Rethinking supply chain strategy as a conceptual system

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Abstract

Changes to the strategy, context or environment of a business unit may necessitate a revision of its supply chain strategy. However, rethinking a supply chain strategy is not an easy problem, and has no clear answer in the specialized literature. Some fundamental questions about supply chain *strategizing*—i.e., the *process of doing* supply chain strategy—have been largely ignored, while others have been answered with overly-simplistic *type-and-match* approaches of unclear validity. In this paper, we present a holistic approach to supply-chain strategizing, called *Conceptual System Assessment and Reformulation* (CSAR), developed through a series of collaborative management research projects over a decade. This paper presents the key ideas of CSAR and explains how it can be used to capture, evaluate and reformulate the supply chain strategy of a business unit. We argue that these ideas can serve as a step towards a theory of supply chain strategy. Finally, we illustrate the practical merits of CSAR by presenting the case of a large world-class corporation that used the approach as a starting point for an initiative to rethink the supply chain strategy of most of its business units.

Keywords: Supply chain strategy, strategizing, capture, evaluation, reformulation

1. Introduction

The importance of supply chain strategy (SCS) has been recognized from the early days of supply chain management (SCM). Stevens (1989) suggested that an integrated

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supply chain strategy can help a company balance the conflicts among its functions to respond to issues such as high supply chain costs, high inventory levels, poor customer service, inter-departmental conflicts and the challenge of goal restructuring. Narasimhan et al. (2008, p. 5234) assert that, "in the competitive global environment in which firms operate today, developing a successful supply chain strategy is critical to a firm's long-term competitive success." Supply chain strategies can not only help managers "improve their companies' integration with suppliers and customers" (Cigolini et al., 2004, p. 8), but also enhance the business performance of the firm and its supply chain partners (Roh et al., 2014). Supply chain strategy is considered "a prerequisite" for supply chain management in any firm, since "top performers have a clear supply chain strategy aligned with overall business objectives and customer requirements" (Varma et al., 2006, p. 226).

Supply chain strategy is regarded as "an increasingly important topic" (Morash, 2001, p. 50). Recent studies have examined supply chain strategies in particular industries—such as food (Lyons and Ma'aram, 2014) and fashion (Brun and Castelli, 2008, Kim, 2013)—as well as the relationship between supply chain strategy and other organizational functions. Juttner et al. (2010) explore the relationship between supply chain and marketing strategies and provide a framework to describe how the two strategies together can contribute to the business strategy. Blackman et al. (2013) elaborate how supply chain strategy influences finance through the case study of Motorola's global supply chain. Zhou et al. (2014) describe the implications of the quality of information for the supply chain strategy. Supply chain strategy can be seen as an umbrella for operations strategy, and has important implications for several aspects of operations strategy. Supply chains, as the producers and conveyors of products, have a close relationship with product design: research shows a strong connection between supply chain strategy and *product complexity* (Novak and Eppinger, 2001), *product life cycle* (Aitken et al., 2003, Patil et al., 2010), and suggests that products and supply chains should be designed simultaneously (Fine, 1998). Supply chain activities also have strong implications for a company's environmental footprint; Wu et al. (2014) show, empirically, that

an alignment between supply chain strategy and corporate environment strategy can improve firm performance. Operations Management researchers have been actively exploring the role of human behavior in operations issues (Bendoly et al., 2006, Boudreau et al., 2003, Boyer et al., 2005). These findings are relevant for the topic of supply chain strategy as well. Some of the quintessential supply chain phenomena, like the bullwhip effect, are shown to be caused by human biases and heuristics (Croson and Donohue, 2006).

Typically, the studies of supply chain strategy explore the links and the performance implications of integration between a focal firm and its customers and suppliers. Much less attention is paid to the *integration* among the supply chain-relevant[1] functions within a firm. Recent empirical evidence suggests that within-firm integration—i.e., alignment between corporate strategy, supply chain strategy, and supply chain capabilities—is positively associated with integration between the focal firm and its supply chain partners (Ralston et al., 2015), prompting the study's authors to argue that "internal integration [within the firm] should occur before external integration" (p. 56). Cooper and Ellram (1993) also suggest that strategic intra-firm integration is an important characteristic of the firms taking the *supply chain perspective*.

