertainty and firm performance.
CARE’s targeted markets emphasise frequent changes of product design. The group mitigated this demand and innovation uncertainty by instituting a faster decision-making process that is more flexible and more responsive. Around 80 per cent of CARE's externally supplied components come from China, and this entails uncertainty as regard offshoring issues. However, the supply market is considered non-critical due to the abundance of alternative suppliers and the availability of reasonable pricing. CARE’s centralised decision making, coupled with its high demand and innovation uncertainty, have forced it to initiate many improvement projects to cut costs, which have resulted in improved efficiency and operational performance. As noted by CARE’s respondent: “We don’t have big issues in terms of efficiency in our production in Italy because we already worked in the past in order to have a big [better] flexibility and elasticity in the production”.

Centralised decision making has allowed CARE to foster strategic agreements with selected key suppliers and enjoy considerable bargaining power and a strong position within its supply chain, which has allowed it to direct negotiations and manage upstream and downstream dyadic relationships to suit its business requirements. That has led to an enhanced performance. As noted by CARE’s group supply chain and planning head: “We never had a negative performance, so we are still in a positive situation in terms of turnover”:

P1. With a cost-efficient supply chain strategy, demand uncertainty and innovation uncertainty are negatively related to firm performance. The level of decision-making centralisation within the organisational structure has a moderating effect.

Decision making in TOOL is decentralised, and its management style promotes intense and prolonged discussions between different layers of management before a decision can be arrived at. TOOL has relatively few suppliers due to the material and technical criticality, and this means high supply uncertainty, a situation that has imposed some restrictions on its improvement projects. Furthermore, decentralisation has resulted in fragmented decision making, which is not conducive to performance improvement. As noted by TOOL’s vice president for supply chain management: “We are looking into improving our performance and we’re having a discussion right now on how can we lift and bring everything together […] Since we’re very much in silos, may be we haven’t looked at the overall picture. There might be unnecessary things that we are doing [and] things we should do […] In supply management, we started working very much in silos so we have experts […] They’re very good at planning or they’re good at purchasing”:

P2. With a blended cost-efficient/responsive supply chain strategy, supply uncertainty is negatively related to firm performance. The level of decision-making centralisation within the organisational structure has a moderating effect.

CARE has multiple cross-functional teams working together to manage the frequent launches of new products, as well as cost-cutting projects. The high levels of internal coordination have helped it improve its operational performance. As noted by CARE’s respondent: “In the first two years [of cross-functional improvement projects] we achieved a

<table>
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<tr>
<td>TOOL Blended:</td>
<td>Cost-efficient upstream, responsive downstream</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
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<tr>
<td>CARE Cost-efficient</td>
<td>Low-to-medium</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Misfit</td>
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Table IV.
Supply chain strategy and external uncertainty factors
good result because we decreased [by] more than one half the total amounts of the obsolete products”. Furthermore, internal integration has facilitated improved collaboration with its key suppliers, which has resulted in successful product launches and the retention of good relationships with suppliers at minimum cost:

P3. With a cost-efficient supply chain strategy, demand uncertainty and innovation uncertainty are negatively related to firm performance. The level of internal coordination within the organisational structure has a moderating effect.

TOOL’s brands compete against each other in the market due to the group’s frequent acquisitions, lack of internal coordination and the individual management of supply chains. There is little internal integration between the different brands. The group relies on recruiting professional experts who work independently, and this has resulted in departmental silos that has kept internal cooperation at a minimum. It has also decreased the group’s bargaining power during supplier negotiations. As noted by TOOL’s respondent: “This is a discussion that we’re having, this is a line organisation so this is the extended management team, we have the different processes […] and what we are discussing now is to form some kind of development management team. So this is our thinking to become more efficient”:

P4. With a blended cost-efficient/responsive supply chain strategy, supply uncertainty is negatively related to firm performance. The level of internal coordination within the organisational structure has a moderating effect.

Stemming from these propositions, this paper puts forward a supply chain fit framework, developed for future testing (depicted in Figure 5), wherein the organisational structure is hypothesised to have a moderating effect on the relationship between supply chain fit and firm performance. As such, this study theorises that firm performance is dependent on a joint interaction between supply chain fit and organisational structure. Testing this framework can help in identifying the different combinations of supply chain strategy, design and organisational structure that can result in improved firm performance.

6. Conclusion
Supply chain fit research has often had an outward look in investigating environmental uncertainties. The main contributions of this study are its extension of our conceptual understanding and its provision of an empirical explanation of the interaction between organisational structure and the relationship between supply chain fit and firm performance.
This research found that the levels of decision-making centralisation and internal coordination can offset the negative impacts of a potential misfit, which was evident particularly in CARE. The analyses presented here augment the body of the supply chain fit literature by exploring internal uncertainty factors, which were overlooked in Fisher’s (1997) model (cf. Gligor, 2017; Prajogo et al., 2018).

This paper contributes to supply chain fit theory and practice, first, by identifying decision-making centralisation and internal coordination mechanisms as the internal uncertainty factors that are the most relevant to supply chain fit research. This is because the authority of decision making in individual firms affects the success of the entire supply chain, especially if the firm is a strong buyer, which was very evident in this research. Moreover, the level of internal integration and coordination within the organisational structure can facilitate/impede information sharing and the deployment of resources amongst the supply chain members, and can affect an organisation’s position in negotiating with its supply base.

Second, this paper puts forward four propositions to investigate the combination of decision-making centralisation, internal coordination and supply, demand and innovation uncertainties on the one hand and firm performance on the other. These propositions can guide supply chain practitioners in recognising that variations in supply chain strategies alone do not necessarily lead to significant differences in performance. The focus instead needs to shift to the joint interaction between the combination of supply chain strategy, product/market-related uncertainties and organisational structure, which can lead to an improvement/deterioration in firm performance.

Third, this study puts forward a conceptual framework for supply chain fit, hypothesising that the organisational structure has a moderating effect on the relationship between supply chain fit and firm performance. The outlined framework contributes to the supply chain fit literature by identifying further environmental conditions in which a supply chain fit (or lack thereof) can be realised. This analysis can be most useful to supply chain researchers and managers in organisations that are experiencing internal uncertainties and are facing environmental changes related to a changing supply chain landscape or their internal structures.

The analyses of this study need to be interpreted with respect to their context, also bearing in mind that supply chains are designed to support products with different characteristics and maturity levels in the market, which influences supply chain strategies and structures. A second limitation is that this study provides a snapshot of supply chains that have been operating for years, a snapshot taken at a critical transformation moment of these corporate groups, when they had just undergone changes to their top management and to their strategies. This static perspective may be regarded as limiting the present findings’ transferability.

The findings support the initial assumption that businesses pay little attention to their internal environment in designing and strategising supply chains. A potential avenue for future research would be to collect quantitative performance data that allow the propositions and the conceptual framework to be tested empirically in order to reveal the possible supply chain fit combinations that lead to improved firm performance.

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<th>Authors/ year</th>
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<td>Fisher (1997)</td>
<td>Matching supply chain strategy and design to product characteristics</td>
<td>Demand uncertainty and product innovativeness</td>
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<td>Efficient and responsive</td>
<td>Conceptual SC</td>
<td>SC fit concept and strategic fit zone (match/mismatch 2x2 framework). Greater performance in 'match' quadrants</td>
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<td>Stock et al. (1998)</td>
<td>Various combinations of strategy, structure, and logistics choices will result in higher firm performance than other combinations of these constructs</td>
<td>Organisational structure (network organisation) and geographical dispersion level</td>
<td>Competitive priorities (flexibility, quality, responsiveness and cost)</td>
<td>Contingency Theory SSP (structure-strategy-performance)</td>
<td>Competitive priorities</td>
<td>Conceptual SC</td>
<td>A framework suggests that greater performance will result when there is a fit between environment, strategy, structure and logistics capabilities</td>
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<td>Stock et al. (2000)</td>
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<td>A high level of enterprise logistics integration alone does not improve performance</td>
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<tr>
<td>Defee and Stank (2005)</td>
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<td>Contingency Theory SSP (structure-strategy-performance)</td>
<td>Multiple</td>
<td>Conceptual SC</td>
<td>A firm's supply chain strategy needs to be aligned to the firm's internal structure and strategy</td>
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<td>Contingency theory</td>
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<td>SC</td>
<td>Most supply chains have blended strategies. There is no empirical evidence to support the notion of a purely market-responsive or physically efficient supply chain strategies. Supply chain strategies is not a simple “either-or” choice.</td>
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<td>Qi et al. (2011)</td>
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<td>Wagner et al. (2012)</td>
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<td>Efficiency is a precursor to responsiveness. Achieving a supply chain fit leads to improved operational performance. Supply chain agility mitigates the negative relationship between</td>
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<td>Hallavo (2015)</td>
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<td>Gligor (2017)</td>
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<td>Prajogo et al. (2018)</td>
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<td>Ambidexterity</td>
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<td>The ambidextrous environment (the ability to simultaneously explore opportunities and exploit competences) as enabler for achieving high supply chain flexibility fit (a measure of supply chain flexibility)</td>
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Agility and resource dependency in ramp-up process of humanitarian organizations

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Abstract

Purpose – The ramp-up in humanitarian logistics operations is a stage when the demand surges, often at the start of an emergency. In response, agility is a key strategy used by the humanitarian organizations (HOs). However, the HOs are constrained by their existing resources and have to respond in the ramp-up process under their resource dependency. The purpose of this paper is to develop a framework on agility-building strategies used by HOs for the ramp-up.

Design/methodology/approach – This study applies both the dynamic capabilities perspective and resource dependence theory to humanitarian relief operations, and develops four testable propositions to explore the agility-building strategies of the HOs for the ramp-up process. A multiple-case study is conducted on six international HOs operating in Indonesia to verify them, in addition to an extensive literature search.

Findings – The case study shows that the human resource management, pre-positioning, standardization and supplier management of the HOs are all related to their resources and environment in the ramp-up process. The authors highlight the practical differences between the few super large, resource rich and centralized HOs with the second-tier HOs.

Research limitations/implications – Given the small sample size and single country as the site of study, some findings may not be applicable to the other HOs or in other regions.

Practical implications – The propositions could be applicable to other HOs operating under similar environments, and potentially to the commercial enterprises operating in a highly volatile environment with severe resource scarcity.

Originality/value – This study provides new insights into ramp-up operations and into how HOs build their agility and reduce their resource dependencies. Theoretically, the paper applies two established theories in the strategic management literature to a new field.

Keywords Strategic management, Humanitarian logistics, Emergency preparedness, Agility strategy, Dynamic capabilities, Resource dependency, Ramp-up process

1. Introduction

For the past few decades the increasing impact and complexity of natural and manmade disasters have pressured humanitarian organizations (HOs) to improve the effectiveness and efficiency of their relief operations (IFRC, 2016). The pressure has reached the greatest in the ramp-up stage when there is a surge in demand for relief supplies and other resources.
such as manpower (Tomasini and Van Wassenhove, 2009). Such pressure has called for the use of appropriate strategies in the HOs to prepare ahead before the start of an emergency (Scholten et al., 2010). In response, many HOs have started to apply commercial supply chain management strategies and practices in their logistics operations for more effective preparation. One of these strategies is agility, the organizational ability to respond to external changes rapidly. It has been identified as a key to effective humanitarian logistics operations (Oloruntoba and Kovács, 2015).

Notwithstanding that the literature has a consensus on the importance of agility strategy in humanitarian relief operations (Scholten et al., 2010), there have been very few empirically validated studies of agility in humanitarian logistics (Oloruntoba and Kovács, 2015). And most of the scholarly works in the field are based on only a few super large global HOs such as the World Food Programme (WFP) and the International Federation of Red Cross and Red Crescent Societies (IFRC) (e.g. L’Hermitte et al., 2016). It has been proposed that the IFRC’s Emergency Response Unit (ERU) is an example of the best practices for improving the responsiveness of HOs (Jahre and Fabbe-Costes, 2015), but its methods may not be workable for a smaller second-tier HO with a decentralized structure and less funding.

There has been much interest in applying quantitative models to the field of humanitarian logistics in recent years (Van Wassenhove and Pedraza-Martinez, 2012; Gupta et al., 2016). Many sophisticated models have been developed on stock pre-positioning and facility location in the preparation stage (e.g. Rezaei-Malek et al., 2016; Manopiniwes and Irohara, 2017). However, those models may not be applicable for many of the second-tier HOs, as they typically are resource-light with limited funding (Oloruntoba and Kovács, 2015). Therefore, gaining an appreciation of how the different types of HOs build their agility internally and leverage external resources to respond effectively in the ramp-up process would definitely help to inform the body of knowledge and the community of practices.

Unlike the few centralized, super-large HOs linked to governments or multinational organizations (e.g. the UN), second-tier HOs are typically decentralized by region and country, with more development programs being conducted at the country level. Being resource-light without many dedicated resources for emergency operations, their budgets for pre-positioning and ramp-up operations are limited. To compensate for the shortage of tangible resources, these HOs have to rely more on their intangible capabilities, leveraging resources from within and outside of the organization in ramp-up operations. The dynamic capabilities perspective (DCP) is a powerful theoretical tool in strategic management (Teece and Pisano, 1994; Teece et al., 1997), which such HOs can apply to develop appropriate agility-building strategies in their ramp-up operations (Oloruntoba and Kovács, 2015). In addition to the DCP, resource dependence theory (RDT) can assess the fit between the HO agility-building strategies and existing resources, capabilities and constraints (Pfeffer and Salancik, 1978). Both the DCP and RDT were applied to the ramp-up process investigation in this study, and that led to four testable propositions. They were then validated in a field study in Indonesia involving total six HOs, one super-large and five second-tier ones.

Practically, this study extends the scope of the current HO agility literature. Several recent humanitarian logistics studies have sought to integrate the preparedness stage with emergency response for the most realistic solution (e.g. Manopiniwes and Irohara, 2017; Wang et al., 2018). Most such studies have remained on the operational level and their findings are more suitable for government agencies or for a few super-large HOs with loose resource constraints. This study, in contrast, has focused more on the strategic responses of second-tier HOs under various resource constraints. Its findings may therefore have greater applicability to the field of humanitarian operations. They provide some new insights into ramp-up operations and into how HOs build their agility and reduce their resource dependencies. The findings of this study can be applied to the other second-tier HOs operating under similar environments, and potentially to commercial enterprises operating in a highly volatile environment with severe resource scarcity.
Theoretically, the study offers a new theoretical perspective, combining the DCP with the RDT, to explore the ramp-up process of HOs strategically, an important process in humanitarian operations.

2. Literature review

In a typical emergency humanitarian relief operation, after a quick assessment of the goods and services needed, a new supply chain is created, configured and activated within a few days in response to the emergency (Thomas, 2003). Importantly, it is always too late to start the configuration of a new supply chain after a disaster has occurred (Tomasini and Van Wassenhove, 2009). To respond effectively, HOs must prepare their resources with a clearly defined response plan well before the onset of an emergency. In short, it must develop agility capabilities.

In commercial supply chain management, supply chain risk is a critical issue for chain members to manage, ranging from the problems of upstream suppliers (e.g. tier-two supplier failures) to that of the downstream customers (e.g. customer requirement modification) (Tang, 2006). Building an agile supply chain is therefore a key risk-mitigation strategy that allows firms to respond smoothly to changes in supply, demand or the general market environment (Lee, 2004). Agility thus covers operations, tactics and strategies, and requires a supportive culture to facilitate cooperation among various entities within and without the organization (Gligor and Holcomb, 2012).

In the context of humanitarian logistics with high demand uncertainty, agility is naturally a crucial aspect of emergency relief operations (Christopher et al., 2006; Oloruntoba and Kovács, 2015). This has been discussed in early studies such as that of Oloruntoba and Gray (2006). Later, Charles et al. (2010) developed a framework for identifying elements of agility as well as the corresponding capabilities to measure the agility of a humanitarian supply chain. However, most of the capabilities reside at the operational level such as volume flexibility and velocity without strategic considerations. Empirically, Scholten et al. (2010) reported on agility among HOs, but again considering mainly on the operational level, though mentioning some strategic issues such as process and network integration.

On the operational level, a common approach to improving agility is pre-positioning. In other words, locally procured relief items are stockpiled in areas vulnerable to natural disasters before an emergency occurs. Early studies like Beamon and Kotleba (2006) developed an inventory management model to improve the responsiveness of HOs to the exogenous demand uncertainty. Balcik and Beamon (2008) then proposed a model incorporating both inventory and facility location decisions for disaster relief. Campbell and Jones (2011) further examined the facility location problem for pre-positioning supplies as well as the inventory level when some locations were vulnerable to disasters. To mitigate such supply risks, dual sourcing has been proposed, and Iakovou et al. (2014) conducted a simulation for slow-onset disruptions in humanitarian operations and shown its effectiveness.

In addition to preparing beforehand, scholars have discussed approaches such as ordering emergency supplies and hiring additional staff for relief operations. Chakravarty (2011) developed a model which integrates both preparation and responses considering two types of uncertainty, disaster intensity and on-site relief needs. While the intensity is known after a disaster strikes, the needs for relief supplies usually remain uncertain for a few more days due to disruptions in the information flow.

Moving from the operational to the strategic level, L’Hermitte et al. (2015) proposed an integrated approach to studying agility in humanitarian logistics by applying the DCP. That framework covers four strategic level agility capabilities: purposeful, action focused, collaborative and learning oriented. The proposed framework has been empirically examined in a single case study involving the WFP (L’Hermitte et al., 2016) and then in a
survey of humanitarian workers (L’Hermitte et al., 2017). They showed the effectiveness of the framework in analyzing agility on a strategic level, but so far no published study has systematically explored the agility capabilities building of HOs to prepare for the ramp-up process when a disaster strikes and the demand surges.

Prior scholarly work has tended to focus on the preparation practices of a few super-large HOs. For example, Jahre and Fabbe-Costes (2015) studied the IFRC’s responsiveness, and both Cozzolino (2012) and L’Hermitte worked with the WFP. Considering HOs under different levels of resource dependency, this study explored the ramp-up process mainly among second-tier HOs. It applied both the DCP and RDT in an attempt to investigate how the strategic and supply network levels of an organization interact to build agility capabilities and how these agility capabilities lead to agile responses in ramp-up operations.

The DCP is a core perspective in the resource-based view of organizations, a management theory which seeks to explain the source of firm competitive advantage (Wernerfelt, 1984; Barney, 1991). The theory proposes that for sustainable competitive advantage a firm should develop firm-specific resources which are difficult for competitors to imitate or substitute. Dynamic capabilities tend to fit that description, being described as “…the ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments” (Teece et al., 1997, p. 516). The DCP provides a structure to explain the source of competitive advantage by integrating resources on various levels and by considering their redeployment, reconfiguration and recombination as the environment changes. Operationally, the DCP has proposed three key types of capabilities: transformation, integration and learning.

Shifting from the internal to the external aspects of an organization, the RDT proposes that organizations are constrained by their environment and they attempt to manage their resource dependencies through various inter-organizational arrangements such as alliances and joint ventures (Pfeffer and Salancik, 1978). Complementing the DCP, the RDT shows how organizations actively manage their relationships with external entities to reduce their vulnerability and boost their autonomy, legitimacy and performance (Drees and Heugens, 2013). In the context of humanitarian operations, the HOs are often constrained by a lack of funds. They generally respond with three possible strategies: adaptation, shaping and avoidance (Mitchell, 2014). Adaptation involves strategies such as alignment and subcontracting when the HOs are the weaker party. Shaping includes donor education and compromise as HOs bargain with their donors. Avoidance refers to approaches like funding source diversification, funding liberation and specialization, which lessen vulnerability of HOs to external control.

3. Theoretical framework and propositions

Returning to the DCP and its three types of capabilities, transformation refers to the transformation of a firm’s structure with the necessary internal and external reconfiguration when the environment experiences a great change. Integration refers to the managerial ability to integrate an organization’s internal and external activities (Teece et al., 1997). In the context of emergency relief operations by an HO, transformation will be of utmost importance when an HO has to quickly mobilize all its resources during the ramp-up process. This mobilization requires significant transformation of existing resources as adding new resources in such a short period is virtually impossible. Next to transformation, integration would also be important as the HO has to engage its partners for emergency operations. To make the transformation and integration of the HO effective, both agility enablers within the organization and the agility capabilities linked with the external environment are needed (L’Hermitte et al., 2015). Three agility enablers, people, processes and technology, as well as the collaborative capability, the only proposed capability that relates to the external organizations, are then discussed to develop the propositions.
3.1 People as agility enabler

For an HO, people as an agility enabler have to include both internal and external manpower. An agile workforce should be experienced, multi-skilled, adaptable, team oriented, able to handle uncertainty and stress and proactive in dealing with threats and opportunities (Sherehiy et al., 2007). In the context of humanitarian logistics, manpower is a critical resource but often in shortage due to funding constraints (Kovács and Spens, 2009). Among the three possible responses suggested by the RDT (Mitchell, 2014), adaptation and shaping would be more feasible for HOs due to their dependency on international donors. They would have to use either an adaptation or shaping approach to build both internal and external manpower agility. The former refers to the equipping of the current staff to multi-task, and the latter refers to the developing a pool of potential staff capable of quick recruitment and integration into emergency operations.

In the context of humanitarian operations, building internal manpower agility often means fitting the staff for both routine development or admin tasks and emergency relief operations. Practically, its implementation varies with the organization’s structure and resources. The few super-large HOs with sufficient funding tend to have centralized structures with trained staff working at the headquarters but on standby for emergency field work. Their approach to funding dependency would be more of shaping – educating their donors about their work and promoting it as exemplifying best practices. In contrast, the second-tier HOs who are short of funds for emergency preparations have to choose adaptation in response to their resource dependency. It would be more practical for them to train staff supported by other programs to be equipped for emergency operations. Regardless of the approaches to counter resource dependency, the key to internal manpower agility is transformation capability.

Building external manpower agility is also important. In humanitarian operations, external manpower can be either volunteers (sometimes from overseas) or local short-term contract workers. Indeed, an HO needs to deploy another set of strategies to integrate its external manpower so that it works smoothly with the permanent staff during an emergency:

P1. An HO would transform its existing staff and integrate external manpower for effective ramp-up in response to an emergency, using either adaptation or shaping approach to reduce its resource dependency.

3.2 Process as agility enabler

Process as an agility enabler is defined as the way that an organization establishes structures and systems to achieve its objective (Sherehiy et al., 2007). In the context of humanitarian operations, it refers to the flexibility of internal processes to meet emergency needs rapidly. Due to the high degree of uncertainty surrounding the emergency needs before a disaster strikes, HOs need to make various preparations. Pre-positioning supplies can be very important (e.g. Balcik and Beamon, 2008; Campbell and Jones, 2011), but practical constraints such as inadequate funding limit their scope for pre-positioning. Resources usually flow in large quantity only after the onset of a disaster (Kovács and Spens, 2009). A few super-large HOs with strong institutional support may be able to take the avoidance approach by pre-positioning significant amounts of key supplies. In contrast, most second-tier HOs have to take the adaptation approach to overcome their funding constraints:

P2. An HO would transform its available funds for effective ramp-up, using either adaptation or avoidance approach to reduce its resource dependency.

3.3 Technology as agility enabler

Technology can be broadly defined as the “science of craft” that includes “principles, processes, and nomenclatures” involving the “applications of science” (Bigelow, 1829). In the
context of humanitarian operations, normal technology enablers like information technology tend to be inapplicable due to a country’s low development status as well as the damage caused by a disaster (Kovács and Spens, 2009). Standardization may, however, be a useful strategy (Holweg, 2005). There have been strong calls in the literature for greater standardization across all the emergency responses activities (e.g. Beamon and Kotleba, 2006; Kovács and Spens, 2011). The DCP suggests that standardization facilitates integration among units within and without an organization. But it is constrained by an HO’s structure and resources, so HOs pursuing standardization may have to overcome both internal and external resistance to improve integration within and without. Here the resource dependency to be managed can be both internal and external. HOs with a more centralized structure and more centralized resources would be more integrated internally, and are expected to pursue this enabler more globally, similar to their approach of shaping in response to funding constraints. On the other hand, second-tier HOs with a more decentralized structure would be less likely to pursue standardization globally. They may instead implement some forms of standardization at the local level (by country or region), both internally and externally with their partners to facilitate integration in the ramp-up process:

P3. An HO with a more centralized structure would pursue standardization more globally for operational integration in the ramp-up process, while an HO with more decentralized structure would pursue standardization more locally.

3.4 Collaborative capability for agility

L’Hermitte et al. (2015) proposed four capability builders for organizations – being purposeful, action focused, collaborative and learning oriented. Among the four, collaborative capability relates specifically to external relationships. The role of collaboration in emergency preparedness is an important but less-explored topic (Balcik et al., 2010). It seems intuitive, therefore, that vertical collaboration of an HO with its suppliers could improve the HO’s agility.

From the RDT perspective, the few super-large HOs with ample funds would take the avoidance approach when dealing with suppliers to avoid supplier dependency. They pre-position by themselves. However, HOs that cannot order sufficient supplies beforehand must collaborate with commercial partners during the preparedness phase to lower their pre-positioning costs. In RDT terms, this can be seen as a type of shaping. They do not have the funds to make binding pre-disaster commitments for supply purchases, but they may instead sign loose framework agreements without definite order dates and amounts. The commercial suppliers may be willing to accept this arrangement and bear the cost of storage for an HO if it promises to be a big customer when disaster strikes. According to RDT, the framework agreement can be seen as a form of inter-organizational arrangement which benefits both parties and reduces their resource dependency (Drees and Heugens, 2013).

Such framework agreements can be considered as a loose form of collaboration between a pure market transaction and a formal partnership. HOs often spend much time negotiating with their key suppliers and signing such framework agreements which fix the prices or set price ranges but neither the order quantities nor the order time. Due to inflation and other uncertainties, they are normally time limited, often lasting only 6 or 12 months. Such agreements expedite procurement in the emergency response phase and provide some quantity assurance, but consume time and effort, and may dampen suppliers’ interest if no large-scale emergency happens during the period of the agreement. In essence, it is the transformation of the HO’s effort and power during the preparation phase for better-integrated emergency operations later:

P4. An HO with greater demand for emergency operations would use either avoidance or shaping approach when dealing with its key suppliers for more effective integration in the ramp-up process and reducing its resource dependency.
4. Research methodology

A case study is conducted on the agility-building strategies of HOs as it is one of the most powerful tools for qualitative research (Voss et al., 2002). Following the guidelines of Gammelgaard (2017) and Vega (2018), the first question asked is “why,” the purpose of the case study. As the topic of study is to explore the agility-building strategies of HOs where the current literature is scant, especially for second-tier HOs, a qualitative approach with the participation of multiple HOs to solicit an in-depth understanding of the ramp-up process and related agility-building strategies is justified.

The second question is “what” (Vega, 2018), i.e. identifying the study focus. While it is ideal to observe a real ramp-up process in an emergency and present the narrative events by time, but in reality that is almost impossible. Those involved have neither time nor energy to devote to research at such times. The second best is to obtain a snapshot of the strategies used by the HOs during the preparation stage for future ramp-ups. For a suitable unit of analysis, the study had to focus on one country to limit the time spent in the field. This country should provide ample evidence of natural disasters occurring on a regular basis, coupled with the presence of numerous HOs (including both super-large and second-tier ones).

Indonesia, the largest nation in Southeast Asia with over 260m people, is then chosen. It is a country which suffers natural disasters such as tsunamis, earthquakes, flash floods and volcanic eruptions relatively frequently. As a result, many HOs are active there with extensive relief and development programs in the field. The HOs operating in Indonesia were then the unit of this study. In addition, Indonesia is a democracy with a vibrant private sector. Most international HOs operating in Indonesia focus on development rather than on emergency relief, but many jump into emergency operations for a short period after a large-scale disaster. Their operations in Indonesia are thus quite different from the activities of HOs in some war-torn or famine-stricken countries where emergency relief is routine. The ramp-up and the agility-building strategies are thus more important.

For the third question, “how practically” (Vega, 2018), limited knowledge and access to the HOs forced us to use convenience sampling in this explorative study (Miles and Huberman, 1994). The research team was already working closely with one of the HOs (designated as Organization D), which had just started on a standardization process to streamline its policies and procedures internally, and had close contact with Organizations B and E. There was also a personal relationship with a senior manager of Organization A. So those four HOs were core participants of this case study. The researchers then used those contacts to meet the organizations’ logistics specialists.

Snowball sampling was also applied to expand the study’s coverage (Heckathorn, 2011). The initial contacts were asked to recommend others they knew. A total of eight international HOs were thus identified, but two of them were unable to participate as the relevant staff were called away for an emergency during the period of the field study (an example of the uncertainty in the humanitarian world). Among the six participating HOs, Organizations C and F are the new contacts introduced by Organization D. Their Jakarta offices are located in the same neighborhood as Organization D, making the face-to-face interviews easier to conduct.

Data collection relied mainly on semi-structured interviews with professionals with longstanding on-the-ground experience in emergency response. While recognizing the attendance challenges in securing the precious time of the professionals and the sensitivity of the information, this approach would render the respondents the freedom to share their experiences and opinions but, at the same time, provided the focus and scope for the discussion. Each interview lasted between 45 and 60 minutes, conducted in the Jakarta offices of participated HOs in English with recording, which were later transcribed into scripts by one of the authors to ensure that there were no errors in the transcribing.

Organization A is a UN-related global HO with a centralized structure for global relief operations, and can be classified as super large. The recent annual income of the other five
HOS ranged widely, from $230m to $2.2bn. All operate in many developing countries. However, they operate with a decentralized structure, and their Indonesian branches have only limited on-going funding for emergency response. They can all thus be categorized into second tier. Organization D is similar to Organization A in terms of global revenue, but its decentralized structures made it, or at least its Indonesian branch during the period of the study, organizationally closer to second-tier organizations. All of the interviewees were senior logistics staff holding titles such as director, senior officer or manager, and with many years of field experience in Asia. Table I shows the profiles of the participating HOs.

Of the six HOs, Organization A specializes in relief operations, while Organization C is at the other extreme with almost no first-hand participation in emergency operations. Organizations B, D, E and F are somewhat in-between, with both development and emergency operations. Each has a different degree of autonomy for its operations in Indonesia. The sample thus provided some variety for the proposition validation.

For the last question “how conceptually” in Vega (2018), the field work began with no clear theoretical framework. At that time, the intention was to build grounded theory through the field work, but that was not very successful. So instead L’Hermitte et al.’s (2015) work was combined with the RDT to build a proper theoretical framework. In fact, the framework was developed only after the field work had been completed, so it was necessary to collect some material from the academic and trade literature to supplement the data in empirical testing of the propositions.

Content analysis was then used to analyze the interview scripts. It has been considered as a systematic approach to address both the primary and secondary qualitative data as well as the literature reviews (Krippendorff, 2004; Vaillancourt, 2016). Content analysis can be structured into four steps: material collection, descriptive analysis, developing analytical categories and conducting a material evaluation (Seuring and Gold, 2012). As the main target material is the interview scripts, the materials selected and initially analyzed are naturally the six interview transcripts from the primary source as the target documents. In addition, secondary information from the HOs and from their archives was also analyzed, as well as the relevant literature.

The analytical categories were based on keywords in the propositions to be tested. The categories eventually used were “internal manpower,” “multi-capability” (for P1), “pre-positioning,” “resources from other programs” (for P2), “standardization” (for P3), “framework agreement” and “supplier coordination” (for P4).

Finally, the material evaluation evaluated the actual use of the proposed agility-building strategies in the six HOs interviewed.

5. Results
Table II shows the results of content analysis on the use of the keywords in each HO. Issues on manpower, supply, standardization and collaboration were investigated in detail.

5.1 Manpower preparation
P1 suggests that the HOs would use either shaping or adaptation approach to reduce the funding dependency for manpower preparation. Shaping is more suitable for a few super-large

<table>
<thead>
<tr>
<th>Organization</th>
<th>Interviewee designation</th>
<th>Type</th>
<th>Revenue (2017)</th>
<th>Headquarters location</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Logistics manager</td>
<td>UN-affiliated</td>
<td>$6.4bn</td>
<td>Italy</td>
</tr>
<tr>
<td>B</td>
<td>Director</td>
<td>Religious NGO</td>
<td>$1.0bn</td>
<td>USA</td>
</tr>
<tr>
<td>C</td>
<td>Country manager</td>
<td>Religious NGO</td>
<td>$230m</td>
<td>USA</td>
</tr>
<tr>
<td>D</td>
<td>Logistics manager</td>
<td>Secular NGO</td>
<td>$2.2bn</td>
<td>UK</td>
</tr>
<tr>
<td>E</td>
<td>Logistics specialist</td>
<td>Secular NGO</td>
<td>$650m</td>
<td>UK</td>
</tr>
<tr>
<td>F</td>
<td>Senior officer</td>
<td>Secular NGO</td>
<td>$1.0bn</td>
<td>UK</td>
</tr>
</tbody>
</table>

Table I. Profiles of the responding organizations

852
<table>
<thead>
<tr>
<th>Keyword</th>
<th>Internal manpower</th>
<th>Multi-capability</th>
<th>Pre-positioning</th>
<th>Resources from other programs</th>
<th>Standardization</th>
<th>Framework agreement</th>
<th>Supplier coordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Send staff from other fields</td>
<td>na</td>
<td>Huge</td>
<td>na</td>
<td>na</td>
<td>Internal for logistics efficiency and reporting</td>
<td>More for development projects</td>
</tr>
<tr>
<td>B</td>
<td>Form a specific team (NDMT)</td>
<td>Both emergency/project or admin</td>
<td>Five warehouses in the country</td>
<td>20% buffer from developed funds</td>
<td>na</td>
<td>Signed long-term agreements (LTA) with commercial sector Agreement with several tenderers</td>
<td>Do mostly procurement on spot</td>
</tr>
<tr>
<td>C</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>D</td>
<td>From a specific team (ERT)</td>
<td>Both emergency/project</td>
<td>na</td>
<td>From program/regional budget</td>
<td>na</td>
<td>Very few framework agreements</td>
<td>Limited due to donor constraints Limited to very few suppliers</td>
</tr>
<tr>
<td>E</td>
<td>From a specific team (ERT)</td>
<td>Both emergency/project</td>
<td>Warehouses to pre-stock, up to 5,000 families' needs</td>
<td>Contingency funding from annual budget</td>
<td>Training of local partners</td>
<td>6-month agreement to fix price</td>
<td>Limited to a few suppliers and service providers</td>
</tr>
<tr>
<td>F</td>
<td>From a specific team (ERT)</td>
<td>Both emergency/project</td>
<td>Start to pre-position with new funds</td>
<td>Some from regional office</td>
<td>Training for both staff and local partners</td>
<td>Some agreements in the past, but none currently</td>
<td>Supplier database and some stocks managed by partners</td>
</tr>
</tbody>
</table>

Table II. Content analysis results

Agility and resource dependency

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analysis results
HOs with more resources. The ERUs of the IFRC and the WFP’s Augmented Logistics Intervention Team for Emergencies are examples in this category. Their approach to their resource dependency is mainly shaping donors’ expectations by educating them about their practices and this has led to much publicity of these practices (e.g. Cozzolino, 2012; Jahre and Fabbe-Costes, 2015). Organization A, which is in this group, mentioned that it normally sends staff from other regions for emergency operations. The manager of Organization A explained:

To reduce the high staff turnover and keep an experienced team, we often assign staff to the other regions since we have many theatres of operation.

This approach works because Organization A operates under a centralized system with the same processes globally. However, it may not be feasible for an HO with a decentralized structure.

In contrast, many of the second-tier HOs have to choose an adaptation approach for funding dependency through internal adjustment. One possible solution for them is to use funding for development programs if they have both relief and development programs. The funding for development programs is then used to support staff who are also capable of relief operations. Once an emergency operation begins, they can quickly be assigned to their new positions and roles in the ramp-up process for the emergency. The potential staff for the emergency operation are normally deployed in the same country or region supported by development programs.

That solution was validated in the interviews. Organizations B, D, E and F all use their current resources to meet the manpower crunch during an emergency operation. For example, Organization B uses a specialized team to do the initial assessment, who works on projects or administrative work in normal times:

On manpower needs, we have a National Disaster Management Team (NDMT) with around 40 members in Indonesia. Most of them are based on projects and others are here doing admin work in normal times. If a disaster happens, they would be sent to the area for assessment within two days. Some NDMT members would take the logistics responsibilities and make decisions such as demand estimation.

Organizations D, E and F have similar practices. The manager of Organization D said:

On the human resources for an emergency, we have a specialized team, called the Emergency Response Team (ERT). In normal times, they are assigned to other jobs but they are all trained for emergency operations. We would send some ERT members to the locations for assessment. They will link up with the beneficiaries, and make decisions in the field such as ordering more supplies and engaging the truck companies if needed.

There is a similar practice in Organization E, as the specialist explained:

On manpower, we have an emergency response team (ERT), whose members are based on programs but have been trained for emergencies. They would do the initial assessment and connect with our networks in the field. Each team would stay in the field for a certain period.

To make the approach workable, the HOs have to develop systematic training programs to equip their staff for such multiple tasks as they may be assigned to emergency posts in the future. Personal diversification or developing ambidextrous capabilities rather than specialization becomes their key human resource development policy.

In addition to internal manpower agility, external manpower agility is also important. The manager of Organization D touched on this issue during the interview:

Our HR department has a network of potential workers. It is part of their talent management. When a disaster strikes, HR would identify our formal staff with experience in the area and call them for help. After the end of the operation, they would leave again. We have a talent database on formal workers, and can assign them quickly for suitable positions. During an emergency response, HR has a huge job to recruit many people in a short period.
Organization D provided more details on building the external manpower agility. To improve its capability of integration, it focuses on former staff who are knowledgeable about its procedures and processes under funding constraints. However, the other managers interviewed did not talk much about external manpower agility building, so the study was not able to formulate a clear picture about its relationship with funding dependency from the case study. Some further in-depth study of this issue is warranted.

5.2 Supply preparation

P2 suggests that an HO would use either avoidance or adaptation approach to reduce the funding dependency in supply preparation. Avoidance is more suitable for a few super-large HOs with strong institutional support. Organization A, supported by the UN, uses this approach by significant pre-positioning as its manager explained:

We have sufficient pre-positioning emergency stock around the world. Funding is an important constraint for us and we have to plan ahead. As it may take three months for us to complete the processing of a dedicated donation and use the funds, we have to allocate sufficient working capital for our supplies in the first three months after the onset of a disaster.

Organization A chooses to pre-position supplies equivalent to three months’ needs for its global operation, showing an avoidance approach to reduce its dependency on the arrival of new emergency funds.

However, the rest second-tier HOs interviewed consider investing a lot of working capital in supply pre-positioning to be infeasible. They instead use adaptation approach by adjusting their internal rules to facilitate the fund usage within the organization. One possible solution is to leverage on the resources of on-going programs, most of which are development programs with more stable long-term funding. The HOs typically allocate a certain percentage of their regular development program funds as a buffer for potential emergency expenses and mobilize them for the ramp-up process as and when needed.

Table II shows that Organizations B, D, E and F all do this, and that B and D even use development funds directly. The specialist of Organization E explained its funding source for emergency operations:

Regarding the ramp-up process, the first issue is the availability of funds. Our organization and peer HOs such as [B and D] that are focusing on child-related programs have contingency funding, where a part of the annual budget is allocated for emergency responses. We have operations in 14 countries in Asia, and nine of them, including Indonesia, are considered as high-risk. Both the country office and its eight field offices have a certain amount of emergency funds.

Organization D has a similar funding policy according to the manager:

Our emergency funding is from both the country finance budget and the program budget.

Organization B’s director provided more explanation of its source of funding:

On the funding sources, once an emergency happens, we can use the National Emergency and Preparedness Fund to purchase additional non-food items. Currently, the fund is only around US$1,500, quite limited. But it can be used right away. In addition, we have a buffer of 20% of the annual development project budget. Each project can use a part of its budget for emergency spending. But the one restriction is that it can only be used for emergencies in the project area.

While the donors may provide specific donations for emergency relief operations, it is important for HOs to have ready funds for an emergency. Having some general fund or access to funds from the development programs greatly improves their agility, as is shown in Organizations B, D, E and F.

Moreover, the five second-tier HOs studied differ in the amounts they pre-position. Organization B only keeps one week of stock. Organization E has up to 5,000 family kits,
equivalent to two weeks of need. Organization F is a bit different from the rest, as it maintained some stock from previous emergency operations and at the time of the interviews had just started to pre-position new supplies without a clear policy about the amount. The remaining two HO s (C and D) pre-position no goods at all. These differences can be explained by the resources that they possess.

For the HO s like B and E, they expect only a short time lag between the onset of a disaster and the arrival of the emergency supplies as they can use internal funds for the procurement. The director of Organization B explained:

Currently, we have five warehouses in different locations of Indonesia for pre-positioning and emergency. We store family kits, children kits, education kits, etc. The stock should cover one week’s supply during an emergency. For example, we have 2,500 units of family packages as well as under-five children packages. After getting funding from other sources, we would deliver more to beneficiaries. It is difficult for us to store too much due to the cost of the goods as well as warehousing costs.

Another factor affecting the pre-positioning amount has also been uncovered in this study – expected emergency needs. Organizations C, D and F have almost no pre-positioned goods due to the low logistics needs in their emergency operations, referred in this sector as “light mode,” as many supplies can be procured locally after the onset of a disaster. The country context plays an important role as the vibrant private sector in Indonesia reduces the pre-positioning needs of the HOs there.

5.3 Standardization

P3 suggests that an HO with a centralized structure would be more likely to use standardization globally to improve the level of integration in the ramp-up process. Among the six organizations studied, only Organization A had such a centralized structure. This approach is then expected to be used more by Organization A globally. It is confirmed as its manager mentioned this issue in discussing the reporting of non-government organizations (NGOs) to donors:

One solution for the NGOs to deal with too many donor requests would be standardization. But the NGOs are very slow to adopt. We are the one pioneer in this aspect.

Supplementing the interviews, there are several published works reported the approach of standardization in a few super-large HO s like the WFP and the IFRC (Cozzolino, 2012; Jahre and Fabbe-Costes, 2015). For example, in Jahre and Fabbe-Costes’s (2015) study on the IFRC, the ERUs are developed as a tool that works well with high-consistent technical standards and fast deployments. In practice, however, such an approach faces various challenges even for the IFRC in fitting with local and national contexts.

In smaller second-tier HO s with a decentralized structure, P3 suggests that standardization would be implemented more locally. Indeed, Organizations E and F had conducted regular training programs for their internal staff as well as external NGO partners. The specialist of Organization E explained:

We have identified some local NGOs in high-risk areas as potential partners for emergency operations. Before the disaster, we have training and workshops for them. They have to be educated about our value and policies and so we can work smoothly during the emergency. We regularly conduct programs such as Disaster Reduction Programs at local level with local NGOs and community organizations. They are both training and socialization sessions. We do not want to spend time on such things during the emergency while they can be done at the preparation stage.

In addition to general capability building, one important purpose of such programs is to facilitate integration during emergency operations. It can therefore be seen as a way
of standardization in a broad sense. Organization F conducted similar programs as its officer said:

We also have some staff training, as well as training for local NGO partners. Recently, we had an intern program to train one person from our partner for one month in Jakarta for various logistics operations. We may need more systematic programs to train our partners effectively. The problem of training local partners is their high turnover rate. If the staff finds a better job, he will leave and we have to train another person. I often need to work with different persons from the same local NGO due to the staff turnover.

Here one problem of training local partners is the high staff turnover rate in local NGOs. Moreover, the training itself may increase the probability of staff leaving due to better knowledge and networking, and have a negative impact on the integration instead. So HOs have chosen an appropriated level of training and integration with their local partners for maximum benefits.