Despite its importance and relevance, supply chain strategy is often neglected in practice. An international survey by Harrison and New (2002, p. 264) found that more than half of the supply chain strategies of over 250 firms across diverse sectors "were either non-existent, patchily defined with poor definition ... or had only some elements defined and lacked detail". A decade later, Dittmann (2012, p. 4) found through "a survey on the state of supply chain strategy" that, although 62% of respondents "said that they have a supply chain strategy", only 18% had "a *documented, multiyear*" sup-

[1]The term *supply-chain relevant* refers to anything that has relevance for the supply chain, irrespective of whether it falls under the jurisdiction of the supply chain function. For example, policies on forecasting, procurement, production and sales are clearly supply-chain relevant, even though they may fall outside the jurisdiction of the SC function.

ply chain strategy. Narasimhan et al. (2008, p. 5232) have noted that firms do not always "realize the strategic role" of supply chain management, and as a result, tend "to exclude SCM from the strategic debate." Having "an unclear understanding of SCM strategy ... causes firms to miss exploitable opportunities to increase competitive advantage" (ibid). The need for supply chain strategy is not limited to large organizations. Sharifi et al. (2013) found that small and medium-sized enterprises (SMEs) typically fail to "consider their supply chain strategy before product introduction" and "consequently experience supply chain problems that are likely to be detrimental to the firms' growth potentials."

One reason for this may be that "the formulation of a supply chain strategy" can be "extremely difficult" (Kotzab et al., 2003, p. 348). Because of its numerous functional interdependencies (Stevens, 1989), a supply chain is akin to a complex system; management theory shows that such systems are indeed difficult to design (Rivkin and Siggelkow, 2007). Varma et al. (2006, p. 226) elaborate on this by noting that since supply chains "comprise a plethora of activities from sourcing raw material to delivering the finished product to the customer, formulating a strategy for SCM becomes a complicated task in itself". This can lead to a "disagreement over the choice of an appropriate supply chain strategy" (McAfee et al., 2002, p. 7), which is unlikely to be resolved without a systematic effort when designing supply chain strategies (Rivkin and Siggelkow, 2007). The difficulty of integration is one of the reasons why Cooper and Ellram (1993) assert the need for *channel leadership* as a key characteristic of the supply chain perspective.

Recognizing this challenge, Stevens (1989, p. 5) asserts that "a structured approach" is "required" for developing supply chain strategy. The need for a structured approach or a process for developing strategy is not unique to supply chain management. The importance of decision processes in firms has been recognized for over half a century, dating back at least to the pioneering work of Cyert and March (1963). Left to their own devices, firms often engage in "unstructured" strategy processes (Mintzberg et al., 1976). However, the more "structured approaches," as called for by Stevens (1989), have

practical benefits. An extensive review of the strategy process literature (Hutzschenreuter and Kleindienst, 2006) shows a positive relationship between the use of structured strategy formulation approach and the performance of the decision made using the approach. In the SCM literature, Fine (2000, p. 213) underscores the importance of a structured approach by calling *supply chain design* the "ultimate core competency of an organization." Yet, the SCM field is characterized as having an unresolved need for a "framework upon which to develop a supply chain strategy" (Martinez-Olvera and Shunk, 2006, p. 4511). The questions, such as how to capture, evaluate, or reformulate a given supply chain strategy have largely been unanswered in the SCM literature. Providing actionable answers to these questions would make it easier for practitioners to engage in supply chain strategizing and to help supply chain strategy attain the prominence it deserves.

2. Literature Review

One of the earliest works advocating the importance of supply chain strategy is by Stevens (1989). It presents "a three phase process" to serve as a "systematic approach for the development of an integrated supply chain strategy." Stevens lists "development of a supply chain strategy" as one of two tasks in Phase III of this approach, whose objective "is to develop a strategy for the company, based on the work done in the first two phases which is consistent with customer desires, management focus, market characteristics and the realities of the organization." Further, he notes that "this strategy should utilise fully the company operations and competitive tools, and allow an approach to supply chain improvements which is integrated with the rest of the business."