5.4 Collaboration with suppliers

P4 suggests that an HO with greater demand for emergency operations would use either avoidance or shaping approach to reduce its resource dependency on suppliers. Avoidance would seem to be most feasible for a super-large HO like Organization A, but it is interesting to note that Organization A still sometimes prefers shaping. In addition to significant pre-positioning to reduce supplier dependency (avoidance), Organization A has signed long-term agreements with some key suppliers:

As we regularly engage in emergency relief, we have many long-term agreements (LTA) with the private sector. For example, the UN signed an LTA with Garuda for flight services in Indonesia. It applies to all UN agencies, including us.

Here, the example the manager gave is of a logistics service provider, a service which the organization cannot pre-stock. So even a super-large HO must sometimes use shaping rather than avoidance with some critical suppliers.

For the second-tier HOs, shaping approach would be their main strategy, although it would depend on the expected volume of demand. Among the remaining five HOs, Organizations B and E had signed long-term agreements with more of their suppliers because they expected higher demands for emergency operations. The specialist of Organization E provided more details:

To speed up the ordering process in an emergency, we have a pre-bid process in normal times. We invite all suppliers to our office and explain to these commercial people what kinds of emergency response we are doing after the onset of a natural disaster. We explain to them why we cannot fix the quantity of our order, and sign pre-agreed contracts with them. The contracts would fix the price but not the order quantity. The trade-off for the demand flexibility is the short duration of the agreements. The suppliers are only willing to fix the price for six months, and the extension of these agreements would depend on the market conditions then.

Organization B took a slightly different approach to such agreements to extend their validity. Its director observed that:

We have agreements with several tenderers. They promise us additional supplies if we need, and set the prices within a certain range. We are not able to fix the prices due to inflation. We would renew these agreements yearly to reflect the price fluctuation.

In contrast, the problems in signing such framework agreements were explained by the officer of Organization F:

On the framework agreements, we try to approach the big companies whose prices are better than the retailers, but they normally set a minimum purchase quantity at a certain price. This year so far has been a quiet year without the large emergencies, and we are still clearing our
leftover stock from the previous years. So, what is the point of signing the agreement if we are not buying? So far, we haven’t signed many. However, one large producer of sarongs, the traditional Indonesian clothing, has a good relationship with us, and we can order as many as we want. We also have a large supplier for the hygiene kits in Surabaya, East Java. We sometimes ask them to stock a certain amount for us for a certain period. We had a good relationship with them previously from 2005 to 2010. We then had purchased a lot from them and we were viewed as a large customer. But recently, we seldom purchased from them and they are not interested in signing the agreement with us.

The manager of Organization D expressed a similar opinion:

We are going to sign framework agreements with several big vendors this year. The agreements would include the specification of the goods we are going to buy as well as the price, but we are not committed to buying. It really depends on our needs, and we can just give a call to buy. However, the recent fuel price hike in Indonesia made it difficult for us to finalize the prices at this moment.

Organization C, being the smallest with almost no emergency operations, can only make verbal and non-binding agreements with the suppliers, as it cannot commit much. The HOs with more emergency demands would be more motivated to sign long-term agreements, and those agreements can be seen as investing time and effort in normal times for a faster response in the aftermath of an emergency. The HOs thus have to identify a number of critical items which they will need in sufficient volume in order to make the effort of negotiating framework agreements worthwhile.

6. Conclusions and implications

This study applied both the DCP and RDT to explore the ramp-up process as HOs shift from their normal daily operations to emergency relief responses. It developed four testable propositions suggesting how the HOs employ various agility-building strategies to transform and integrate both internally and externally for an effective ramp-up under various resource constraints. The multi-case study in Indonesia has shown that a super-large HO may prefer to use avoidance approach – pre-positioning a significant amount of supplies to reduce funding and supplier dependency. Most of the second-tier HOs, however, may mainly choose an adaptation approach. Typically they use their country-level development program funds to meet their temporary emergency needs. They also train their staff to be ambidextrous enough for emergency operations through internal manpower agility. They may also use shaping approach to manage their dependency on key suppliers by signing procurement framework agreements to speed up ramp-up operations.

These findings are applicable to HOs beyond Indonesia, particularly second-tier HOs running both emergency and development programs in countries with a vibrant private sector. Instead of focusing on their development programs per se, they could and should plan well ahead to prepare for potential emergency needs, especially in countries where natural disasters are frequent. They should train their own staff with the knowledge and skills needed in emergency response. Knowledge of the HO policies and procedures for relief operations, and skills such as demand estimation after a disaster should be developed in advance. Rather than to focus on specialization, agility – ambidexterity in both the relief and development operations – should be the goal of human resource development in such second-tier HOs. Besides limited pre-positioning of relief goods, HOs could leverage on their commercial partners to keep inventory to increase their pre-positioning capacity and reduce their warehousing costs by signing framework agreements.

This in-depth case-based investigation of agility strategy in humanitarian logistics is theoretically novel in that it applied both the DCP and RDT. Doing so links strategic
management literature with the actual humanitarian logistics practices in an Asian context, closing the gap between theory and practice. Further empirical study of the topic in other geopolitical and cultural contexts with other HOs may improve our understanding of the agility-building strategy in ramp-up operations, further bridging the gap between theory and practice.

As for the research limitations of this study, it is recognized that securing interviews for sensitive information on the procurement and funding practices of the HOs is a challenge and can render data triangulation unworkable. Larger-scale research would certainly be desirable, but deploying large-scale case study or survey for an active humanitarian theater of operations in this part of the world is probably an unrealistic goal.

Scholars might, however, explore other aspects of agility-building strategy and resource dependency approaches in HOs. The management of external manpower strategy was not fully explored here, and how technological solutions in addition to standardization might help to build agility in the ramp-up is another potentially fruitful topic.

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Further reading


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Omnichannel fulfillment strategies: defining the concept and building an agenda for future inquiry

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Abstract
Purpose – Since the emergence of e-commerce uprooted traditional brick-and-mortar retail in the early 2000s, many retailers have reacted by first independently servicing both the online and in-store channels (multichannel retailing) and subsequently integrating both channels to provide a seamless front-end customer interface (omnichannel retailing). Accordingly, firms had to adjust their logistics and supply chain management (SCM) processes from fulfilling orders for each channel separately to integrating channels on the back-end (omnichannel fulfillment). This development is mirrored by an emerging stream of academic publications. The purpose of this paper is to provide a snapshot of the current state of omnichannel fulfillment research via a systematic literature review (SLR) in order to identify omnichannel fulfillment strategies and to establish an agenda for future inquiry.

Design/methodology/approach – This SLR is based on 104 papers published in peer-reviewed journals through December 2018. It employs a six-step process, from research question to the presentation of the insights. Findings – All selected manuscripts are categorized based on demographics such as publication date, outlet, methodology, etc. Analysis of the manuscripts suggests that the integration of fulfillment channel inventory and resources is becoming an important objective of fulfillment management. Appropriate omnichannel strategies based on retailer attributes are not well understood. Industry specific research has been conducted necessitating generalized extension for retailers. These findings provide a clear opportunity for the academic community to take more of the lead in terms of knowledge creation by proposing paths for industry pursuit of channel integration to successfully implement omnichannel fulfillment. Opportunities for future inquiry are highlighted.

Originality/value – This manuscript proposes a definition of omnichannel fulfillment strategies and identifies fulfillment links that are used interchangeably across channels as the key delimiter between omnichannel fulfillment strategies and related concepts. Six omnichannel fulfillment strategies from the extant literature are identified and conceptualized. Future research opportunities around omnichannel fulfillment, potential interdependencies between the established strategies and their impact on related SCM issues such as distribution and reverse logistics are detailed.

Keywords North America, Literature review, Omnichannel, Retail logistics, Supply chain processes

Paper type Literature review

1. Introduction
Over the past two decades retailing has undergone dramatic and accelerating change, largely due to the advent of the direct-to-consumer online channel and an ongoing surge in information technology capabilities (Gallino and Moreno, 2014; Piotrowicz and Cuthbertson,
Sales for the online channel continue to grow rapidly, while foot traffic has become stagnant or is declining among many brick-and-mortar stores (Sorescu et al., 2011). Indeed, during calendar year 2017, approximately 7,000 US brick-and-mortar stores closed, and iconic merchandisers such as JC Penney, Kmart, Macy’s, Radio Shack and Sears each closed more than 100 stores (Thomas, 2017).

Retailers initially adapted to these disruptive channel developments by developing multichannel marketing, fulfillment and delivery strategies (Agatz et al., 2008; Rigby, 2011; Christensen and Raynor, 2013). To this end, companies typically established online fulfillment operations that were autonomous from their brick-and-mortar operations. This often included separate and distinct order fulfillment capabilities for each channel, which resulted in dedicated storage facilities for each channel as well as inventory and other fulfillment assets that were committed to a specific channel (Frazier, 1999; Swaminathan and Tayur, 2003).

Within the past 15 years, some retailers began to refine their multichannel capabilities to focus on so-called “omnichannel” capabilities. Briefly, an omnichannel experience allows a customer to order from multiple platforms (omnichannel retailing) and the order can be filled from any location using inventory and other fulfillment assets flexibly across channels (omnichannel fulfillment). Conceptually, omnichannel capabilities provide a seamless shopping experience where the distinctions between brick-and-mortar and online operations become immaterial (Ishfaq et al., 2016; Galipoglu et al., 2018). The grocery industry was among the earliest to experiment with an omnichannel capability by implementing a buy-online-ship-from-store (BOSS) option for customers (De Koster, 2002; Boyer and Hult, 2006). One consequence of companies developing their omnichannel fulfillment strategies is a realization that tying fulfillment assets to particular channels increases inefficiency in terms of managing logistics costs and service.

In response to these changes in the retail environment, interest in omnichannel fulfillment has been increasing and academic articles focusing on the fulfillment and inventory aspects of omnichannel have become more plentiful in recent years. As such, we propose that the omnichannel fulfillment literature has developed sufficiently to justify a comprehensive analysis by means of a systematic literature review (SLR) of omnichannel fulfillment strategies. In addition, given the dynamic state of the concept, having a clear understanding of where academic inquiry has been provides a valuable platform to examine where inquiry should go moving forward. More specifically, the manuscript addresses the following research questions:

RQ1. What is the definition of omnichannel fulfillment strategies?

RQ2. What has been studied regarding omnichannel fulfillment and inventory usage?

RQ3. What are the future opportunities regarding omnichannel fulfillment strategies research?

We believe that addressing these questions can make multiple contributions to the literature; for one, the manuscript provides a detailed and comprehensive definition of the term “omnichannel fulfillment strategy” that can be used to guide a focus on fulfillment-related research within the broader omnichannel literature. The manuscript also adds to the emerging body of SLRs in the logistics and supply chain management (SCM) discipline (e.g. Galipoglu et al., 2018; Friday et al., 2018). Moreover, consistent with Burgess et al.’s (2006) seminal research on SLRs in SCM, the present manuscript can facilitate conceptual and theoretical development by identifying promising avenues for future inquiry.

During the review process, three literature review manuscripts were identified as pertaining to omnichannel fulfillment (Table I). Beck and Rygl (2015) and Galipoglu et al. (2018) concentrate primarily on the general concept of omnichannel. Melacini et al. (2018) identifies network design, capacity management, delivery planning and execution as main
issues related to e-fulfillment and distribution. Comparing Beck and Rygl (2015) to Galipoglu et al. (2018) and Melacini et al. (2018) illustrates the need to delimitate omnichannel fulfillment from omnichannel demand-side considerations. For example, Galipoglu et al. (2018) and Melacini et al. (2018) both characterize the fulfillment strategy for buy-online-pickup-in-store (BOPS or BOPIS) as omnichannel. Beck and Rygl (2015) categorize BOPS as part of cross-channel retail management but they do not view the strategy as omnichannel. They argue that from a demand-creation viewpoint, BOPS customers conduct their transactions online only and fulfillment from the store is merely an additional convenience option provided to customers. From a supply chain perspective, the fulfillment function is indeed omnichannel; the order was initiated online and was fulfilled using store inventory and store resources (Bendoly et al., 2005; Boyer and Hult, 2006). Customers are provided the ability to shop how they wish and store inventory and resources are used to fulfill demand from more than one channel.

Beck and Rygl (2015) provide a taxonomy of omnichannel retailing concepts. Galipoglu et al. (2018) identify the research themes and intellectual foundations of omnichannel supply-side research. Melacini et al. (2018) note four omnichannel strategies. However, recognizing and delineating omnichannel fulfillment strategies was not the authors’ stated objective; they focused on identifying the main issues and themes regarding omnichannel e-fulfillment. This SLR adds to previous literature review work by developing a definition of

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<table>
<thead>
<tr>
<th>Literature review</th>
<th>Review organization</th>
<th>Noted omnichannel fulfillment strategies</th>
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<tbody>
<tr>
<td>Beck and Rygl (2015)</td>
<td>Taxonomy of multichannel retailing. Categories are delimited by whether the consumer is able to initiate the cross-channel activity or if the cross-channel integration is controlled by the retailer Multichannel retailing Cat I (customer initiated) Cat II (retailer provided) Cross-channel retailing (partial) Cat III (customer initiated) Cat IV (retailer provided) Cross-channel retailing (full) Cat V (customer initiated) Cat VI (retailer provided) Omnichannel retailing Cat VII (customer initiated) Cat VIII (retailer provided)</td>
<td>BOPS (Cat III) BORIS (Cat III)</td>
</tr>
<tr>
<td>Galipoglu et al. (2018)</td>
<td>Research themes of multichannel and omnichannel research Channel management and strategy Channel supply side Channel demand side</td>
<td>BOPS (click and collect) BORIS (order online return to store)</td>
</tr>
<tr>
<td>Melacini et al. (2018)</td>
<td>Key themes for e-fulfillment and distribution Distribution network design Inventory and capacity management Delivery planning and execution</td>
<td>BOPS/STS BORIS BOSS Omnichannel distribution centers</td>
</tr>
<tr>
<td>This SLR</td>
<td>Definition of an omnichannel fulfillment strategy. Identify and delineate omnichannel strategies according to Purchase origination Fulfillment links Receipt destination</td>
<td>BOPS STS BORIS BOSS Omnichannel distribution centers Omnichannel drop shipping</td>
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Table I. Literature reviews pertaining to omnichannel fulfillment
2. Defining and delimiting omnichannel fulfillment strategies

Omnichannel retailing research has been robust in the marketing literature for several years (Brynjolfsson et al., 2013; Rigby, 2011); more recently, omnichannel fulfillment research has begun to accelerate (Piotrowicz and Cuthbertson, 2014; Saghir et al., 2017; Verhoef et al., 2015). Beginning in the 1990s, multichannel and dedicated-channel distribution research has accompanied the growth of e-commerce (Agatz et al., 2008). Related to the multichannel distribution research, omnichannel fulfillment research encompasses the integration of multiple distribution channels (Bendoly et al., 2005; Gao and Su, 2017). Verhoef et al. (2015) identified the firm’s perspective of omnichannel retailing as the “synergetic management of the retail channels such that the customer experience and the performance across channels are optimized” (Beck and Rygl, 2015). The firm view of omnichannel retailing consists of how customers experience making purchases and how their purchases are fulfilled. Table II provides researchers’ definitions and descriptions regarding the three views that comprise omnichannel retailing: the firm view of omnichannel, the demand-side view of omnichannel that emanates principally from the marketing literature and the supply-side view of omnichannel that is developing out of the logistics/SCM and operations management literature (Beck and Rygl, 2015; Galipoglu et al., 2018).

The established marketing-based, demand-side view of omnichannel highlights the consumer’s desire for a consistent and nearly invisible order fulfillment experience. Indeed, if the product exists in the retail network, the customer wants to be able to make the purchase with as little hassle as possible regardless of location and channel (Piotrowicz and Cuthbertson, 2014). Shoppers increasingly demand more convenience. They want to make purchases anytime, anywhere and from any device; to obtain their items in the store or have them delivered at home; and to be able to return their purchases hassle-free regardless of drop-off location (Mercier et al., 2014; Piotrowicz and Cuthbertson, 2014). The marketing and SCM literature generally identify the demand-side view of omnichannel as providing a seamless shopping experience through all available shopping channels (Ailawadi and Farris, 2017; Gao and Su, 2017; Rigby, 2011).

The integration of fulfillment capabilities is coalescing as the SCM, supply-side view of omnichannel (Ishfaq et al., 2016; Gao and Su, 2017). Bendoly et al. (2005) identify channel integration fulfillment as the use of multiple modes of fulfillment for “mutual support of, or as semi-interchangeable alternatives for, end-customers transactions.” The authors explain that some modes are better suited for channel fulfillment than are others; however, the modes can be interchanged between channels when necessary. Broadly, the supply-side view, omnichannel fulfillment, represents the integration of the physical distribution structure to meet customer demand from any combination of fulfillment channels (Bendoly et al., 2005; Ishfaq et al., 2016; Hübner, Holzapfel and Kuhn, 2016; Hübner, Wollenburg and Holzapfel, 2016). The integration of distribution channels includes both dedicated and interchanged order-flow paths (Banker, 2013).

As part of the fulfillment process, omnichannel delivery takes into account the emerging last-mile logistics concepts that utilize various modes of delivery to best serve online customers. Methods such as crowd-sourced delivery, ship-to-locker and third-party ordering
and delivery services are becoming important components for specific omnichannel distribution services (Deutsch and Golany, 2018; Lempert, 2018). Crowd-sourced delivery is currently used for deliveries both from stores and DCs (Castillo et al., 2018). Although it is a growing component of retailers’ omnichannel strategies, the nascent omnichannel delivery literature is very sparse. The roles of dedicated delivery and omnichannel delivery options regarding omnichannel fulfillment are still developing. Research into omnichannel delivery may take different directions regionally. While not common in North America, click-and-collect options augmenting lockers are being implemented in Europe that include train stations and post offices (Poulter, 2014). We outline omnichannel fulfillment touchpoints with omnichannel delivery and other relevant concepts in our discussion of future research opportunities in Section 5.

<table>
<thead>
<tr>
<th>Firm view of omnichannel</th>
<th>Omnichannel fulfillment strategies</th>
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<tbody>
<tr>
<td>Beck and Rygl (2015)</td>
<td>The retailer shares customer, pricing, and inventory data across all channels, the channels are fully integrated from the retailer’s viewpoint</td>
</tr>
<tr>
<td>Verhoel et al. (2015)</td>
<td>Omnichannel management is the synergetic management of the numerous available channels and customer touchpoints, in such a way that the customer experience across channels and the performance over channels is optimized</td>
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<tr>
<td>Hübner, Holzapfel and Kuhn (2016) and Hübner, Wollenburg and Holzapfel (2016)</td>
<td>With an advanced omnichannel logistics approach, neither the customer nor the retailer distinguishes between channels anymore</td>
</tr>
<tr>
<td>Demand-side view of omnichannel</td>
<td></td>
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<tr>
<td>Rigby (2011)</td>
<td>Customers value parts of the shopping experience differently, but all are likely to want perfect integration of the digital and the physical</td>
</tr>
<tr>
<td>Lewis et al. (2014)</td>
<td>Customers want to be able to shop in a seamless and integrated way across multiple channels</td>
</tr>
<tr>
<td>Piotrowicz and Cuthbertson (2014)</td>
<td>The omnichannel concept is perceived as an evolution of the multichannel. While in multichannel, a division exists between the physical and online store; in omnichannel, customers move freely between online, mobile devices, and physical store, all within a single transaction process</td>
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<tr>
<td>Ishfaq et al. (2016)</td>
<td>The omnichannel approach seeks to provide a seamless consumer experience across all available shopping channels</td>
</tr>
<tr>
<td>Bernon et al. (2015)</td>
<td>Omnichannel retailing is a seamless approach to retailing that offers a single and unified shopping experience across all retail channel formats</td>
</tr>
<tr>
<td>Ailawadi and Farris (2017)</td>
<td>Omnichannel accepts the inevitability of needing to employ multiple channels and is focused on integrating activities within and across channels to correspond to how consumers shop</td>
</tr>
<tr>
<td>Gao and Su (2017)</td>
<td>Providing customers with a seamless shopping experience through all available shopping channels.</td>
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<tr>
<td>Supply-side view of omnichannel</td>
<td></td>
</tr>
<tr>
<td>Bendoly et al. (2005)</td>
<td>Channel integration represents the use of multiple modes of fulfillment for mutual support of, or as semi-interchangeable alternatives for, end-customers’ transactions</td>
</tr>
<tr>
<td>Ishfaq et al. (2016)</td>
<td>(Omnichannel) requires retailers to align their physical (store-based) and virtual (online and mobile) channels through the coordination of order management, fulfillment, and logistics processes</td>
</tr>
<tr>
<td>Hübner, Holzapfel and Kuhn (2016), Hübner, Wollenburg and Holzapfel (2016)</td>
<td>There is only one common logistics interface to the customer and distance orders can be processed through the stores as well as orders placed in-store for home delivery. Information exchange, joint operations, logistics and inventories across channels enable conflation of the fulfillment processes</td>
</tr>
<tr>
<td>Gao and Su (2017)</td>
<td>Integrating existing channels to enrich customer value and improve operational efficiency</td>
</tr>
<tr>
<td>Castillo et al. (2018)</td>
<td>How firms simultaneously manage in-store and online (delivery) channels to create customer value</td>
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Table II. Omnichannel definitions and descriptions
To date, the omnichannel retailing literature is uneven with respect to identifying and addressing the distinct logistical aspects of specific omnichannel strategies that facilitate the integration of retailers’ fulfillment channels. Integration involves enabling personnel, inventory availability and other retailer assets to be used flexibly across different channels. The importance of concept definition is highlighted by Podsakoff et al. (2016), who point out multiple problems with poor concept definition. These include an inability to distinguish a particular concept from other related concepts as well as challenges with operationalizing a particular concept.