Fisher's Matrix

In one of the most influential articles in the supply chain management literature, Fisher (1997) presents a framework — a typology of supply chain strategies — that has

become a cornerstone of the extant view of supply chain strategy. He claims that products can be categorized as "either primarily functional or primarily innovative" based on their demand patterns. Likewise, he categorizes supply chains as either "physically efficient or responsive to the market." Based on these two dichotomous variables, Fisher generates a 2-by-2 *matrix*, where each of the four possible *combinations* of *product type* and *supply chain type* represents a *supply chain strategy*. Fisher claims two of these combinations (the "matches") are advantageous, while the other two (the "mismatches") should be avoided. Fisher suggests that the 2-by-2 matrix can be used to evaluate an existing supply chain strategy "to discover whether the process the company uses for supplying products is well matched to the product type: an efficient process for functional products and a responsive process for innovative products." Similarly, the framework can also be employed to correct a mismatched supply chain strategy.

Although Fisher's framework "has been widely accepted by researchers" (Qi et al., 2009), multiple efforts to empirically validate it have produced mixed, inconclusive or negative results. Lo and Power (2010) found empirical evidence against Fisher's categorization of products and supply chains into dichotomous types. Similar evidence against the validity of Fisher's product types was obtained in a study by Qi et al. (2009), which also found that Fisher's preferred *matches* were outperformed by other combinations not included in his framework. Selldin and Olhager (2007) found no evidence in support of key predictions from Fisher's framework regarding the effect of his preferred matches on performance.

After the results of their own study suggested Fisher's model to be "questionable," Lo and Power (2010) proposed several reasons to explain why it is not supported by empirical data. They argue that "there appears to be more factors [that need to be] considered as the determinants of supply chain strategy". A similar thought is expressed by Li and O'Brien (2001) when they remark that no "typical supply chain strategy performs the best all the time", speculating that the "operational environment significantly influences their roles." Thus, the empirical evidence suggests that Fisher's simplification of products and supply chains into dichotomous *types*, combined

with his reduction of the problem of supply chain strategy to a *matching* of these types, leaves out of the picture more important and decisive factors.

Arcs of integration

Frohlich and Westbrook (2001) envision supply chain strategies as *arcs of integration* and propose that "different supply chain strategies can be empirically classified into at least five valid types, defined by the direction (towards suppliers and/or customers) and degree of integration". Based on this approach, the supply chain strategy of a given firm could be described by the degree of integration, such as, for example, a "narrow arc of integration with customers, and a broad arc of integration with suppliers".

This approach focuses on a single feature, namely *integration*, at the expense of all the other features of a given supply chain strategy. It fails to consider other potentially important aspects, such as how the supply chain strategy relates to the firm's strategic objectives or to the supply chain operations in the field. Furthermore, it is not clear how thinking about a supply chain strategy as an *arc of integration* can serve as an actionable starting point for its subsequent evaluation and reformulation.

Techniques-tools matrix

Cigolini et al. (2004) ask, for the first time, an interesting question: "how can [a supply chain strategy] be operationally defined and represented?" They develop a partial catalog of "techniques" that operate at the interface between companies, and then identify in the literature the supply chain "tools" that support the implementation of these techniques. The authors propose creating a *techniques-tools matrix* to denote which tools provide support to which techniques. Cigolini et al. (2004) state that "perhaps the most promising usage of the techniques-tools matrix is in its inherent ability to synthesize and represent SCM strategies."

The techniques-tools matrix is a significant step towards operationally defining and representing a supply chain strategy. Nevertheless, it suffers from a few limitations. It does not describe how the supply chain techniques and tools relate to the firm's overall strategy. By focusing exclusively on the interface between firms, it also ignores the

activities that take place inside the firm. In addition, it is not clear how the *techniques-tools matrix* can be used as an actionable starting point for evaluating and reformulating a supply chain strategy. Finally, its reliance on a catalog of supply chain techniques carries the risk of inducing the user to pick items based on social desirability.