Regarding omnichannel fulfillment strategies, we believe that three components of the order fulfillment process offer clarity: purchase origination, fulfillment links and purchase receipt (Croxton, 2003; Gunasekaran and Ngai, 2005). The order flow begins with the customer’s purchase initiation and is completed when the purchase is received by the end customer (Banker, 2013). The purchase origination can happen either in the retail store or online. The inventory used to fulfill the purchase can be pulled from a retail store, a retailer’s distribution center or a supplier’s distribution center. Hübner, Holzapfel and Kuhn (2016) and Hübner, Wollenburg and Holzapfel (2016) refer to the fulfillment processes between the purchase source and purchase reception as links. The fulfillment links between purchase origination and purchase receipt include the purchased item(s) (inventory), personnel that prepared the order, as well as DC, supplier and store assets utilized. The order-flow paths of the fulfillment links are typically intended to be most efficient for a dedicated distribution channel or are deliberately designed to be relatively efficient for more than one distribution channel (Bendoly et al., 2005). Finally, with respect to the purchase receipt, the purchase can be received or retrieved at a retail store, at the customer’s residence or at another location convenient to the customer. Table III demonstrates the fulfillment processes for the BOPS and for the BOSS strategies.

To delimitate supply-side omnichannel fulfillment strategies and to aid in delineating between strategies, we propose that omnichannel fulfillment strategies be defined as:

Processes that enable a firm to meet customer demand through the flexible sharing of fulfillment link(s) across any combination of channels with respect to purchase origination and purchase receipt.

Flexibility with inventory and fulfillment resources has been enabled through rapid developments in information technology capabilities (Oh et al., 2012). Much of omnichannel fulfillment flexibility is achieved via rapidly developing distributed order management systems (Simon et al., 2015; Manhattan Momentum, 2017). The focus on the flexible sharing of inventory, personnel and fulfillment assets in the definition of omnichannel fulfillment

<table>
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<tr>
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<th>BOPS</th>
<th>Online channel</th>
<th>BOPS</th>
<th>Online channel</th>
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<tbody>
<tr>
<td><strong>In-store channel</strong></td>
<td>The order begins</td>
<td>online via the</td>
<td>The order begins</td>
<td>online via the</td>
</tr>
<tr>
<td>Purchase originiation</td>
<td>online via the</td>
<td>retailer's website</td>
<td>online via the</td>
<td>retailer's website</td>
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<tr>
<td></td>
<td>or a mobile</td>
<td>application</td>
<td></td>
<td>application</td>
</tr>
<tr>
<td></td>
<td>fulfillment links</td>
<td></td>
<td>The order is fulfilled from</td>
<td>A retail store using store</td>
</tr>
<tr>
<td></td>
<td>The order is fulfilled from</td>
<td>store inventory, store personnel</td>
<td>inventory, store personnel</td>
<td>inventory, store personnel</td>
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<tr>
<td></td>
<td>a retail store</td>
<td>store personnel</td>
<td></td>
<td>and store resources</td>
</tr>
<tr>
<td></td>
<td>using store inventory, store personnel</td>
<td>and store resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Receipt destination</strong></td>
<td>The item is picked up</td>
<td>by the customer at a retail store</td>
<td>The item is delivered to the customer's home</td>
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</table>

Table III. BOPS and BOSS fulfillment strategies
strategies is necessary to reflect the breadth and complexity of the concept as well as to provide boundaries for our examination of the extant academic literature on this topic. For example, this detailed definition allowed us to identify and delineate six distinct omnichannel fulfillment strategies that are currently practiced in industry and are identified in the SCM and marketing literature. These strategies include BOPS or BOPIS, buy-online-ship-to-store (STS), BOSS, omnichannel distribution centers, omnichannel drop shipping and buy-online-return-in-store (BORIS). Each of these six omnichannel strategies is described in greater detail in Table AI. Predominately, in the literature, with the exception of omnichannel drop shipping, these strategies are not concerned with the sourcing function of SCM. An additional exception is the forecasting literature. From a demand-side perspective, other omnichannel strategies exist; however, from a supply-side perspective, they are indistinguishable from other dedicated-channel and omnichannel fulfillment strategies. For example, buy-in-store-deliver-to-store is fulfilled identically as an STS order. Buy-in-store-deliver-to-home is fulfilled the same as an online order (Agatz et al., 2008; Gallino et al., 2016).

While BORIS is not part of the forward order fulfillment process, the strategy has direct implications for omnichannel fulfillment from an inventory, personnel and assets perspective. A key aspect of BORIS is that the returned items cross from the online to the in-store channel where they can be processed to become inventory to fulfill orders from either channel (Table IV). Thus, BORIS is a reverse logistics strategy that retail firms utilize as part of their omnichannel capabilities (Bernon et al., 2015; Ofek et al., 2011).

An advantage of using the idea of flexible sharing of inventory for the definition of omnichannel fulfillment strategies is the opportunity to clearly delineate the concept from other notions with the label “omnichannel” that appear in the literature. Retailers are presently utilizing their inventory, personnel and other assets to fulfill multiple-channel orders using both dedicated-channel fulfillment strategies and omnichannel fulfillment strategies. Only the flexible sharing of fulfillment links across distribution channels can be considered uniquely an omnichannel fulfillment strategy. For example, crowd-sourced delivery from direct-to-consumer distribution centers fulfilling strictly online orders is clearly a dedicated-channel distribution strategy (Phillips, 2018). However, crowd-sourced delivery cane used to deliver online orders from dedicated-channel DCs, omnichannel DCs and from stores making it a possible delivery means for omnichannel fulfillment (Castillo et al., 2018). Omnichannel fulfillment management, therefore, can be viewed as the synergetic managing of the retailer’s portfolio of both omnichannel fulfillment and dedicated-channel fulfillment strategies.

### 3. Methodology
SLRs were originally introduced for medical research and in the sciences (Mulrow, 1987), but have been adapted to the social sciences, including business disciplines such as accounting (e.g. Massaro et al., 2016), finance (Müllner, 2017) as well as marketing and management (Denyer and Tranfield, 2009; Tranfield et al., 2003). For SCM specifically,
Durach et al. (2017) indicated that SLRs have become increasingly important with rising numbers of articles being published in recent years. We followed the SLR guidelines established by Mulrow (1987), the Cochrane Collaboration (Higgins and Green, 2011), the Campbell Collaboration (2016) as well as Tranfield et al. (2003) to guide the review process. Durach et al. (2017) succinctly summarize these guidelines and adjust them for use by SCM-focused researchers by condensing them into a set of six sequential steps. Table V summarizes the six steps and their goals as well as the actions taken by the research team in the current study.

Unlike many SLR’s, we did not limit the publication dates during the search (which went through the end of December 2018) in order to avoid arbitrarily excluding earlier manuscripts. The initial results of a keywords search returned a large number of hits. For example, for the main keyword “omnichannel,” results produced 5,300 hits from Google Scholar and 774 hits from EBSCO Business Source Premier. However, once limited to academic journal entries for EBSCO, the number dropped significantly to only 39 entries. Since Google Scholar does not provide an “academic journal only” option, we only used it to augment the results from EBSCO. This procedure was repeated for all keywords, and the output of this keyword search is summarized in Table VI. After a review of the titles and abstracts, the majority of the identified manuscripts could be eliminated from further evaluation. This process resulted in 62 papers that were viewed as having relevance to the extant omnichannel strategies from a fulfillment perspective.

A review of backward and forward citations as well as additional manuscripts that were picked up by Google Scholar via keyword search led us to identify another 76 potentially relevant manuscripts, which expanded the pool to 138 articles. Of these 138 manuscripts, 34 articles were excluded because independent analysis by two members of the research team suggested that they were either only tangentially related to the concept of omnichannel fulfillment (e.g. mentioning relevant issues once but never exploring any details) or did not appear in peer-reviewed outlets (this only pertained to manuscripts added to the review via backward citations or Google Scholar). This resulted in a final pool of 104 articles for further analysis, and to the best of our knowledge contains all relevant academic papers between 2002 (when the first manuscript was published) and the end of December 2018.

4. Findings

4.1 Demographic findings: dates of publication, authors and disciplines

This section provides an overview of the identified pool of omnichannel fulfillment literature. Consistent with other SLRs, this overview discusses descriptive material, such as publication dates, methodologies, publication outlets, among others, that provides a “lay of the land” of the omnichannel fulfillment research. Figure 1, which offers an overview of the papers by publication date, indicates limited omnichannel fulfillment research activity between 2002 and 2014 in the sense that no more than six articles were published in a particular calendar year. By contrast, Figure 1 also indicates that 77 of the 104 (or 74 percent) of the omnichannel fulfillment articles were published in 2015–2018, with the number of papers increasing more than four-fold in 2018 vs 2015. This research surge since 2015 suggests that omnichannel fulfillment is poised to become an increasingly common topic in the academic literature – reflecting the rising importance in industry.

The review process also tracked the background of each author with respect to academic discipline (as reflected by an author’s university website) and this information is presented in Figure 2. If all authors of a paper came from the same discipline, it was categorized accordingly (e.g. SCM, operations, etc.). In cases of collaboration between authors from different disciplines, the paper was categorized as “mixed.” According to Figure 2, the author teams are most likely to be from either the logistics/SCM (40 papers) or operations (28 papers) disciplines. These findings might not be unexpected given fulfillment’s emphasis on logistics/SCM and operations.
<table>
<thead>
<tr>
<th>Step description</th>
<th>Goal of the step</th>
<th>Actions by research team in the current study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: define research question</td>
<td>Establish relevance and timeliness</td>
<td>We defined the research question to gauge the state of the current SCM research with respect to omnichannel. Timeliness and relevance are established in the introduction. The contribution of this effort is to summarize the current state of research and thus be able to identify gaps in the literature and opportunities for further inquiry. Due to the novelty of the omnichannel concept in SCM research, we opted for a very inclusive approach. We included articles from all theoretical backgrounds and methods. In the early collection process, we considered articles from all business disciplines and only selected into marketing vs SCM-related manuscripts in a secondary step. In a final step, we eliminated articles that did not pertain to omnichannel fulfillment. Due to the nature of the research team, only articles in the English language were reviewed. Further, this provides comparability of the results as English is the predominant language in SCM research.</td>
</tr>
<tr>
<td>Step 2: determine required characteristics of primary studies</td>
<td>Craft inclusion/exclusion criteria such as research method, study focus, language, etc.</td>
<td>We employed the search engines Business Source Premier by EBSCOhost as well as Google Scholar. We selected the following list of keywords. We always looked for different spellings and acronyms. Keywords were initially selected based on seminal articles in the field and expanded throughout the search process to capture as many articles as possible. Omnichannel, Omni-channel, Omni channel, Bricks-and-clicks, Bricks and clicks, Click-and-mortar, Click and mortar, Buy online, pickup in store, BOPS, BOPUS, BOPIS, Click-and-reserve, Buy online, deliver from store, Deliver from store, BODS, Buy online, ship from store, Ship from store, SFS, BOSS, Buy online, ship to store, Buy-online-ship-to-store, Ship-to-store, STS, BOSTS, Click-and-collect, Ship to locker, Ship and get, Ship &amp; get, Parcel locker.</td>
</tr>
<tr>
<td>Step 3: retrieve sample of potentially relevant literature</td>
<td>Determine research procedures such as databases and cross-referencing, Select initial keywords</td>
<td></td>
</tr>
</tbody>
</table>
What might be unexpected in Figure 2 is the finding that only 6 of the 104 manuscripts (5.8 percent) involved authors from multiple disciplines (i.e. “mixed”). More specifically, although omnichannel fulfillment involves marketing, logistics, supply chain and operations activities in companies, to date there has been limited research that incorporates these different perspectives. Furthermore, we found no manuscripts that include authors from the strategy, organizational behavior, accounting or finance disciplines, all of which are areas potentially impacted by omnichannel fulfillment strategies. Moving forward, there appear to be clear opportunities for authors from multiple disciplines to collaborate on omnichannel fulfillment research.
To provide visibility with respect to the journals that emerged from our analysis, we include an overview of the outlets of the reviewed articles in Figure 3. As shown in Figure 3, the 104 articles have appeared in 46 separate outlets, and no one outlet accounts for more than 13 articles. For the most part, the disciplinary emphasis of the journals is similar to what was found in terms of the researchers’ disciplines. More specifically, the logistics/SCM discipline is represented by journals such as the *International Journal of Physical Distribution & Logistics Management (IJDPLM)* (the high number of publications in this journal is in part due to a recent special issue on the topic) and the *International Journal of Retail and Distribution Management (IJRDM)*.

---

<table>
<thead>
<tr>
<th>Keyword</th>
<th>No. of EBSCO entries academic journals</th>
<th>Relevant articles after content review (abstract basis)</th>
</tr>
</thead>
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<tr>
<td>Omnichannel</td>
<td>31</td>
<td>21</td>
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<tr>
<td>Omni-channel</td>
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<td></td>
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<td>Omni channel</td>
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<td>Bricks-and-clicks</td>
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<td>Bricks and clicks</td>
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<td>4</td>
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<td>Click-and-mortar</td>
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<tr>
<td>Click and mortar</td>
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<td>1</td>
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<td>BOPIS</td>
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</tr>
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</tr>
<tr>
<td>Deliver from store</td>
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<tr>
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<td>Ship from store</td>
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<td>9</td>
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<td>Click and collect</td>
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<td>Ship to locker</td>
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<td>Ship and get</td>
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<td>Ship &amp; get</td>
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<tr>
<td>Hybrid DC</td>
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<tr>
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<tr>
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</tr>
<tr>
<td>Omnichannel reverse logistics</td>
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</tr>
<tr>
<td>Buy online, return in store</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>BORIS</td>
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<td></td>
</tr>
<tr>
<td>Sum of Articles</td>
<td>4,687</td>
<td>48</td>
</tr>
</tbody>
</table>

Table VI. Keyword search results via EBSCO

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Omnichannel fulfillment strategies
It is noteworthy that most of the relevant pieces in the logistics/SCM realm have appeared in just a few journals (roughly 18 percent of all reviewed articles have appeared in *IJPDLM* and *IJRDM* alone) while outlets such as the *Journal of Business Logistics* (three manuscripts) or the *Journal of Supply Chain Management* (no relevant manuscripts) do not currently reflect the emerging academic interest in omnichannel fulfillment. The operations discipline is represented by journals such as *Management Science* and the *Journal of Operations Management*, while marketing is represented by journals such as the *Journal of Retailing*. The strong showing of the *Journal of Business Forecasting* reflects a 2017 special issue that focused on the implications of omnichannel for forecasting.

4.2 Content-oriented findings: methods and fulfillment strategies

Figure 4, which summarizes the research methodologies utilized, indicates that more than 80 percent of the fulfillment research relies upon one of three methodologies – analytical
Omnichannel fulfillment strategies

Figure 3.
Manuscripts by outlet

Figure 4.
Manuscripts by research methodology
modeling (46 papers), qualitative empirical (18 papers) and quantitative empirical (22 papers). Content analysis of the articles (not presented in Figure 4) indicates that the analytical and empirical streams have formed largely in isolation from each other. That is, analytical pieces rarely reference empirical work in detail (other than a few individual citations in the paper’s introduction sections to demonstrate relevance) and empirical manuscripts largely ignore the insights from the analytical modeling side. As such, one potential avenue moving forward involves omnichannel fulfillment research that incorporates both analytical and empirical characteristics.

Only three of the reviewed manuscripts are literature reviews, which created an additional impetus for the current manuscript. Specifically, two reviews (Beck and Rygl, 2015; Galipoglu et al., 2018) focus on literature around the general concept of omnichannel while this current review of the literature specifically pertains to omnichannel fulfillment. The third review by Melacini et al. (2018) identifies network design, capacity management, delivery planning and execution as main issues related to e-fulfillment and distribution. The current manuscript complements the Melacini et al. (2018) review of the extant literature by explicitly identifying and delimiting six omnichannel fulfillment strategies based on three parameters — purchase origination, fulfillment links and purchase receipt. Melacini et al. (2018) noted four of the omnichannel strategies identified in this SLR: BOPS/STS, BOSS, omnichannel distribution centers and BORIS. Because both BOPS and STS involve picking up online or in-store kiosk orders at stores, Melacini et al. (2018) did not delineate between the two strategies. From an omnichannel fulfillment strategies perspective, the BOPS and STS fulfillment links are not the same. BOPS utilizes the pickup store’s inventory and store resources and can be accomplished in hours. STS utilizes a DC’s or another store’s inventory and resources and orders are typically fulfilled over a period of days (Gao and Su, 2017; Murfield et al., 2017). Omnichannel drop shipping is also identified as an omnichannel fulfillment strategy. The fulfillment link is provided by the retail supplier to augment the retailer’s network inventory when needed (Khouja and Stylianou, 2009; Simon et al., 2015).

Figure 5 presents an analysis of the different methodologies over time and shows that research between 2002 and 2014 employed almost exclusively analytical and empirical-quantitative methods. A majority of the pre-2015 analytical papers broach the topic from a purely theoretical perspective and lack any visible resonance from outside the modeling community. BOSS research was among the earliest efforts by analytic researchers; Bendoly (2004) used simulation to demonstrate situations where BOSS implementations could draw down, and in some cases completely deplete, in-store inventory, which could lead to lost in-store sales. Similarly, Seifert et al. (2006) utilized optimization models to
demonstrate that integrating fulfillment for retailers’ virtual stores with the retailers’ exiting store replenishment network resulted in significant savings over separate channel-fulfillment networks. At the time, most retailers were pursuing channel-dedicated fulfillment capabilities, and many retailers were still using third-party providers for online orders.

Herer et al. (2006) added to the analytic literature by showing the connection between BOSS and the transshipment literature. They demonstrate that a stochastic optimization model quickly overwhelms computing power when attempting to determine stocking levels for stores that utilize BOSS. Herer et al. (2006) and Mahar et al. (2009) combine to demonstrate the inventory pooling benefit of integrated multichannel fulfillment.

Analytic studies in the 2010s include Liu et al. (2010), who use a facility location optimization model to identify the best distribution centers within a fulfillment network to convert to omnichannel fulfillment. Also regarding distribution centers, Kull et al. (2013) use corporate panel data and discrete event simulation to demonstrate different sources of inventory record inaccuracy for a multichannel distribution center. More recent manuscripts address modeling considerations regarding agility (Lim et al., 2017), transshipment considerations (Zhao et al., 2015) and mathematically the appropriateness of BOPS for various products (Gao and Su, 2017).

As a general rule, the pre-2016 quantitative empirical pieces mostly “feel the pulse” of the industry via management surveys and case studies that gauged practitioner interest but did not ground the work in applicable theory and largely lacked a formalization of the underlying concepts as well as homogeneous terminology. This appears to be a similar pattern of evolution as seen during the early stages of logistics outsourcing and SCM research (see, for example, Selviaridis and Spring, 2007; Stevens, 1989; Stevens and Johnson, 2016). Examples of pre-2016 quantitative empirical research include Boyer and Hult (2006), who considered consumer satisfaction with grocery products received from distribution centers vs from stores. Bell et al. (2015) used a case study and corporate data to analyze the sales effect of opening retail showrooms with some inventory for a traditionally online-only retailer. Michel (2015) surveyed the current status and growth of omnichannel fulfillment within retail. While the majority of quantitative empirical manuscripts take deep dives into omnichannel fulfillment strategies and provide explanations for the results, with the exception of Bell et al. (2015), they lack theoretical grounding.

Further review of the literature indicates that starting in 2002 labels such as “bricks-and-clicks” or “click-and-mortar” transcended from industry and news outlets into the academic discourse in SCM, but seemed to be used interchangeably and lacked an established meaning or definition. Early publications often employed the term “multi-channel,” which – unlike “omnichannel” – does not necessarily require any form of integration between channels. Gradually, starting around 2010, the vocabulary evolved to terms such as “cross-channel” or “integrated multi-channel.” The term “omnichannel” did not appear as a title (Piotrowicz and Cuthbertson, 2014) or in the author keywords (Lockie, 2014) until 2014. The first appearance of conceptual work in omnichannel fulfillment (see Figure 5) appeared in 2014. In the same year, the first publications emerged that pursue qualitative empirical methods such as case studies (e.g. Lockie, 2014) and thus sparked a stream of manuscripts across a broader set of methods, with an emerging homogeneity in terminology.

To summarize, the analysis of research methodologies suggest that the integration of fulfillment channel inventory and resources is becoming an important objective of omnichannel fulfillment management (Rigby, 2011; Beck and Rygl, 2015; Gao and Su, 2017). Earlier literature provide important developmental steps toward integration (Bendoly, 2004; Boyer and Hult, 2006; Agatz et al., 2008). Often retailers have been moving forward with omnichannel initiatives prior to theoretical understanding of implications. For example, Manhattan and Associates (Manhattan Momentum, 2017) suggest that broader-based department store retailers such as Walmart and Macy’s are generally pursuing higher
service levels from their omnichannel fulfillment management while specialty retailers trend toward seeking better inventory utilization. Appropriate omnichannel strategies based on retailer attributes are not well understood. Industry specific research has been conducted necessitating generalized extension for retailers (De Koster, 2002; Boyer and Hult, 2006; Castillo et al., 2018). We believe that these are important findings because they provide a clear opportunity for the academic community to take more of the lead in terms of knowledge creation by proposing paths for industry pursuit of channel integration to successfully implement omnichannel fulfillment.

Figure 6 shows the fulfillment strategies that are identified by the different papers; because some manuscripts discuss more than one strategy in detail, the total number of identified strategies differs from the number of papers that were reviewed for this study. According to Figure 6, the most commonly discussed strategies, appearing in at least 30 articles, are BOPS and BOSS. This might reflect literature suggestions that companies in pursuit of omnichannel opportunities leverage their stores both for the pickup of online orders (BOPS) as well as to become local distribution hubs for online orders (BOSS). The popularity of omnichannel DCs, comprising 23 articles, appears to align with industry trending away from the traditional model of separate fulfillment operations between in-store and online orders to allow inventory to travel flexibly between channels. The papers that discuss what we dubbed “general omnichannel” are for the most part conceptual pieces that have only more recently provided formalized definitions of omnichannel (and its connection to forecasting) in the literature.

5. An agenda for future inquiry
To date, the omnichannel fulfillment literature exhibits a disconnect between empirically based manuscripts and modeling papers. Specifically, in the extant literature insights from analytical work do not generally translate into the hypotheses development of empirical pieces; alternatively, modeling papers fail to ground their assumptions in the boundary conditions raised by empirical work. Thus, there is potential for researchers in these methodological communities to inform each other’s research. Our analysis of the extant
literature suggests three main opportunities for future omnichannel fulfillment research. These opportunities are discussed below and Table VIII highlights existing research, potential research questions, as well as possible methodologies, analysis techniques and research designs.