CPPR Framework

Martinez-Olvera and Shunk (2006) have proposed a "comprehensive framework for the development of a supply chain strategy," called the Customer-Product-Process-Resource (CPPR) framework. It is built upon the premise that there are six "business models" that manufacturing firms may follow: engineer-to-order, make-to-order, make-to-order and assemble-to-order, assemble-to-order, make-to-stock, and make-to-forecast. The authors argue that each one is associated with a series of specific values for the "supply chain structural elements," which in turn define a supply chain strategy. It follows from the CPPR framework that there are six ideal supply chain strategies, one for each business model.

Martinez-Olvera and Shunk (2006) also provide a "realignment methodology" consisting of four steps: (a) expressing the current supply chain strategy using the attributes of the CPPR framework, (b) determining feasibility of migrating to one of the six ideal strategies in the CPPR framework, (c) estimating the effort required for each feasible migration, and (d) selecting the migration that would require the least effort and satisfy the budget constraint. In simple terms, Martinez-Olvera and Shunk (2006) propose improving an existing supply chain strategy by *migrating* it to the closest of six predetermined supply chain strategies.

The CPPR reformulation approach has some merits. First, it uses the existing supply chain strategy of the firm as a starting point of the strategizing exercise. This may force practitioners to develop awareness of the current state of the firm's supply chain before the redesign effort is undertaken. Second, by seeking to reduce the cost of proposed changes, the method minimizes unnecessary modifications to the supply chain strategy: deviations from the current state are undertaken only if they result in an

improvement. However, this method deliberately overlooks the business strategy of the firm as an input for strategizing, even though supporting the business strategy of the firm is a paramount objective of the supply chain strategy (Stevens, 1989, Narasimhan et al., 2008). As a result, the method may end up recommending the migration to a supply chain strategy that does not fit the firm's business strategy, for the only reason that this specific migration represents the lowest cost and effort among the many feasible alternatives for realignment.

SCDD Approach

Schnetzler et al. (2007) also proposed a method for the development of a supply chain strategy. Applying the principles of axiomatic design and their review of the supply chain literature, they derived a hierarchical list of 130 pairs of "goals" and "means" for the supply chain. They call this collection of 260 different goals and means the *Supply Chain Design Decomposition*, or SCDD[2]. They also present "a methodology for utilizing the SCDD [framework for the] systematic development and operationalization of a supply chain strategy." The methodology consists of twelve steps, grouped into four phases. Phase 2, *Design*, starts by setting strategic priorities, informed by the competitive and corporate strategy and the position of the firm, and then operationalizing these priorities step by step.

This operationalization is done by following the SCDD framework from the top down. Starting with the topmost objective, the designer asks: "How can this objective be achieved through supply chain management?" The designer then moves to the second level to determine how a series of objectives in areas such as quality, reliability, lead time, etc. can be achieved. This is done following a common, *predetermined* sequence. The authors postulate that following this blueprint the designer will be able to translate strategic objectives into strategic means, then into operational objectives and finally into specific resource decisions. Phase 3, *Choice*, looks for "potential conflicts

[2]Due to its large size, the SCDD is only shown partly in their paper; the complete version is presented in Schnetzler (2005), a doctoral thesis in German.

among objectives" and for "synergistic effects," and verifies that all objectives and sub-objectives are fulfilled.

One limitation of SCDD is that the methodology was designed for the *formulation* of a *new* supply chain strategy, not for the *reformulation* of an *existing* supply chain strategy. Although Schnetzler et al. (2007) list among the applications of the methodology the development of "improvement strategies" for existing supply chains, the approach they outline makes no provision for considering what Martinez-Olvera and Shunk (2006) called the "*as-is* situation". The existing supply chain strategy of the firm is essentially ignored in this approach. This is an important omission for at least three reasons. First, supply chain strategies are typically implemented using assets—such as production plants, networks of distribution centers, transportation fleets, IT systems, etc.—that are capital intensive and put a *dynamic constraint* on the firm's desired supply chain strategy (Ghemawat, 1991). Ignoring a firm's commitment to its existing supply chain assets can make the transformation difficult, if not impossible. Second, neglecting the existing assets in reformulating the supply chain strategy could also result in the failure to exploit the potentially *valuable* supply chain resources and capabilities, that could render competitive advantage to the firm (Barney, 1991). Third, supply-chain relevant functions often have a high degree of interdependence; making changes to some parts of the supply chain strategy while disregarding their interaction with other parts in the existing strategy can result in sub-optimal, or even inferior, performance of the new strategy (Rivkin and Siggelkow, 2007).