5.1 Identifying policies for improving and optimizing omnichannel fulfillment strategies
There have been several approaches to make better decisions regarding individual omnichannel fulfillment strategies, particularly in the analytical research. As discussed in Section 4, several manuscripts address individual omnichannel fulfillment strategies, such as Liu et al. (2010) who developed a model to assist in determining which DCs within a network should implement omnichannel. In a similar vein, Bendoly (2004) considered the potential for causing store stockouts when using BOSS and Mahar et al. (2009) considered assignment policies within a BOSS enabled omnichannel network.

Trends are also beginning to be identified empirically; Gallino et al. (2016) identified greater sales dispersion when a retailer adds STS to its omnichannel capabilities. In addition, Kull et al. (2013) demonstrated how channel fulfillment within an omnichannel DC can lead to different types of inventory inaccuracy. For example, systematically adding more picks from the online channel can cause the DC to have more inventory than the warehouse management system indicates (Kull et al., 2013). Table VII depicts representative research of the six individual omnichannel fulfillment strategies and their relation to the three components of the retail transaction outlined in Section 2.

While these (and other) papers make important contributions to the literature, there appear to be plentiful research opportunities associated with improving the performance of omnichannel fulfillment implementations. For example, industry practice suggests that omnichannel DCs appear to be more attractive to retailers with smaller stores that are replenished via less-than-truckload (Guillot, 2016). Is this because store replenishment and direct-to-consumer online fulfillment are more similar for smaller-store retailers? Moreover, smaller-store retailers frequently replenish stores with less-than-case quantities; are larger-store retailers, therefore, more attracted to BOSS when utilizing their store replenishment networks to support direct-to-consumer orders (Rabinovich et al., 2007)? Ship-to-locker is maturing, especially in Europe. How are locker locations being decided? What are the benefits of locker locations at stores, at train stations, at post office, etc.?

<table>
<thead>
<tr>
<th>Omnichannel fulfillment strategies</th>
<th>BOSS</th>
<th>STS</th>
<th>BOSS</th>
<th>Omnichannel DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase initiation</td>
<td>Online</td>
<td>Online</td>
<td>Online</td>
<td>Either channel</td>
</tr>
<tr>
<td>Fulfillment risks</td>
<td>Store</td>
<td>Either channel</td>
<td>Store</td>
<td>Shared by both channels</td>
</tr>
<tr>
<td>Purchase receipt</td>
<td>Store (via picker)</td>
<td>Store (via picker)</td>
<td>Online (via delivery)</td>
<td>Either channel</td>
</tr>
</tbody>
</table>

Table VII. Omnichannel fulfillment strategies and the three components of the retail transaction
In addition, current research does not address the reasons specific retailers seek omnichannel strategies. For example, department stores are forward positioning products in their stores in anticipation of fulfilling online orders. Specialty stores are using BOSS to augment capacity and inventory constraints of their DC-based online fulfillment capabilities (Manhattan Momentum, 2017). Optimizing based on firm goals and retailer attributes may produce different insights for different categories of retailers. At present, these managerial questions remain unanswered in the literature (Leriche, 2015). Omnichannel fulfillment strategies form the building blocks for generalized omnichannel fulfillment theory. Further research will be needed as additional viable omnichannel fulfillment strategies emerge and are recognized.

5.2 Omnichannel fulfillment theoretical underpinning and establishing an omnichannel fulfillment strategies portfolio for retailers

Galipoglu et al. (2018) propose that identifying theoretical underpinnings of omnichannel fulfillment strategies can help researchers better examine the mix of omnichannel fulfillment strategies for different types of retailers. It is important to note that research into the simultaneous use of fulfillment channels is noticeably different than historic research that has simply compared channels and strategies (Hübner, Holzapfel and Kuhn, 2016; Hübner, Wollenburg and Holzapfel, 2016; Galipoglu et al., 2018). Rather than just coexisting, some omnichannel strategies naturally interact with each other: For example, as previously mentioned, if returns are processed as omnichannel inventory, BORIS potentially provides inventory positions for BOSS and BOPS. Further research needs to develop suitable theory (Sutton and Staw, 1995) that can better explain why and when omnichannel fulfillment strategies are successful.

Better theoretical understanding of omnichannel fulfillment can also help identify which capabilities can be outsourced to logistics service providers; to date the role of logistics service providers regarding omnichannel fulfillment strategies has received little attention in the literature (Piotrowicz and Cuthbertson, 2014). For example, retailers are asking logistics service providers to not only replenish stores but to also assist in online direct-to-consumer fulfillment (Panayides, 2007; Stank et al., 2017; Zhang et al., 2017). Should these continue as outsourced functions, or should they be solely integrated as core functions of the retailer?

Furthermore, retailers should consider how to effectively pair their omnichannel fulfillment strategies with the appropriate mix of last-mile delivery options. While traditional parcel services are able to efficiently handle aggregated deliveries of online orders from a DC, they are likely unsuitable to economically deliver dispersed and shorter-distance orders from a store to the customer that are necessary to fully implement BOSS strategies. Longer-distance BOSS shipments may still be best serviced by traditional parcel delivery services. For stores near customers, crowd-sourced delivery, employee delivery and third-party delivery independent of the parcel services may provide higher service levels to customers and more economical options to retailers. Ship-to-locker at companies own retail location might be accomplished using store inventory or the retailer’s store replenishment assets. Consequently, this eliminates last-mile delivery in a manner similar to STS. Practitioners and researchers should evaluate novel distribution solutions that fit the omnichannel challenge.

As an example, crowd-sourced delivery options may provide an innovative solution to these challenges: crowd-sourced delivery is an emerging delivery method where packages are brought to their final destination by other customers, ride-share drivers from platforms such as Uber and Lift or other travelers if the drop is on their way (Paloheimo et al., 2016). Thus, crowd-sourced delivery means switching out a “traditional” parcel delivery for any given ad hoc last-mile delivery solution (Castillo et al., 2018). As such, if applied as a novel delivery solution in a regular e-commerce environment, it does not
qualify as an omnichannel strategy in the sense of our definition because the fulfillment process remains unaffected.

However, if crowd-sourced delivery solutions are used to transport packages from retail stores to the customer, they can emerge as a powerful facilitator of BOSS (Nassauer, 2018; Abdulkader et al., 2018). Thus, from a research perspective, opportunities to integrate crowd-sourced deliveries with an omnichannel fulfillment strategy should be further evaluated because they will likely emerge as a key means of leveraging retail outlets as mini distribution centers for omnichannel fulfillment. Going beyond the forward order fulfillment process, research can also explore options to integrate BOSS and BORIS strategies if crowd-sourced delivery providers for BOSS orders pick up returns from the same or closely located customers as part of their trip.

Another trend often discussed as part of the omnichannel delivery literature is the ship-to-locker concept: ship-to-locker has been a popular delivery method in Europe for several years (Morganti et al., 2014). Considered alone, delivery to a pickup point as opposed to the customer’s front door is not an omnichannel concept because simply changing the drop location of the package does not alter the fulfillment process. However, some lockers have more recently been incorporated into retail locations. Amazon has added delivery lockers at its Whole Foods Markets (Haddon and Stevens, 2018). As a third-party, 7-Eleven has also added delivery lockers to its stores (Chao, 2015).

If these lockers inside the retail locations are managed by the in-store channel, this concept qualifies as part of an omnichannel strategy because the inventory crosses from the online to the in-store channel. As such, ship-to-in-store-locker can be considered a variant of STS and researchers could evaluate the economic, as well as possibly the environmental benefits of offering these in-store lockers as an alternative to home delivery. Furthermore, if a customer does not pick up his/her order from an in-store locker, the item could be reclaimed by store employees and processed as a return – essentially a unique form of BORIS. So far, this combination of STS and BORIS has not been adopted in practice on any scale; research could investigate the value of further integrating these concepts via in-store lockers. The role of novel delivery methods as part of omnichannel fulfillment management is not well understood.

While several papers provide an overview of omnichannel fulfillment (Hübner et al., 2015; Ishfaq et al., 2016; Picot-Coupey et al., 2016), there is limited research that addresses the proper mix of fulfillment strategies for retailers. Retailers suffering declines in-store foot traffic may seek to implement BOSS and BOPS to justify variety at stores to keep their stores attractive as destination to customers. When seeking to add a product segment to their offering, retailers may seek to utilize omnichannel drop shipping to minimize the risk inherent to carrying too much or too little inventory of new products (Khouja and Stylianou, 2009). At a minimum, future research could investigate the omnichannel fulfillment strategies of different types of retailers such as department stores, specialty stores, category killers and big-box retailers. Retailers are pursuing different omnichannel fulfillment strategies and in different manners (Manhattan Momentum, 2017). Are particular fulfillment strategies associated with specific types of retailers? What is the proper portfolio of omnichannel fulfillment strategies and dedicated-channel fulfillment strategies for retailers to pursue?

5.3 Omnichannel fulfillment and cross-functional considerations
A key aspect for omnichannel success involves the coordination and cooperation across marketing, fulfillment and delivery. Research is needed to better understand the dynamic between omnichannel marketing efforts, omnichannel fulfillment capabilities and omnichannel delivery. The literature suggests that marketing “promises” may have outpaced fulfillment capabilities as firms have reacted to pressures in the marketplace to
make channels available before logistics teams had the fulfillment processes developed (Lambert et al., 2008). Future research could investigate the impact of cross-functional efforts among marketing, fulfillment and delivery as well as efforts between suppliers and retailers regarding omnichannel fulfillment implementation. More empirical research into how omnichannel fulfillment strategies can benefit sales and decrease costs is needed.

Omnichannel fulfillment approaches are by their nature cross-functional and research efforts across a broader set of disciplines could be valuable when examining these complex strategies. As previously mentioned, fewer than 10 percent of manuscripts regarding omnichannel fulfillment involved authors from multiple disciplines. In addition, the extant fulfillment literature lacks input from the organizational behavior and human resource management disciplines; likewise, there are currently no contributions from the strategy, accounting or finance disciplines. There appear to be plentiful opportunities to incorporate researchers from these disciplines as well as their concepts and theories. For example, inventory management is a key facet in omnichannel fulfillment; inventory has obvious financial and accounting implications. Likewise, the role of logistics service providers in omnichannel fulfillment might touch upon organizational behavior, human resource management, strategy, finance and accounting considerations (Table VIII).

6. Summary and conclusions
This paper provides an SLR of 104 research papers focused on omnichannel fulfillment published between 2002 and 2018. The manuscript proposes a definition of omnichannel fulfillment and the 104 papers are analyzed across selected demographic and contextual characteristics. This analysis provides a foundation that identifies three broad areas for future omnichannel fulfillment research. While considerable effort was made to ensure that this review would be all inclusive, the rapidly growing literature on the subject matter makes it possible that some relevant research studies may have been overlooked.

The term “omnichannel fulfillment strategy” is defined using nomenclature where inventory, personnel and fulfillment assets are flexibly shared to fulfill orders regardless of channel of order origination and regardless of ultimate channel of receipt. In contrast to omnichannel delivery, which is an emerging last-mile logistics concept that focuses on innovative delivery alternatives, omnichannel fulfillment emphasizes on interchangeably employing inventory positions and resources to complete a customer order across any combination of channels with respect to order origination and order receipt.

Demographic analysis of the literature indicated a surge in omnichannel fulfillment manuscripts after 2015; these three years combined accounted for more than 70 percent of all omnichannel fulfillment articles published between 2002 and 2018. While the logistics/SCM and operations disciplines have been well represented in the extant literature, less than 6 percent of the articles involve authors from multiple disciplines. Moreover, to date the omnichannel fulfillment literature lacks input from scholars in disciplines such as strategy, organizational behavior, finance, among others. The analysis also indicates that the omnichannel fulfillment research between 2002 and 2018 was published in 46 separate journals, and no one journal accounts for more than 13 articles.

Contextual analysis of methodologies and strategies found that more than 80 percent of the manuscripts rely on one of three methodologies – analytical modeling, quantitative empirical and qualitative empirical. Furthermore, the research between 2002 and 2014 utilized almost exclusively analytic and quantitative empirical methods. In terms of strategies, six different strategies emerge in the literature, with the two most popular being BOPS and BOSS.

The analysis offers multiple insights concerning future research in the area of omnichannel research. To begin, omnichannel fulfillment research is on an upward trajectory, as seen by the pronounced increase in academic journal articles across the 2015–2018 time period. Moreover, while the extant literature exhibits strong contributions
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<td>Very little theoretical basis for omnichannel fulfillment has been developed. Only RBV is cited in papers (Galipoglu et al., 2018)</td>
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from the operations and logistics/SCM disciplines, future research should involve researchers from multiple disciplines, to include strategy, organizational behavior and finance.

The extant literature also shows the need for more empirical, analytical and case study research for improving and optimizing omnichannel fulfillment strategies. According to Galipoglu et al. (2018), there is a need for better omnichannel fulfillment theoretical underpinning and for establishing the best mix of omnichannel fulfillment strategies for different retailers’ omnichannel fulfillment portfolio. Finally, the literature could benefit from research into the integration of omnichannel fulfillment with omnichannel marketing and omnichannel delivery.

References


Appendix

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<th>Strategy</th>
<th>Description</th>
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<td>Buy-online-pick-up-in-store (BOPS)</td>
<td>BOPS is initiated by a customer’s online order with the customer requesting to pick up the order at the store (Murfield et al., 2017; Bell et al., 2014). The BOPS network consists of the stores and the DCs that replenish the stores. The inventory used to fulfill BOPS orders comes from the stores’ on hand supply (Gallino and Moreno, 2014)</td>
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<tr>
<td>Buy-online-ship-to-store (STS)</td>
<td>STS is also initiated by a customer’s online order with the customer requesting to pick up the order at the store. The difference with BOPS is the inventory used to fulfill STS orders does not come from the store’s on hand supply. STS orders are fulfilled from DCs and are shipped to the stores. Often these are different DCs than are used to replenish stores. The STS network consists of the stores and the DCs that satisfy STS orders (Gallino et al., 2016)</td>
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<tr>
<td>Buy-online-ship-from-store (BOSS)</td>
<td>BOSS is again initiated by a customer's online order with the customer requesting delivery. The order is directed to a store for fulfillment (De Koster, 2003; Bendoly, 2004; Boyer and Hult, 2006). Much like BOPS, the BOSS network consists of the stores and the DCs that replenish the stores (Bendoly, 2004; Chiang and Monahan, 2005)</td>
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<td>Omnichannel distribution centers</td>
<td>Omnichannel distribution centers fill the role of both store replenishment DCs and of direct-to-consumer DCs. DC inventory is shared across both channels (Michel, 2015). An omnichannel DC is a single-echelon fulfillment system when servicing online customers and it is the first node of a two-echelon network when replenishing stores (Liu et al., 2010)</td>
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<td>Omnichannel drop shipping</td>
<td>Omnichannel drop shipping differs from traditional drop shipping in that the retailer also carries the supplier's product in its own DCs and/or stores. The supplier's inventory is not always utilized and fulfillment by the supplier occurs because the retailer is either out-of-stock or to suit another objective of the distributed order management system (Khouja and Stylianou, 2009). The omnichannel drop shipping network includes the supplier and retailer DCs that fulfill online orders as well as stores that can fulfill orders</td>
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<tr>
<td>Buy-online-return-in-store (BORIS)</td>
<td>BORIS occurs when a customer returns an item purchased online to a retailer’s store. The item is processed to inventory and may ultimately be resold in the store (Bernon et al., 2015; Ofek et al., 2011) or be shipped directly from the store to another online customer. The retailer may also return the item to a DC for repackaging or for other preparation for resale or liquidation. Finally, the retailer may simply dispose of the item from the store or the retailer may ship it for liquidation</td>
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Table AI. Omnichannel fulfillment strategies

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The effects of trust and distrust on ICT-enabled information sharing in supply chains
Evidence from small- and medium-sized enterprises in two developing economies

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Abstract

Purpose – Drawing on transaction cost economics (TCE) and social exchange theory (SET), the purpose of this paper is to explain why and how external environment, governance structures and interpersonal relationships influence information and communication technology (ICT)-enabled information sharing in supply chains (SCs) of small- and medium-sized enterprises (SMEs) from developing economies.

Design/methodology/approach – The authors adopt a theory-building approach using a multiple-case study design, including four SMEs operating in SCs from two developing economies (i.e. Republic of North Macedonia and People’s Republic of China), in which the authors conduct both within-case and cross-case analyses.

Findings – Social bonds (known as vrski in Macedonian and guanxi in Chinese) were found to govern buyer–supplier exchanges by supporting the establishment of personal trust and the reduction of distrust. These social bonds compensate for the institutional deficiencies in developing economies and thus encourage ICT-enabled information sharing by SMEs in their SCs.

Research limitations/implications – By applying the theoretical perspectives of TCE and SET to the cross-case analysis, the authors develop nine propositions to explain ICT-enabled information sharing and its interdependencies with external environment, governance structures and interpersonal relationships in developing economies. Further research is recommended to refine and test the generalizability of the theoretical model.

Practical implications – Firms have to develop and nurture social bonds with their suppliers from developing economies to reduce risks related to the environmental uncertainty and institutional voids. This can increase trust and decrease distrust associated with ICT-enabled information sharing.

Originality/value – The study examines why and how external environment (environmental uncertainty and institutional environment), social bonds (vrski and guanxi) and interpersonal mechanisms (trust and distrust) influence ICT-enabled information sharing of SMEs operating in developing economies.

Keywords China, Europe, Small- to medium-sized enterprises, Case study, Information technology, Buyer–supplier relationships, Food logistics

Paper type Research paper

Introduction

Developing economies often receive technology, particularly for industrialization, automation and infrastructure. Most developing economies still face crises due to poor governance, high population growth, political instability and structural dependence on developed economies (Yeager, 2018). Their structural and contextual deficiencies make it difficult for small- and medium-sized enterprises (SMEs) to achieve and sustain competitive
advantages (Tang and Hull, 2012). Nevertheless, organizational survival in hyper-competitive and dynamic markets largely depends on integrated supply chains (SCs) with smooth information, material and financial flows, which lead to improved operational and strategic performance (Leuschner et al., 2013). Thus, SMEs from developing economies need to integrate their internal processes with SC partners to improve the overall SC performance through intensive information sharing and collaboration (Rezaei et al., 2015).

Advances in information and communication technologies (ICTs), especially enterprise-level communication and collaboration technologies (e.g. e-mail, VoIP, web file hosting and video conferencing) and SC management technologies (e.g. electronic data interchange, bar codes and RFIDs), make it easier for firms to share timely information and thus collaborate effectively with suppliers and customers (Zaheer and Trkman, 2017), integrating information across SCs (Tseng and Liao, 2015). However, SMEs operating in developing economies still face the challenge of ICT-enabled information sharing with SC partners, mainly due to the inherent environmental uncertainty (Mirkovski et al., 2016). Furthermore, ICT-enabled information sharing is not the single most important determinant of successful SC integration. In isolation, information sharing is insufficient to improve the SC performance as a whole (Fabbe-Costes and Jahre, 2008), especially amid environmental turbulence and institutional voids.

The environmental turbulence and institutional voids of developing economies can hinder SC operations (Silvestre, 2015). Highly turbulent business environments can cause organizational inertia that impedes organizational learning and innovation in SCs (March and Olsen, 1975), whereas weak or absent institutions create voids that can increase environmental uncertainty (Chadee and Roxas, 2013). Thus, SCs from developing economies are prone to relational contracting, in which interpersonal mechanisms, such as trust and distrust, facilitate or impede buyer-supplier exchanges (Monios and Bergqvist, 2016). This is especially true in the highly fragmented and artisan-oriented wine SCs from developing economies, where wineries work with various suppliers, such as grape farmers and manufacturers of glass bottles, bottle capsules and corks, to create aesthetically appealing bottled wines (Golicic et al., 2014).

Prior research has examined the influence of technological, organizational and environmental factors on ICT adoption and use for information sharing and collaboration of SMEs in developing economies. However, limited research exists on how the interplay between external environment, governance structures and interpersonal mechanisms in developing economies impacts the ICT-enabled information sharing of SMEs that is an important constituent of SC collaboration. To the best of our knowledge, only one previous study (Mirkovski et al., 2016) has explored the influence of environmental uncertainty, contractual governance and relational governance on the ICT-enabled information sharing of SMEs in developing economies. However, Mirkovski et al. (2016) only implicitly considered the institutional environment, which partially depicts the complex external environment in developing economies. They also did not consider the relationships between interpersonal mechanisms and ICT-enabled information sharing, which are crucial for information flows of SCs in developing economies.

To address this research gap, we modify Mirkovski et al.'s (2016) model to explicitly consider the institutional environment and explore its relationship with governance structures to provide a more comprehensive explanation of the external environment in developing economies. Also, we investigate the relationships between interpersonal mechanisms and SC collaboration to improve our understanding of how trust and distrust moderate ICT-enabled information sharing in SCs from developing economies. Our main contribution is the development of a comprehensive theoretical model that explains why and how the external environment (environmental uncertainty and institutional environment), social bonds (vrski and guanxi) and interpersonal mechanisms (trust and distrust) influence ICT-enabled information sharing of SMEs operating in developing economies.
Liu and Mckinnon (2016, p. 976) argued that due to “its economic, political and cultural settings, [SC] development in China has presented new research challenges.” They emphasized that existing western-developed theories have limited applicability and lack contextualization, and thus called for development of more home-grown theories “through emergence of new concepts which, with subsequent elaboration, integration, and validation, would gain the status of a theory” (p. 990). In line with this call, we adopt a theory-building approach using a multiple case study design. We studied four SMEs within the wine SCs of two developing economies[1] – the Republic of North Macedonia and the People’s Republic of China (hereafter referred as to Macedonia and China, respectively). From applying the theoretical lenses of transaction cost economics (TCE) and social exchange theory (SET) to the cross-case analysis, we develop nine propositions to explain how the interdependencies between the external environment, governance structures and interpersonal mechanisms impact ICT-enabled information sharing of SMEs in developing economies. Accordingly, we attempt to answer the following research questions:

RQ1. How and why do environmental uncertainty and institutional environment impact the governance structures of SMEs operating in SCs from developing economies?

RQ2. How do trust and distrust moderate the relationship between information sharing and ICT-enabled information sharing of SMEs operating in SCs from developing economies?

The rest of the paper is organized as follows. First, we review the literature to define the research gap and establish our theoretical foundations. Second, we describe our research methodology. Third, we present the within-case and cross-case analyses and then develop our propositions. Last, we discuss our propositions in relation to existing literature and summarize the contributions and limitations of our study.

Literature review

Environment, governance and interpersonal mechanisms in SCs from developing economies

Environmental uncertainty and institutional environment are critical macro-conditions for managing buyer–supplier relationships in developing economies (Luo and Yu, 2016). Environmental uncertainty is the degree of change and instability in the environment (Dess and Beard, 1984), which complicates the coordination between buyers and suppliers due to incomplete and asymmetric information (Krishnan et al., 2006). The institutional environment is defined as the “elaboration of rules and requirements to which individual organizations must conform in order to receive legitimacy and support” (Scott, 1995, p. 132). Developing economies often lack rule-based institutional systems and are dominated by relationship-based personalized exchanges that increase risk and transaction costs (Williamson, 1985).

Prior research identifies two governance structures for regulating market exchanges: contractual bonds and social bonds. Contractual bonds refer to SC partners’ adherence to specific written or oral agreements (Coleman, 1966), in which suppliers agree to manufacture and deliver goods and are compensated for their work in accordance with the contact terms (Wuyts and Geyskens, 2005). Social bonds are “the degree of mutual personal friendship and liking shared by the buyer and seller” (Wilson, 1995), which are unwritten agreements unenforceable by formal authority and power but rather reflect the aspiration to establish and nurture a reputation of integrity and trust (Gligor and Holcomb, 2013).

In developing economies, such as Macedonia and China, where the rule of law and enforcement of rights are weak, firms often rely on social bonds to achieve strategic flexibility (Cao and Lumineau, 2015). Developing and nurturing social bonds with suppliers,
competitors, distributors and governments are crucial for running operations and sustaining competitiveness (Jia and Zsidisin, 2014). Guanxi (written as “关系” in Chinese) is central to China’s social hierarchy, economic structure and institutional environment. Guanxi is the concept of drawing on a web of connections to secure a favor in personal and organizational relations (Xin and Pearce, 1996). Similar to guanxi, vrski (written as “врски” in Macedonian) is a network of contacts or social capital accessed by individuals seeking a favor or a service (Donner et al., 2014). Vrski represents an intangible corporate asset in the Macedonian business context.

Trust and distrust are important interpersonal mechanisms in SCs from developing economies with institutional deficiencies (Lumineau, 2017). Trust reflects the probability of a partner’s behavior toward a vulnerable focal firm in a SC, which creates value beyond the minimization of transaction costs in buyer–supplier exchanges (Rousseau et al., 1998). Distrust is the extent to which one believes that another individual does not have the desired beneficial characteristics with feelings of relative certainty (McKnight and Chervany, 2001). Distrust is not simply the absence of trust; it is a distinct construct from trust, or low trust (Lumineau, 2017). Distrust in buyer–supplier exchanges causes firms to adopt preventive mechanisms (e.g. information search, contact, negotiation, contract, monitoring and control) to reduce transactional uncertainty (Rindfleisch and Heide, 1997).

Supply chain collaboration in developing economies

SC collaboration is the joint work between two or more firms from one or multiple SCs, which plan or execute operations together horizontally (e.g. competitors, universities and intermediaries) and/or vertically (e.g. suppliers, retailers and consumers) with the intention of achieving a greater success than they could obtain in isolation (Skjoett-Larsen et al., 2003). Information sharing, a component of SC collaboration, enables SC partners to capture, store and provide information necessary for effective collaborative decision making (Simatupang and Sridharan, 2008). It involves data acquisition, processing, representation, storage and dissemination of demand conditions, end-to-end inventory status and locations, order status, cost-related data, and performance status. Simatupang and Sridharan (2008) further describe information sharing as a “glue” that integrates all the elements – collaborative performance system, decision synchronization, incentive alignment and innovative SC processes – of their SC collaboration framework through enabling greater SC visibly for improved collaborative decision making.

Prior research has investigated the influence of technological, organizational and environmental factors on ICT adoption and use for information sharing and collaboration of SMEs in developing economies (see Table AI). Most of these studies (Kurnia et al., 2015; Afolayan et al., 2015; Kabanda and Brown, 2015) focused on examining the determinants of ICT adoption and use through various theoretical perspectives such as the diffusion of innovations theory (DOI), the technology–organization–environment (TOE) framework and the resource-based theory (RBT) of the firm. Few studies (Gorane and Kant, 2017; Ding et al., 2012) have focused on investigating the impact of ICT use on organizational and SC performance.

Mirkovski et al. (2016) is the only study that explored the influence of environmental uncertainty and governance structures on ICT use for information sharing and collaboration of SMEs in both developed and developing economies. However, the latter study only implicitly considered the construct of institutional environment, which is a rather simplistic depiction of the complex and turbulent external environment in developing economies. Furthermore, Mirkovski et al. (2016) neither collected data on nor explored the relationships between interpersonal mechanisms and ICT-enabled information sharing in developing economies.

Building on Mirkovski et al. (2016), we develop a theoretical model that provides a comprehensive explanation of how and why the interdependencies between external
environment, governance structures and interpersonal mechanisms influence ICT-enabled information sharing, including information sharing and ICT-enabled information sharing, of SMEs operating in SCs from developing economies.

Theoretical perspectives: transaction cost economies and social exchange theory

Research recognizes TCE (Young et al., 2014) and SET (Lioukas and Reuer, 2015) as valuable theoretical lenses for studying macro-conditions in developing economies. We use TCE and SET to explain the interdependencies between external environment, governance structures and interpersonal mechanisms, which, in turn, influence ICT-enabled information sharing of SMEs in SCs from developing economies.

TCE defines the conditions under which firms should conduct activities internally or externally (Williamson, 1975). It proposes two fundamental modes, market (i.e. coordinating activities through external transactions) and hierarchy (i.e. coordinating activities within a firm) for governance and coordination of material flows in buyer–supplier exchanges (Williamson, 1975). In contrast, SET explains the exchange mechanisms in interpersonal relationships and considers the interaction processes between parties to be the center of the social exchange relationship, in which a firm’s behavior influences and evokes responses from other firms in an exchange relationship (Anderson and Narus, 1990).

Research methodology

Given the unclear relationship between ICT-enabled information sharing and its interdependencies with the external environment (environmental uncertainty and institutional environment), governance structures (contractual bonds and social bonds) and interpersonal mechanisms (trust and distrust) in SCs from developing economies, we adopt an inductive, theory-building approach using a multiple case study design (Eisenhardt and Graebner, 2007). The main units of analysis are information sharing and ICT-enabled information sharing in SMEs from the Macedonian and Chinese wine SCs, which are embedded in three theoretical perspectives of analysis, including environmental uncertainty, institutional environment and SC collaboration.

Case selection

Case selection was based on two criteria: theoretical replication and control. First, to enable theoretical replication and to better understand the relationship between external environment and government structures, we selected firms operating in comparable contexts – the developing economies of Macedonia and China – that fit the overarching themes in our model: external environment, governance structures, interpersonal mechanisms and SC collaboration. Second, we collected data from firms regularly involved in buyer–supplier exchanges to better understand the moderating influence of trust and distrust on the relationship between information sharing and ICT-enabled information sharing in SCs from developing economies.

Our case selection also aimed to control for factors such as firm size, industry and core business to ensure comparable units of analysis. We selected SMEs with a core business of bottled wine production in two developing economies within well-established wine industries. This allowed us to gain insights about SC collaboration, especially ICT-enabled information sharing, of SMEs with first-tier (e.g. grape farmers) and second-tier (e.g. glass bottle manufacturers) suppliers.

The four largest global producers, namely, France, Italy, Spain and the USA, have dominated the wine industry for the past three decades (Food and Agriculture Organization, 2018). Newer players, such as Macedonia and China, began to emerge on the international stage as important wine producers in the half decade after the year 2000 (Li and Bardaji, 2017;
Data collection
Data in this study were collected primarily by interviewing individuals who had extensive knowledge about SC operations or buyer–supplier relationships. We conducted formal face-to-face and online (via video conference) interviews with the operational managers, general manager and owner/manager of two Macedonian and two Chinese wineries. The formal interviews were conducted in two rounds, each following a semi-structured protocol including general and follow-up questions (see Appendix 2). The formal interviews lasted 60–90 min, totaling approximately 640 min (10.5 h) of audio recordings. We also conducted informal interviews with the operations staff in the wineries (i.e. oenologist, commercial manager and marketing assistant) during the on-site visits to better understand the background circumstances of each case. The informal interviews had durations of 30–45 min, adding up to around 320 min (5.3 h) of audio recordings.

Official company documents, interview observation notes and on-site observations notes supplemented our qualitative interview-based data. Notes were written after each formal and informal interview and winery visit. These notes codified facts and impressions about the operating environments in each case. Official company documents, such as supplier e-mail communication, suppliers’ minutes of meetings, company catalogs and promotional flyers, were used to corroborate critical details and insights from the on-site observation notes and informal interviews (see Table I).

Data analysis
We conducted the analysis in two stages (Miles and Huberman, 1994). First, within-case analysis focused on the salient characteristics of the three main themes: external environment, interpersonal mechanisms and governance structures. Cross-case analysis subsequently identified similarities and differences across the three main themes and highlighted emerging patterns. The template analysis technique (Nowell et al., 2017) was adopted for a thematic analysis of the transcribed interviews, company documentation, interview observation notes and on-site observation notes.

We began by developing a coding template that summarized the identified themes as an essential set of data. We were not fully constrained by preconceived ideas (i.e. priori codes) and allowed for codes to emerge (i.e. grounded codes), which were modified several times throughout the analysis depending on their relevance, ending up with eight themes (see Table II). Statements corresponding to these themes were selected, coded and analyzed using NVivo 10. To further meet the rigorous criteria for conducting a case study (i.e. construct validity, internal validity, external validity and reliability construct), we followed established procedures (see Table AII) to ensure the systematic documentation and rigor of the data analysis (Lee, 1989; Yin, 2009).

Within-case analysis
Cases 1 and 2: Kappa and Zeta in the Macedonian wine industry
Macedonia is a landlocked country in Southeastern Europe. It has around 83,000 acres of vineyards, predominantly owned and maintained by a mix of independent grape farmers and large agricultural conglomerates (Ministry of Agriculture Forestry and Water Economy, 2012). Its 86 licensed wineries mostly have small to medium production capacity, bottling around five million cases annually. Approximately 20,000 independent farmers contribute more than 50 percent of the fresh grapes for wine production. The wine
<table>
<thead>
<tr>
<th>Winery name (location)</th>
<th>Interviewees</th>
<th>1st round</th>
<th>2nd round</th>
<th>Documents and notes (length and dates)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kappa (Macedonia)</strong></td>
<td>Operational manager</td>
<td>Individual formal interview (~90 min; June 2011; face to face)</td>
<td>Individual formal interview (~90 min; May 2013; face to face)</td>
<td>Interview observational and on-site observational notes (~2 pages, June 2011)</td>
</tr>
<tr>
<td></td>
<td>Oenologist</td>
<td>Individual informal interview (~45 min; June 2011; face to face)</td>
<td>Individual informal interview (~45 min; May 2013; face to face)</td>
<td>Suppliers’ minutes of meeting (~1 page, June 2011)</td>
</tr>
<tr>
<td><strong>Zeta (Macedonia)</strong></td>
<td>Operational manager</td>
<td>Individual formal interview (~90 min; June 2011; face to face)</td>
<td>Individual formal interview (~80 min; May 2013; face to face)</td>
<td>Interview observational and on-site observational notes (~2 pages, June 2011)</td>
</tr>
<tr>
<td></td>
<td>Oenologist</td>
<td>Individual informal interviews (~45 min; June 2011; face to face)</td>
<td>Individual informal interviews (~40 min; May 2013; face to face)</td>
<td>Suppliers’ minutes of meeting (~1 page, June 2011)</td>
</tr>
<tr>
<td><strong>Sigma (China)</strong></td>
<td>General manager</td>
<td>Individual formal interview (~80 min; October 2012; face to face)</td>
<td>Individual formal interview (~80 min; May 2013; video conference)</td>
<td>Interview observational and on-site observational notes (~2 pages, October 2012)</td>
</tr>
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<td></td>
<td>Commercial manager</td>
<td>Individual informal interview (~45 min; October 2012; face to face)</td>
<td>Individual informal interview (~40 min; May 2013; video conference)</td>
<td>Company catalogue and promotional flyers (~2 pages, October 2012)</td>
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<td><strong>Gamma (China)</strong></td>
<td>Owner/Manager</td>
<td>Individual formal interview (~60 min; March 2014; face to face)</td>
<td>Individual formal interview (~70 min; May 2013; video conference)</td>
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<td>Marketing assistant</td>
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<td>Observational and on-site notes (~2 pages; March 2014)</td>
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<td><strong>Total</strong></td>
<td></td>
<td>485 min (~8 h)</td>
<td>475 min (~8 h)</td>
<td>19 pages</td>
</tr>
</tbody>
</table>

Table I. Data collection

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industry is a significant contributor to Macedonia’s export economy, engaging about 25,000 full- and part-time employees (Ministry of Agriculture Forestry and Water Economy, 2012).

Kappa produces entry- and mid-level wines, whereas Zeta focuses on production of premium wines. Kappa’s organizational structure is moderately layered in which employees have clearly defined responsibilities. Zeta has a flat organizational structure with low levels of specialization. Kappa and Zeta source their wine supplies from multiple manufacturers located in Macedonia, Greece, Bulgaria, Serbia, France, Spain and Germany. Kappa works with ten independent local vineyards that supply additional fresh grapes for wine production. Zeta sources up to 60 percent of its fresh grapes for wine production from five local vineyards.

Environmental uncertainty

Kappa’s and Zeta’s managers experience high uncertainty in terms of supply, quality and price for fresh grapes, glass bottles and wine labels/cartons. For example, managers usually...
have difficulties in dealing with the vineyards from whom they purchase additional supplies of grapes. The difficulties come primarily from the unpredictability of the annual grape harvest. The harvest is influenced by uncontrollable events, such as the weather. The specific quantity, quality and price for fresh grapes are not known until they are harvested. The turbulent environment in the market for wine supplies makes it difficult and costly for wineries to create contracts with their suppliers that account for all potential risks. Under such conditions, suppliers may act opportunistically by interpreting vague contractual articles and clauses to their own benefit. To prevent opportunistic behavior, Kappa and Zeta use relational governance structures, such as social bonds, that focus on long-term relationships rather than short-term contractual transactions:

[...] I would say it is an open relationship that allows you to rely on a supplier in some unusual conditions. You know, if you have such close cooperation with your suppliers, that makes them more flexible in dealing with you in terms of prices, quantities, delivery terms, and so on. (Zeta’s manager)

Managers believe that development and cultivation of social bonds with suppliers may overcome the limitations of contractual governance, such as contractual bonds, in dealing with environmental uncertainty in the market for wine supplies. Kappa’s manager prefers to establish social bonds (vrski) for social control and inspection of local vineyards’ poor operational procedures and unreliable quality assurance practices, which may reduce the quality and supply for fresh grapes:

We like to work closely with our grape cooperatives. Most of the time they are under our supervision and I have many in-person meetings with them to ensure that they are working according to the given instructions for [grape] pruning, tying and harvesting. (Kappa’s manager)

Kappa’s and Zeta’s managers stress the importance of social bonds in dealing with suppliers. Giving and taking favors from suppliers is an integral part of doing business. Managers point out that social bonds directly impact trust establishment in buyer–supplier exchanges, in which trust is the product of good relationships. Calling in a favor is particularly important when doing business with monopolistic suppliers, such as glass bottle and label/carton manufacturers, who increase the environmental uncertainty for wine suppliers in terms of price:

For printing houses, it is not profitable to turn on their machines for orders of less than 2,000 [labels] [...] in such situations definitely we have to use our established relationship and try to persuade them to do us a favor. (Kappa’s manager)

Institutional environment
Managers mention that social bonds play an important role in the development of long-term and trusted partnerships with suppliers. Social bonds protect wineries’ commercial exchange interests on the local market for wine supplies. Due to the lack of systemic trust and weak legal enforceability of contracts, which are a consequence of the ineffective legal system in Macedonia, social bonds are extensively practiced to protect exchanges with suppliers:

Why do I want to go to court directly and incur all these costs and time? Most of the court procedures in Macedonia are expensive and time consuming. For both of the parties, it is more beneficial to find common grounds and avoid the courts. (Kappa’s manager)

Kappa’s and Zeta’s managers stated that the weak legal enforceability of the institutional environment in Macedonia influences their preference to develop either contractual or social
bonds in exchanges with suppliers. Weak legal enforceability of contractual bonds, especially in terms of interest protection and money refunds, increases the value for social bonds:

(In) Macedonia the laws are not really respected. Actually, people are more respected than laws. So, when you sign a contract with a local supplier, it is basically a symbolic one. (Zeta’s manager)

Supply chain collaboration

In their initial negotiations, Kappa’s and Zeta’s managers define product or service agreements, which specify expected levels of performance from suppliers. Managers and suppliers engage in dynamic bi-directional negotiations, which may result in written agreements including details on product type, product price, product quality levels, product lead-time, product packing and delivery, and payment terms. Managers have face-to-face meetings with suppliers in the initial negotiations. They acknowledge that e-mail, instant messenger (IM) and video conferencing cannot replace the richness of face-to-face interactions that are necessary to facilitate information sharing in the initial negotiations with suppliers:

Face-to-face communication is better for the initial contacts with suppliers. [...] Basically, during these initial face-to-face contacts with your suppliers you develop trust. (Kappa’s manager)

These in-person contacts with suppliers are significant for decreasing distrust in the early stages of buyer–supplier exchanges when both of the parties are not familiar with each other. Distrusting beliefs about suppliers’ integrity and competence in terms of manufacturing, delivery and ICT capabilities encourages managers to impose high control activities in the initial negotiations, which limit suppliers’ operational autonomy and reduce use of e-mail, IM and video conferencing for information sharing:

It is important to make the first contact face-to-face so that your suppliers give you better prices and trust you for the long-term commitment. (Zeta’s manager)

Managers assert that it is more efficient to rely on ICT-enabled information sharing with suppliers after establishing the initial contacts. They mention that after finalizing the commercial conditions in the initial negotiations, information sharing becomes standardized. Once the initial trust is established and suppliers are persuaded about the long-term commitment of Kappa and Zeta, most of the information sharing is conducted over e-mail and IM. Moreover, managers avoid under- or over-stocking due to the small sizes of their warehouses; thus, they expect timely and precise supply deliveries, and use e-mail and IM to share accurate details about delivery dates and product availability:

They [suppliers] need to tell us exactly when they will ship the order so that we prepare for production. They inform us about the delivery dates on email or Skype messenger. (Kappa’s manager)

Before each order placement, suppliers send us the stock levels of their supplies over email. (Zeta’s manager)

In the technical product specification exchange, managers coordinate with suppliers to produce customized products in accordance with the preferences of end-consumers. Suppliers create prototypes of customized supplies (e.g. new glass bottle designs) in the form of technical product specifications, which are shared with managers for further refinement. Kappa’s and Zeta’s managers share technical drawings and specifications with suppliers through web file-hosting sites. Subsequent face-to-face meetings are necessary to confirm details. Managers rely on both ICTs and personal interactions to share technical drawings and specifications due to distrust in suppliers’ manufacturing capabilities:

The fastest and most efficient way would be to share these [technical drawings and specifications] with our suppliers electronically through file hosting services [...] to make things clearer and avoid costly mistakes, we prefer to have meetings with our supplier in person. (Kappa’s manager)
I think that email would be good enough [for collaborative tasks]. Perhaps we can attach some images or technical drawings for reference. We had such customization case for our capsules, where we had to send email with attached images of the wine bottle necks so that the supplier understands the size requirements. (Zeta’s manager)

Trust moderates the relationships between information sharing and ICT-enabled information sharing. Kappa’s and Zeta’s managers have developed trust in their long-term suppliers. These long-term partnerships are characterized by trusting beliefs in suppliers’ integrity, benevolence and competence in terms of manufacturing capability, which leads to engagement in trust-related behaviors. Trusted suppliers are given higher operational autonomy and tend to use ICT frequently to share information freely and coordinate activities informally.

Cases 3 and 4: Sigma and Gamma in the Chinese wine industry

China’s increasing wine consumption has contributed to the emergence of many wineries across the country. There is a particular concentration of wineries in the western regions of Tibet and Xinjiang, which have fertile grounds, dry climates, high altitudes, sandy soils and low precipitation (Li, 2016). China has around 500 officially registered wineries that produce approximately 150m cases annually from approximately 2m acres of vineyards. More than 50 percent of the market share is controlled by government-owned and investment holding companies (Li and Bardají, 2017).

Sigma produces entry-level wines, whereas Gamma focuses on production of mid-range wines. Sigma and Gamma have hierarchical organizational structures with high job specialization. Sigma and Gamma source wine supplies from multiple manufacturers in China and the USA. Sigma has approximately 100 acres of vineyards, which account for 20 percent of its annual production, and sources additional fresh grapes from six local vineyards. Gamma, on the other hand, has around 250 acres of vineyards, accounting for 95 percent of its production capacity. Two local vineyards supply the remaining fresh grapes for wine production.

Environmental uncertainty

Sigma and Gamma operate in a highly uncertain environment regarding the quality and prices for fresh grapes and wine labels/cartons. For example, it is difficult to find suppliers of high-quality wine labels and cartons. Social bonds (guanxi) contribute significantly to trust, providing operational flexibility for wineries and suppliers to handle uncertainties related to long-term exchange relationships. Establishing social bonds with local vineyards reduces environmental uncertainty for fresh grapes and has a positive influence on Sigma’s and Gamma’s trusting belief about supplier’s benevolence:

And I know how they [grape suppliers] grow their [fresh] grapes so [...] people that are your friends are more likely to give you help when you need it. In that situation, you will not be on the “top of the pile” and they will be more willing to help you. (Gamma’s manager)

Managers mention that social bonds in buyer–supplier relationships are more valuable than contracts for mitigating potential risks in the market for wine supplies in China. Emotional ties are associated with tolerance and vagueness of commercial conditions in contracts. When activities drift away from the contracted terms, disputes are less likely with suppliers who have strong personal relationships with managers:

If we [winery and suppliers] have differences with respect to price, we will reach a compromise [...] if we do not need the product immediately, we don’t care about the delayed time. We become even better friends after this cooperation. (Sigma’s manager)
Institutional environment
Sigma’s and Gamma’s managers expressed concerns about legally protecting their interests and getting money refunds, thus increasing distrust of Chinese suppliers. Distrust in a supplier’s integrity and competence for manufacturing capability leads to high control activities, which reduces ICT-enabled information sharing. If managers are doubtful that a particular supplier has made good faith agreements or possesses adequate manufacturing capabilities to meet requirements, they are more likely to engage in control activities:

If a supplier in the past didn’t live up to her promises [manufacturing capabilities] then I will be more careful when dealing with her […] I will not organize all the details over email or IM, and will make an [face-to-face] appointment. (Gamma’s manager)

Similarly, managers have a tendency to engage in disputes and avoid potential business transactions. The latter decreases the frequency of ICT-enabled information sharing with suppliers who are not believed to have sufficient manufacturing and delivery capabilities:

For example, some products must be delivered within one week, but they are delayed. […] Sometimes we signed and finished packing, he [supplier] changed something or the quality has problem. We had to quarrel […] some of them [suppliers] are quite shameless. (Sigma’s manager)

Despite managers’ concerns with the institutional environment in China, contractual bonds are still perceived as valuable governance structures in buyer–supplier exchanges. Sigma’s manager signs formal contracts with suppliers to define commercial conditions. Contractual bonds are a foundation for achieving consensus regarding the initial contract terms. However, these contracts tend to be renegotiated regularly:

For the first time, we always sign a contract with suppliers. The conditions are basic, but we use the contract only as an anchor […] Of course, the conditions change as we have to meet the demands of many customers, [so] we renegotiate with suppliers as needed. (Sigma’s manager)

By contrast, Gamma’s manager does not sign formal contracts with suppliers largely due to the weak legal enforceability in China. Contracts are perceived to have limited value as it takes much time and money to enforce them. The manager uses a simple invoice, which clearly states the purchase terms and conditions, to monitor transactions with suppliers. Contractual bonds are not perceived as a reassurance and do not have any positive impact on trusting beliefs about suppliers’ manufacturing and delivery capabilities:

We don’t have [annual] contract with them [suppliers]. We have requirements about the grape ripeness and the sugar levels […] if the grapes are diseased, not more than 2% can be affected. These are industry standards and they have to be met by [grape] suppliers. (Gamma’s manager)

Supply chain collaboration
In the delivery dates and product availability exchanges, Sigma’s and Gamma’s managers share information on stock levels and estimated delivery times with suppliers. Gamma’s manager considers that sharing information over ICT is more accurate. However, Sigma’s manager acknowledges that occasional face-to-face meetings are necessary for urgent matters in the initial negotiations:

If we already have good cooperation with a supplier, we use electronic means: email, IM and so on. In such a way, we will be more efficient and accurate in our communication. (Gamma’s manager)

It is convenient for us to communicate [with suppliers] over email. If we have a very important issue in the beginning of our business and we need to solve it immediately, then we like to visit our suppliers in person or ask them to come over. (Sigma’s manager)

For new product development, Sigma’s and Gamma’s managers exchange ideas and suggestions with suppliers to collaboratively create new glass bottles, bottle capsules and
labels/cartons. Managers mention that ICT is an efficient and effective platform for information sharing with trusted suppliers. E-mail, IM, video conferencing and web file-hosting sites are used for information sharing of delivery dates, product availability and technical product specification, and new product development between wineries and their suppliers:

We share information needed for our [wine] production and work on designing new labels. (Gamma’s manager)

Trust has a moderating impact on ICT-enabled information sharing. If managers are confident that a certain supplier is trustworthy and possesses the capability to manufacture and deliver according to their requirements, it is more probable for them to use ICT for information sharing:

There will not be a problem if we all treat each other sincerely […] Trust is very helpful for the next [electronic] communication […] If we know this supplier and she can meet our requirements then we can use electronic communication to exchange information and work together on new products. (Sigma’s manager)

Ours labels are quite detailed and there is lot of work that goes into them. So, we work with suppliers we trust. For big prints, larger orders, we always work with suppliers who we know [… ] we do the all the work over the Internet. (Gamma’s manager)

**Propositions from applying theoretical perspectives to cross-case analysis**

*Environmental uncertainty*

A central argument of TCE is that buyers and suppliers are rarely in a position to foresee all possible eventualities during the course of their exchange relationship. This makes contractual governance structures vulnerable to opportunism in terms of performance levels, non-conformance punishments, conflict resolution and relationship termination (Williamson, 1975). Environmental uncertainty creates adaptation (i.e. inability to specify precisely certain contractual aspects) and evaluation (i.e. difficulty to determine the enforceability of the contractual terms) problems for market governance (Williamson, 1975), which increase the transaction costs of contract renegotiation and terms modification and reinforcement (Rindfleisch and Heide, 1997). Hence, high environmental uncertainty may encourage suppliers to engage in opportunistic behaviors.

Uncertainty regarding the supply, quality and price of key inputs encourages the developing and nurturing of social bonds in both cases. Macedonian managers face high levels of uncertainty regarding the supply of fresh grapes, glass bottles and wine labels/cartons. Hence, they tend to establish social bonds with independent vineyards and other suppliers. Similarly, there is a high level of uncertainty with respect to the quality and price of fresh grapes and wine labels/cartons in the Chinese wine industry. This decreases the use of contractual bonds and increases the reliance on social bonds to safeguard buyer–supplier transactions. Therefore, we propose:

*P1a.* Higher levels of environmental uncertainty decrease the reliance on contractual bonds by SMEs in SCs from developing economies.

*P1b.* Higher levels of environmental uncertainty increased the reliance on social bonds by SMEs in SCs from developing economies.

*Institutional environment*

One of the fundamental assumptions of TCE is the existence of institutional frameworks for protecting market transactions (Williamson, 1975). Institutional frameworks are “rules-of-the-game” that regulate exchanges using regulative, normative and cognitive structures
(Williamson, 1985). TCE further posits that in the absence of strong formal institutions, as typically occur in developing economies, contractual governance structures are harder to legally enforce, which necessitates “self-enforcing” governance mechanisms for regulating buyer–supplier transactions (Williamson, 1985).

In both cases, managers are concerned about the institutional deficiencies, such as lack of institutional transparency and accountability, lack of judicial independence and impartiality, and frequency of occurrence of corrupt behavior such as bribery and extortion, which reduce systemic trust and legal enforceability. Ineffective legal systems in Macedonia and China encourage managers to extensively cultivate interpersonal relationships with suppliers. Managers prefer to do business with trustworthy suppliers who are within their social circle. The weak legal enforceability of transactions for fresh grapes and wine supplies in terms of interest protection and money refund reduces the use of contractual bonds. Hence, we posit:

\[ P2a. \] Institutional deficiencies decrease the reliance on contractual bonds by SMEs in SCs from developing economies.

\[ P2b. \] Institutional deficiencies increase the reliance on social bonds by SMEs in SCs from developing economies.

TCE has been used to explain issues related to SC partnerships, including commitment and stability (Williamson, 2008). TCE explains the proliferation of intermediate governance structures, such as SCs, and proposes that these modes are regulated with “economic weapons,” such as legally enforceable contracts and other credible economic commitments, to create a locked-in condition under which fair SC partnerships are sustained (Williamson, 2008). Contracts reduce the potential for opportunism by locking partners into a commitment with expected long-term gains that exceed the potential short-term gains from opportunism or defection (Williamson, 2008).

SET complements TCE by focusing on how social relationships impact and transform market-based relationships and exchange governance (Nooteboom, 1996), which is relevant to developing economies with weak institutional environments. Developing economies are deficient in rule-based systems and commonly rely on relationship-based personalized exchanges. Institutional structures in developing economies are susceptible to relational contracting rather than arm’s length transactions, in which formal rules are substituted by informal ones (Martinsons, 2008).

Macedonian managers typically do not sign formal contracts with local suppliers due to the weak legal enforceability of contractual bonds. Social bonds enhance managers’ trust in their suppliers’ benevolence and integrity. Social bonds also have a negative effect on distrusting beliefs about suppliers’ integrity and manufacturing capabilities. In the Chinese wine industry, managers do sign contracts with their suppliers; however, these contracts are perceived only as a starting point for regular renegotiation rather than a fixed mechanism for safeguarding buyer–supplier transactions. Reliance on social bonds to protect buyer–supplier transactions positively influences managers’ trusting beliefs about suppliers’ benevolence and manufacturing capability, which encourages continuance of business transactions. Emotional ties to suppliers are associated with tolerance and vagueness over contracts. Hence, we develop the following propositions:

\[ P3a. \] An increased reliance on social bonds by SMEs will be associated with increased levels of trust in SCs from developing economies.

\[ P3b. \] An increased reliance on social bonds by SMEs will be associated with decreased levels of distrust in SCs from developing economies.
Supply chain collaboration

Wine SCs typically begin with raw materials: fresh grapes, wine yeast, labels/cartons, glass bottles, bottle capsules and bottle corks. In the fragmented upstream SCs of the Macedonian and Chinese wine industries, wineries act as focal firms that aggregate different raw materials from various first-tier suppliers to produce bottled wines (see Figure 1). Wineries usually deal with multiple suppliers, resulting in a multitude of orders and material flows throughout the year (see Table III).

Trust is considered a moderating mechanism in exchanges between wineries and their suppliers. Frequent information exchange, which is a trait of a trustworthy exchange relationship, enhances managers’ comprehension of suppliers and their business environment (Croom et al., 2007). Information from suppliers regarding the demand for raw materials and unstable market prices decreases the information gap, which makes wine SCs more resilient to market contingencies.

Macedonian and Chinese managers perceive that trust and distrust are moderating mechanisms in buyer–supplier exchanges. Managers’ trusting beliefs about suppliers’ integrity, benevolence and competence for manufacturing and delivery lead to acceptance of influence, high autonomy, free information sharing and continuance of business. The latter behaviors encourage ICT-enabled information sharing. Therefore, we posit:

\[ P4a. \text{ Trust increases the use of ICT for information sharing by SMEs in SCs from developing economies.} \]

Sundaramurthy and Lewis (2003) show that distrust has a negative effect on buyer–supplier relationships, decreasing the performance of both buyers and suppliers. Distrust causes wine SC partners both to hesitate to disclose information and to be suspicious of the validity of information received. Managers who distrust their suppliers’ competence in terms of

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**Figure 1.**
Material, information and financial flows in upstream wine SC
manufacturing and delivery capabilities and their integrity and benevolence impose mechanisms for tight control, engage in disputes and avoid business transactions. The latter limits ICT-enabled information sharing in both Macedonian and Chinese wine SCs. Hence:

*P4b.* Distrust decreases the use of ICT for information sharing by SMEs in SCs from developing economies.

TCE posits two main assumptions: bounded rationality (i.e. when a firm is unable to fully process all available market information due to limited access and time) and opportunism (i.e. when a firm pursues self-serving behavior) (Williamson, 1975). In developing economies with high levels of bounded rationality and opportunism, firms have to meticulously monitor and control their market exchanges to reduce opportunistic behaviors such as ignorance of responsibilities, inflation of prices, late deliveries and partial information disclosure (Badri et al., 2000). To reduce transactional uncertainty, firms impose preventive mechanisms, such as information search, contact, negotiation, contract, monitoring, control, assurance and inspection (Rindfleisch and Heide, 1997).

Martinez and Williams (2010) argue that ICTs can be efficient tools for searching, contacting, negotiating, monitoring and controlling suppliers, thus reducing transaction costs and minimizing opportunistic behaviors in dyadic buyer–supplier relationships. ICTs facilitate information flows between wineries and their upstream suppliers (see Figure 2). Macedonian and Chinese managers prefer to use ICTs over other available communication channels, such as face to face, for information sharing, due to lower costs and higher efficiency, which, in turn, leads to an increase in SC collaboration. Technologies such as e-mail, IM, video conferencing and web file-hosting sites are used to

<table>
<thead>
<tr>
<th>Suppliers/Winery (location)</th>
<th>Kappa (Macedonia)</th>
<th>Zeta (Macedonia)</th>
<th>Sigma (China)</th>
<th>Gamma (China)</th>
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<tbody>
<tr>
<td>Fresh grape vineyards</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of suppliers</td>
<td>10</td>
<td>5</td>
<td>6</td>
<td>2</td>
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<tr>
<td>Annual order placement</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Annual material flow</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Glass bottle supplier</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of suppliers</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Annual order placement</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Annual material flow</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>2</td>
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<tr>
<td>Bottle capsule supplier</td>
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<td></td>
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<td></td>
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<tr>
<td>Number of suppliers</td>
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<td>1</td>
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<tr>
<td>Annual order placement</td>
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<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Annual material flow</td>
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<td>1</td>
</tr>
<tr>
<td>Bottle cork supplier</td>
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<td>Number of suppliers</td>
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<td>2</td>
<td>1</td>
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<tr>
<td>Annual order placement</td>
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<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Annual material flow</td>
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<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Label/ Carton supplier</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Number of suppliers</td>
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<tr>
<td>Annual order placement</td>
<td>11</td>
<td>15</td>
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<tr>
<td>Annual material flow</td>
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<td>30</td>
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<tr>
<td>Wine yeast supplier</td>
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<tr>
<td>Number of suppliers</td>
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<td>Annual order placement</td>
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<tr>
<td>Annual material flow</td>
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</tr>
</tbody>
</table>

*Table III.* Winery–supplier interaction frequency

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share information concerning initial negotiations, delivery dates and product availability exchange, technical product specification exchange, and new product development exchange (see Table IV).

Macedonian managers consider face-to-face communication necessary only for initial interactions with their suppliers. In contrast, Chinese managers rely on face-to-face communication to solve only immediate or urgent matters in the initial negotiations with suppliers or when they share information with them to develop new products. Hence, when wineries increase their information quality and exchange frequency (i.e. sharing more relevant operational, tactical and strategic information over a specific period of time) with a supplier, it is more likely that ICT becomes the preferred channel for information sharing.

### Table IV. ICT-enabled information sharing in SC processes

<table>
<thead>
<tr>
<th>Winery (location)/process</th>
<th>Initial negotiations</th>
<th>Delivery dates and product availability exchange</th>
<th>Technical product specification exchange</th>
<th>New product development exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kappa (Macedonia)</td>
<td>Face to face</td>
<td>E-mail and IM</td>
<td>Web file-hosting sites, and face to face</td>
<td>E-mail, IM, video conference and web file-hosting sites</td>
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<tr>
<td>Zeta (Macedonia)</td>
<td>Face to face</td>
<td>E-mail and IM</td>
<td>E-mail</td>
<td>Instant messaging, video conference and web file-hosting sites</td>
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<tr>
<td>Sigma (China)</td>
<td>E-mail, video conferencing and face to face</td>
<td>E-mail and IM</td>
<td>E-mail and web file-hosting sites</td>
<td>E-mail, video conferencing and web file-hosting services sites</td>
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<td>Gamma (China)</td>
<td>E-mail, IM and face to face</td>
<td>E-mail and IM</td>
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<td>E-mail, IM and face to face</td>
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**Figure 2.** Material, information and financial flows in upstream wine SC.
because it reduces opportunism and transaction costs, thus increasing ICT-enabled information sharing. Hence, we propose:

\[ P5. \] High-frequency and high-quality information sharing increases the use of ICT for information sharing by SMEs in SCs from developing economies.

Discussion and conclusions

Our study developed a comprehensive theoretical model to explain how and why the interdependencies between external environment, governance structures and interpersonal mechanisms influence ICT-enabled information sharing of SMEs operating in SCs from developing economies. Our study is in line with Soosay and Hyland’s (2015) call for further contributions to the emerging theme of “collaboration for technology-enabled [SCs].” Furthermore, we responded to Liu and McKinnon’s (2016) call for a more contextualized theoretical development by adopting an inductive, theory-building methodology to explore the wine industries of Macedonia and China. Based on cross-case analysis and the theoretical lenses of TCE and SET, we developed nine propositions in our model (see Figure 3).

\[ P1a–P2b \] relate the external environment to the choice of governance structure in SCs from developing economies. The environmental uncertainty for fresh grapes and wine supplies in the Macedonian and Chinese wine industries, together with institutional deficiencies, encourages managers to develop and nurture social bonds with independent vineyards and wine suppliers. This is consistent with Silvestre (2015) in that environmental turbulence and institutional voids lead to a lack of transparency and trust, a high degree of complexity and decision making under conditions of extreme ambiguity. Taken together, these conditions encourage the use of more flexible governance in buyer–supplier exchanges. Similarly, this finding confirms Mirkovski et al.’s (2016) claims that environmental uncertainty reduces contractual governance, yet increases social governance in SCs from both developed and developing economies.

\[ P3a \text{ and } P3b \] deals with the impact of relational governance structures on interpersonal mechanisms. Due to the weak legal enforceability of contracts, Macedonian and Chinese managers perceive social bonds to be more valuable for protecting their interests in transactions. This increases their trust and reduces their distrust in suppliers’ benevolence, integrity and competence. This is in line with Santarelli and Tran’s (2013) findings that social capital nurtures trustworthy relations of entrepreneurial firms and their suppliers operating in Vietnam.

\[ P4a \text{ and } P4b \] argues that trust and distrust moderate the relationships between information sharing and ICT-enabled information sharing. On the one hand, the trusting beliefs of Macedonian and Chinese managers about suppliers’ integrity, benevolence and

\[ P5 \text{ (+)} \]

ICT-enabled information sharing
competence encourage acceptance of influence, high autonomy, free information sharing and continuance of business. These behaviors positively moderate the relationships between information sharing and ICT-enabled information sharing. On the other hand, managers’ distrusting beliefs about suppliers’ integrity, benevolence and competence lead to imposing mechanisms for tight control, engaging in disputes and avoiding business transactions, which negatively moderate the relationship between information sharing and ICT-enabled information sharing. This finding is congruent with Chae et al. (2005) who explored the moderating role of interorganizational relationships between SC partners (i.e. trust, interdependence, long-term orientation/commitments and information sharing) in the relationship between interorganizational IT and SC collaboration. This study verified that existing formative contexts between partners both enable and constrain the effect of IT on interorganizational collaboration.

P5 explains the relationship between information sharing and ICT-enabled information sharing. Macedonian and Chinese managers prefer to use ICTs, such as e-mail, IM, video conferencing and web file-hosting sites, for information sharing and collaboration due to the lower costs and higher efficiency. With the increase of information quality and exchange frequency between a winery and its suppliers, ICT-enabled information sharing will likely increase as it reduces opportunism and transaction costs, consistent with Chong et al.’s (2009) findings that ICT reduces transaction costs in SCs.

Contributions to theory
Our theoretical contribution is threefold. First, we develop a theoretical model and set of propositions that explain how trust and distrust moderate the relationship between information sharing and ICT-enabled information sharing; and why environmental uncertainty and institutional environment impact governance structures in four SMEs from the upstream wine SCs of two developing economies. We propose that the nature of the external environment (i.e. environmental uncertainty and institutional environment) encourages the use of social bonds to safeguard exchanges in SCs from developing economies. This, in turn, contributes to trust development and distrust reduction that moderate the relationship between information sharing and ICT-enabled information sharing. Second, using the theoretical lenses afforded by TCE and SET, we explore the antecedents of trust and distrust in developing economies, which contribute to the use of ICT for information sharing and thus increase SC collaboration. We modify Mirkovski et al.’s (2016) model to explicitly consider the construct of institutional environment and explore its relationship with governance structures, which provides a more comprehensive explanation of the external environment in developing economies; and investigate the relationships between the interpersonal mechanisms and ICT-enabled information sharing with qualitative data, all of which provide a better understanding of the moderating role of trust and distrust in ICT-enabled information sharing in SCs from developing economies. Third, we add to the knowledge base on ICT-enabled information sharing of SMEs in the artisan-oriented and low-tech wine industries. Our theoretical model provides a comprehensive explanation of how and why the interdependencies between external environment, governance structures and interpersonal mechanisms impact ICT-enabled information sharing of SMEs operating in SCs from developing economies.

Contribution to practice
Firms and their managers who intend to facilitate collaboration for ICT-enabled SCs in developing economies will also benefit from this study. First, firms have to develop and nurture social bonds with their suppliers, especially those associated with high levels of environmental uncertainty in terms of supply, quality and price. For example, SMEs and their suppliers can collaboratively plan for supply and demand projections (e.g. annual
projection for fresh grape purchase); cooperatively host idea brainstorming sessions for new product development (e.g. developing new bottle wine concepts targeted at emerging markets); and/or jointly host teambuilding activities and events (e.g. joint grape harvesting). This will increase trust and decrease distrust associated with ICT-enabled information sharing, which, in turn, will contribute to information integration in SCs. Second, firms from developing economies should consider engaging in activities that help reduce both environmental uncertainty and institutional voids in SCs, since these will have a positive impact on ICT-enabled information sharing and thus SC collaboration. For example, SMEs can consider: developing contractual bonds by using a developed economy’s institutions (e.g. Chinese SC partners signing a legally binding contract in Hong Kong); using private information to support decisions in buyer–supplier exchanges (e.g. withdrawing intellectual property from opportunistic suppliers); internalizing certain production activities (e.g. design of wine labels) to reduce transaction costs; and leveraging social responsibility to improve legitimacy and credibility and reduce opportunism in buyer–supplier exchanges (e.g. sourcing from environmentally conscious suppliers).

Limitations and future research

Our inductive theory-building approach draws on cases from two developing economies to develop a set of propositions about the interorganizational information sharing in SMEs. We encourage future research to examine interorganizational information sharing in other (larger) developing economies (e.g. India, Brazil and Turkey) as well as more developed economies (e.g. the USA and Western Europe). A particular focus should be placed on how social bonds influence trust and distrust, and thus the willingness to share information with unfamiliar SC partners. Such studies could further refine and test the generalizability of our preliminary theoretical model. Researchers are also encouraged to collect data from other SC partners, such as first- and second-tier suppliers, to further refine and validate our propositions.

Note


References


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<tr>
<td>Foong (1999)</td>
<td>Influence of user personal attributes and system-related attributes on ICT use of SMEs</td>
<td>Top management support, IT expertise, extensive computerization of tasks, easy access to computer facilities and educated users are significant determinants of ICT use</td>
<td>Manufacturing and services</td>
<td>Survey (n = 49)</td>
<td>n/a</td>
<td>Malaysia</td>
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<td>Sarosa and Zowghi (2003)</td>
<td>Development of a process model for ICT adoption in SMEs</td>
<td>The proposed process model, which considers drivers and barriers, ICT adoption consists of six steps: (1) assessing the SMEs’ IT requirements; (2) assessing the organizational IT maturity; (3) evaluating the available IT solutions in the market; (4) matching the available solutions with the SMEs’ IT requirements and SMEs’ IT maturity/readiness; (5) implementing the selected IT solution; and (6) posting the adoption evaluation</td>
<td>Manufacturing (furniture)</td>
<td>Case study (n = 1)</td>
<td>Diffusion of innovation theory (DOI)</td>
<td>Indonesia</td>
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<td>Acar et al. (2005)</td>
<td>Perceptions of the impact of ICTs, extent of investment of ICTs, level of usage of ICT and software preferences of SMEs in the construction industry</td>
<td>Organizational size impacts attitudes toward ICTs of SMEs. SMEs use ICT internally for record-keeping, accounting, scheduling and information sharing, whereas they use ICT externally for bidding, scheduling and measuring productivity</td>
<td>Manufacturing (construction)</td>
<td>Survey (n = 227)</td>
<td>n/a</td>
<td>Turkey</td>
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<td>Arroyo et al. (2007)</td>
<td>Influence of external (supply chain (SC) partners’ pressure and business environment) and internal (top management risk perceptions and attitude toward ICT, organizational infrastructure, and organizational culture) factors on ICT adoption and use of SMEs in SCs</td>
<td>SC partners have impact on ICT adoption only, whereas top management perception of risk, organizational infrastructure and organizational culture have impact on both ICT adoption and use</td>
<td>Manufacturing and services</td>
<td>Survey (n = 84)</td>
<td>DOI</td>
<td>Mexico</td>
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<td>Ghobakhloo <em>et al.</em> (2011)</td>
<td>Influence of employee involvement, top management involvement and support, employee IS knowledge, and external assistance on ICT use and satisfaction</td>
<td>ICT adoption success is affected by employee involvement and IS knowledge, top management support and external assistance</td>
<td>Manufacturing</td>
<td>Survey ((n = 124))</td>
<td>Resource-based theory (RBT)</td>
<td>Iran</td>
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<td>Ding <em>et al.</em> (2012)</td>
<td>Moderating role of ICT support in relationship between standard operations procedures in SMEs</td>
<td>ICT support strengthens the relationship between performance benchmarking and distribution support but weakens that between processes for increasing flexibility and distribution support as well as that between processes for increasing responsiveness and agility</td>
<td>Service (logistics)</td>
<td>Survey ((n = 76))</td>
<td>RBT</td>
<td>China</td>
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<td>Kurnia, Karnali and Rahim (2015)</td>
<td>ICT adoption and use of SMEs from three perspectives: (1) Technological context: perceived benefits, compatibility, complexity, security/risks and cost (2) Organizational context: size, financial resources, information technology expertise, information technology infrastructure, top management support, organizational structure and organizational culture (3) Environmental context: industry structure, competitive pressure, government support, government regulations, supporting infrastructure and national culture</td>
<td>Cost, compatibility, organizational size, availability of financial and IT resources, management support, foreign government support and regulations, supporting infrastructure, national culture have influence on ICT use of Indonesian SMEs operating in grocery SCs</td>
<td>Manufacturing (grocery)</td>
<td>Case study ((n = 8))</td>
<td>DOI, technology–organization–environment (TOE) framework, resource dependency theory, institutional theory, national culture theory (NCT)</td>
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<tr>
<td>Kurnia, Choudrie, Mahbubur and Alzougool (2015)</td>
<td>Influence of organizational readiness (perceived benefits), industry readiness (perceived industry structure and standards), national readiness (perceived supporting services) and perceived environmental pressure on ICT adoption of SMEs</td>
<td>Environmental pressure has significant influence on the adoption of various ICTs. Organizational and national readiness has different influences across diverse ICTs, while the influence of industry readiness is shown to be insignificant.</td>
<td>Manufacturing (grocery)</td>
<td>Survey ($n = 125$)</td>
<td>DOI and NCT</td>
<td>Malaysia</td>
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<tr>
<td>Afolayan et al. (2015)</td>
<td>Influence of ease of use, perceived benefits, perceived usefulness, SC position and industry on ICT adoption and use of SMEs</td>
<td>Lack of security and reliability, distrust, insufficient access to capital, poor infrastructure and corruption are the main factors contributing to the low ICT adoption and use of SMEs in Nigeria</td>
<td>Manufacturing (mining, construction, agriculture) service (education, trading, wholesale, retail, transportation and storage, tourism and leisure)</td>
<td>Survey ($n = 161$)</td>
<td>Theory of planned behavior (TPB)</td>
<td>Nigeria</td>
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<td>Kabanda and Brown (2015)</td>
<td>Enablers of and barriers to ICT adoption and use of SMEs</td>
<td>Factors perceived to be conducive for ICT include the availability of business resources, specifically business relationships with ICT foreign companies; top management support; the use of mobile technology for interactive and transactive purposes with consumers and suppliers; and the strategic use of mobile phones to avoid ICT-related challenges such as those associated with fixed line telephone and internet-enabled desktop computing</td>
<td>Manufacturing</td>
<td>Case study ($n = 32$)</td>
<td>Perceived e-readiness model</td>
<td>Tanzania</td>
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<td>Garg and Choeu (2015)</td>
<td>Influence of relative advantage, competitive pressure, IT knowledge, security and government support on ICT adoption of SMEs</td>
<td>Relative advantage, competitive pressure and IT knowledge are the only statistically significant factors, out of which relative advantage is the most influencing factor</td>
<td>Service (retail)</td>
<td>Survey</td>
<td>TOE</td>
<td>South Africa</td>
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<tr>
<td>Gareeb and Naicker (2015)</td>
<td>ICT adoption and use of SMEs from three perspectives:</td>
<td>SMEs are largely influenced by technology factors, especially compatibility, ease of use and relative advantage to adopt ICT. Environmental factors, such as supplier pressure and customer pressure, showed the least positive impact on ICT adoption</td>
<td>Service (retail, subsistence)</td>
<td>Survey</td>
<td>TOE, theory of reasoned action</td>
<td>South Africa</td>
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<tr>
<td>Irma et al. (2016)</td>
<td>ICT adoption and use of SMEs from four perspectives:</td>
<td>Factors from the individual context are found to be the most influential for ICT adoption of SMEs. Lack of government support, lack of market and industry involvement in ICT use, conservative market and industry, and lack of trust in business partners are the most prominent barriers to ICT adoption of SMEs</td>
<td>Manufacturing</td>
<td>Case study</td>
<td>TOE, technology acceptance model</td>
<td>Indonesia</td>
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| Mapeshoane and Pather (2016) | (3) Individual context: attitude toward ICT adoption, IT knowledge, market position, intentions to adopt ICT  
(4) Industrial context: government support, ICT use involvement of market and market | Performance expectancy, effort expectancy, social influence, facilitating condition and national culture on intention to use and behavioral use of ICT in SMEs | Service (tourism and leisure) | Case study (n = 15) | United theory of acceptance and use of technology | Lesotho |
| Mirkovski et al. (2016)   | Influence of environmental uncertainty, contractual governance and relational governance on ICT use of SMEs in developed and developing economies | Environmental uncertainty has significant indirect influence on ICT use by SMEs from developed and developing economies | Manufacturing (agriculture) | Case study (n = 10) | Transaction costs economics and Social exchange theory | USA and Macedonia |
| Gorane and Kant (2017)    | Influence of ICT on SC integration, operational responsiveness, green practices, operational performance, customer satisfaction and financial performance of manufacturing SMEs | ICT has positive impact supplier relationship, customer relationship and information sharing | Manufacturing (automotive, electrical and electronics, chemical and plastics, pharmaceutical) | Survey (n = 292) | n/a | India |
Appendix 2. Interview protocol

ICT-enabled information sharing and SC collaboration

(1) What are the processes involved in your interactions with new/existing suppliers? 你和现在的（新的）供货商交流时，需要哪些流程？

(2) Are there any pre-contract negotiations involved in these interactions with new suppliers? 新的供货商交流时，是否需要一些原先的合约协商?

- Do you attempt to develop ties with your new suppliers? 你是否尝试要和新的供货商建立起好的关系?

- How do you develop these ties? 你是如何建立这种关系的?

- Do you prefer to develop such ties through face-to-face or computer-mediated interactions? 你希望通过“面对面的交谈”还是通过“计算机为媒介的交流”来建立这种关系?

- How much time do you spend to develop these ties with your new suppliers (hours/days/months)? 你大概需要花费多长时间来和新的供货商来建立这种联系?

  - How many hours are spent on face-to-face interactions? 你大概花费多少个小时在“面对面的交谈”上?

  - How many hours are spent on phone conversations? 你大概花费多少个小时在电话交流上?

  - How many e-mails are exchanged? 大概需要多少封邮件的交流?

  - How many hours are spent on IM communication? 大概花费多少个小时在“即时信息”的交流上?

  - How many hours are spent on video conferencing? 大概花费多少个小时在“视频会议”上?

  - How many files are exchanged over file-hosting services? 大概花费多少个小时在“文件托管服务”?

- Do you feel safe to immediately establish ties with your new suppliers? Do you trust to your suppliers or your legal system? Does the legal system reduce the uncertainty associated with new suppliers? 你觉得如果很快的和新的供货商建立关系是否是安全的?你相信你的供应商或者你的法律体制（你所在的法律体制）?这种法律体制是否可以降低你和新的供货商交易的不确定性?

- Do you think that ICT can adequately support the media richness/synchronicity of pre-contract negotiations? Please state concrete reasons. 在预先的合约协商过程中,你觉得信息交流技术（例如）是否提供了充足的媒介丰富信息（媒介同步信息）?请说明原因

(3) Are communication and information sharing important in contract negotiations with suppliers? 在同供货商合约协商的过程中,你认为交流和信息分享是重要的吗?

- How is communication and information sharing important in contract negotiations with suppliers? 在同供货商协商合约的过程中,你是如何看待交流和分享信息的?

- Why is communication and information sharing important in contract negotiations with suppliers? 在同供货商协商合约的过程中,你为什么认为交流和信息分享是重要的?

- When is communication and information sharing important in contract negotiations with suppliers? 在同供货商协商合约的过程中,在什么情况下,你认为交流和分享信息是重要的?

- What type of communication is most practiced in these negotiations before reaching consensus with suppliers? 在和供应商达成一致之前,你最常使用哪种交流方式和供应商协商?

  - Trust-based communication: topics outside business domain are discussed and encouraged. 基于信任的交流:和生意无关的话题会被讨论和鼓励
- Product-focused communication: topics outside business domain are avoided and discouraged?

- During these negotiations how frequently do you communicate and share information? Intensity of information sharing? In this kind of process, you share and exchange information? Information sharing frequency? (for example, ...)

- How long do these contract negotiations last (hours, days, months)? In these negotiations, how much time is spent?
  - How many hours are spent on face-to-face interactions? How much time is spent in “face-to-face” talks?
  - How many hours are spent on phone conversations? How much time is spent in “phone” conversations?
  - How many e-mails are exchanged? How many e-mails are exchanged in a “store”?
  - How many hours are spent on video conferencing? How much time is spent in “video” conferences?
  - How many files are exchanged over file-hosting services? How often are files exchanged?

- Do you communicate and share information through already established channels? Do you practice direct or indirect (intermediate) communication? Is the channel used already established?

- Is this communication and information sharing standardized and formal? Is this communication and information sharing standardized and formal?

- Can you communicate and share information without trust? You can exchange information without trust?

- Do you think that there are any ways to improve the communication and information sharing in these negotiations? In the process of negotiations, do you think there are any ways to improve the communication and information sharing?

- Do you think that ICT can adequately support the media richness/synchronicity of contract negotiations? Please state concrete reasons. In the context of negotiations, do you think ICT can adequately support the media richness/synchronicity of contract negotiations? If yes, please provide specific reasons.

(4) How important is it to have accurate and timely information regarding shipping dates and product availability? What type of information is usually shared regarding shipping dates and product availability? How technical and detailed is this information? What is the technical and detailed level of information?

- During these information exchanges how frequently do you communicate with your suppliers? In this kind of process, you share and exchange information?
  - How many hours are spent on face-to-face interactions? How much time is spent in “face-to-face” talks?
  - How many hours are spent on phone conversations? How much time is spent in “phone” conversations?
  - How many e-mails are exchanged? How many e-mails are exchanged?
How do you share and communicate information about product requirements with your suppliers?

Is this communication and information sharing standardized and formal?

How accurate and reliable does this kind of information have to be? How technical are these product requirements?

What type of communication is involved in the latter process?

Do you think that ICT can adequately support the media richness/synchronicity of such information exchanges? Please state concrete reasons.

(5) How do you share and communicate information about product requirements with your suppliers? You are how you with suppliers share and exchange product requirements?

What type of communication is involved in the latter process?

How accurate and reliable does this kind of information have to be? How technical are these product requirements?

Is this communication and information sharing standardized and formal?

Is this communication and information sharing effective and efficient?

During these information exchanges how frequently do you communicate with your suppliers?

How many hours are spent on face-to-face interactions?

How many hours are spent on phone conversations?

How many e-mails are exchanged?

How many hours are spent on IM communication?

How many hours are spent on video conferencing?

How many files are exchanged over file-hosting services?
- What type of communication and information sharing are most desirable and practiced in such dealings with suppliers? 
- Trust-based communication: topics outside business domain are discussed and encouraged? 基于信任的交流: 和生意无关的话题会被讨论和鼓励
- Product-focused communication: topics outside business domain are avoided and discouraged? 强调产品的交流: 和生意无关的话题会被避免和不鼓励
- Do you think that ICT can adequately support the media richness/synchronicity of such information exchanges? Please state concrete reasons. 你觉得信息交流技术(例如)是否充分的提供了此类信息交换所需要的媒介丰富度(媒介同步度)? 请说明原因

(6) How often do you collaborate with your supplier on common manufacturing processes? In manufacturing processes you collaborate with your supplier? 
- What type of collaboration do you have with your supplier? 你与供应商的合作方式是怎样的？
- How important are these collaborations for the quality/reliability/trustworthiness of the manufacturing process? 你认为交流合作对于这类制造过程的质量/可靠性/可信度有多重要?
- Do you use any ICT to collaboratively work with your suppliers? 你是否使用ICT与供应商协作？
- Does trust improve collaboration? Is it better to collaborate with trusted suppliers? 你认为信任是否能够增进交流合作？
- Do you think that ICT can adequately support the media richness/synchronicity of such collaborations? Please state concrete reasons. 你觉得信息交流技术(例如)是否充分的提供了此类信息交换所需要的媒介丰富度(媒介同步度)? 请说明原因

(7) How do you collaboratively create/design products with your suppliers? 你如何与你的供应商合作创造/设计产品的？
- What does that collaboration involve? 这种合作交流涉及到哪些方面?
- Does trust improve collaboration? Do you get better ideas for design with trusted suppliers? 信任是否可以改善交流合作?你是否得到更好的想法在和你信任的供应商一起设计时?
- Do you use any technologies to support such collaborations? 你是否使用某项技术来支持你们的合作交流?

(8) If you have well-established communication with a supplier, is it more likely that you will to jointly adopt ICT such as e-mail, IM, video conferencing, wikis, web-based file-hosting service? 你与供应商有良好的交流，你会更有可能使用信息交流技术(例如电子邮件, 即时消息, 视频会议, 维基百科, 网络硬盘)?

(9) If you have significant level of collaboration activities with a supplier, is it more likely that you will to jointly adopt ICT such as e-mail, IM, video conferencing, wikis, web-based file-hosting service? 你与供应商有较多的交流合作，你会更有可能使用信息交流技术(例如电子邮件, 即时消息, 视频会议, 维基百科, 网络硬盘)?

(10) If you are already sharing both operation and strategic information with a supplier, is it more likely that you will to jointly adopt ICT such as e-mail, IM, video conferencing, wikis, web-based file-hosting service? 你与供应商分享了企业的经营和战略信息，你会更有可能使用信息交流技术(例如电子邮件, 即时消息, 视频会议, 维基百科, 网络硬盘)?

(11) Do you face any pressure from suppliers? 你是否感觉到一些来自供应商的压力?
Ties (emotion, obligation and trust) section

1. Do you often communicate with your suppliers on a social basis outside of work? 你是否经常和你的供应商有除了工作以外的交流？
2. Are you able to openly talk with your suppliers as friends? 你是否会坦率的像朋友一样和你的供应商交流？
3. If you were to change a particular supplier, would you lose a good friend? 如果你更换供应商，你是否会因此而失去一个朋友？
4. Do you consider to be close with your suppliers? 你是否认为和你的供应商更加亲近？
5. Do you consider suppliers' wants and needs when important decisions are made? 在做重大决定的时候，你是否考虑过供应商的需求？
6. Do you have a brotherhood feeling toward your suppliers? 你是否和你的供应商有兄弟般的情谊？
7. Would you try your best to help out supplier when he/she is in need because he/she is a friend of yours? 当供应商需要帮助的时候，你是否在尽力帮助你的供应商因为他/她是你的朋友？
8. Do you feel a sense of obligation toward your supplier for doing him/her a favor? 你是否认为你有义务帮助你的供应商？
9. Do think that “calling in” favors is integral part of doing business with suppliers? 在和供应商做生意时，
10. The practice of “give and take” of favor is a key part of the relationship with suppliers? 这种互惠互助的形式是否是和供应商建立良好关系的关键？
11. Would you feel embarrassed if you were unable to provide a requested favor to a supplier? 你是否感觉很尴尬如果你不能给你的供应商提供帮助？
12. Do you think that it is bad business not to return favors to suppliers? 你是否认为这是坏的生意，如果你不能够帮助你的供应商？
13. Are you happy to do a favor to a supplier when he/she requests one? 在供应商需要时，你是否乐意帮助他们？

- What type of pressure is it? Reinforcement or persuasion? 你觉得这是什么样子的压力? 强制性的还是说服型的?
- How does this pressure affect your communication, information sharing and collaboration efforts with the same supplier? Does it affect trust or ties? 这种压力如何影响了你与供应商的交流，信息分享和合作?你认为这种压力是否影响你对供应商的信任和关系?
- Does supplier pressure have positive or negative influence on communication, information sharing and collaboration? 供应商的压力是否积极或者消极的影响了你与供应商的交流，信息分享和合作？
(14) Do you think that suppliers are sometimes making false claims? 你是否认为供货商有时在制造虚假的声明?
(15) Do you think that suppliers are completely open and honest in dealing with you? 你是否认为供应链商是完全坦率诚实的在应对你?
(16) Do you think that suppliers respect you and are concerned with your own needs? 你是否认为供货商尊重你并且也考虑你的需求?
(17) Do other peoples in the company trust your suppliers? 你公司里的其他人是否信任你的供货商?
(18) Are all of the suppliers trustworthy? 是否所有的供货商都是可信的?

Appendix 3. Criteria for conducting case study

References for Appendices

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Procedures from Literature (Yin, 2009; Lee, 1989)</th>
<th>Why/How proposed procedures were addressed in this study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal validity</td>
<td>Explanation building</td>
<td>In-depth descriptions for all individual winery cases were provided. The descriptions were used to develop correlation themes and construct propositions</td>
</tr>
<tr>
<td>Construct validity</td>
<td>Multiple sources of evidence</td>
<td>Multiple interviews with key informants from each selected company, access to company documentation and other modes of interaction with informants (e.g. social, e-mail, instant messenger and mobile instant messenger)</td>
</tr>
<tr>
<td></td>
<td>Review of case study by key informants</td>
<td>One owner and one manager from the wineries reviewed a drafted copy of the case studies</td>
</tr>
<tr>
<td></td>
<td>Establishment of the chain of evidence</td>
<td>A chain of evidence was maintained with a detailed process narrative and cross-referencing with transcripts</td>
</tr>
<tr>
<td>Reliability</td>
<td>Establishment/Maintenance of case study database</td>
<td>Notes: interview transcripts, narrative (e.g. coding scheme), documents (e.g. questionnaires, catalogs and promotional flyers)</td>
</tr>
<tr>
<td></td>
<td>Development of case study protocol</td>
<td>Set of questionnaires, literature review, case selection, research invitation, study proposal, data analysis criteria and presentation of case studies</td>
</tr>
<tr>
<td></td>
<td>Inter-coder reliability</td>
<td>All interviews were independently coded by another researcher who was not familiar with either the research subject or the context. Cohen’s $\kappa$ equals to 0.84, suggesting a high level of agreement between the researcher and the independent coder</td>
</tr>
<tr>
<td>External validity</td>
<td>Increasing degree of freedom</td>
<td>Multiple observation of each prediction: multiple (4) cases studies</td>
</tr>
<tr>
<td></td>
<td>Application of replication logic</td>
<td>The propositions were related to each of the four case studies. Each winery can be considered a separate study in which different instances are related to the same propositions</td>
</tr>
</tbody>
</table>

Table AII. Rigor criteria for conducting case study


Yin, R.K. (2009), Case Study Research: Design and Methods, Sage, Newbury Park, CA.

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Kristijan Mirkovski, Robert M. Davison and Maris G. Martinsons