At risk of oversimplification, the CPPR and SCDD approaches are antipodes: whereas Martinez-Olvera and Shunk (2006) focus solely on going from where a firm is today to the closest *best spot*, with no regard to what the firm's top-most objective is, Schnetzler et al. (2007) focus solely in deriving from the top down a whole new strategy with the purpose of satisfying the top-most objective of the firm, yet paying no attention to where the firm's supply chain is today. Neither CPPR nor SCDD considers *both* the starting point *and* the final objective of the firm's supply chain.

Summary. Supply chain strategy is considered critical for a firm's long-term competitive success. The ability to design and reformulate supply chain strategy is even called the "ultimate core competency of an organization" (Fine, 2000, p. 213). Despite its importance, *supply chain strategizing* has mostly been relegated to rather simple type-and-match approaches of unclear empirical validity. A few methods do transcend the type-and-match approach, providing a more nuanced understanding of supply chain strategy and guide the process of strategizing. However, none of the methods in the extant literature provide a holistic view of supply chain strategy as (a) a bridge between the business strategy and supply chain operations with strong connections to both ends, as well as (b) a system of (highly) interdependent activities in the supply-chain relevant functions. Given the important role of a supply chain strategy as an enabler of the business strategy through effective coordination among various production, distribution, and service functions, this is an important gap in the SCM literature that we seek to fill in the present work.

3. Supply Chain Strategy as a Conceptual System

In this section, we present a new approach to rethinking the supply chain strategy of a business unit (BU), called *Conceptual System Assessment and Reformulation* (CSAR). This approach was developed over a decade-long research initiative on supply chain strategy, outlined in Table 1. We worked simultaneously on two fronts: (a) developing a preliminary understanding, or *theory*, of supply chain strategy in a business unit, and (b) developing *methods* that could be applied by practitioners to rethink a supply chain strategy. In the following section, we present the key ideas of the CSAR approach for rethinking the supply chain strategy of a BU.

A working definition of supply chain strategy (SCS)

We define the supply chain strategy of a BU as the collection of general and specific objectives set for the supply chain of the BU, and the policies and choices put in place to support them, with the purpose of supporting the business strategy, given the BU's

Exploratory interviews (2006 – 2007)	We conducted five exploratory interviews with supply chain managers from firms in diverse industries and from different levels in the hierarchy — from vice-president (VP) to plant manager — to explore the view they had of supply chain strategy and its role in their firms. Key insights from these interviews were validated through two additional interviews with two VPs from separate companies. (HiddenAuthor, 2010, p. 83–84)
Multiple case study analysis (2007)	We analyzed 20 case studies (Yin, 2013, Stake, 2013) to understand how supply chain strategy is articulated. To keep assumptions in check (Gummesson, 2000), we followed an inductive approach, described in HiddenAuthor (2010, p. 35–43), based on qualitative research techniques (Easterby-Smith et al., 2002, Eriksson and Kovalainen, 2008), mostly the *glaserian* grounded theory tradition (Glaser and Strauss, 1967, Charmaz, 2014). Open coding was used in a first pass, to stay close to the data, and categorical coding was used later to identify deeper concepts behind the text (Goulding, 2002). Other qualitative data analysis techniques (Eisenhardt, 1989, Eisenhardt and Graebner, 2007, Miles and Huberman, 1994) were also applied. (HiddenAuthor, 2010, p. 50–88)
First CMR project (2007–2009)	We engaged a business unit of a specialty chemical manufacturer in a collaborative management research (CMR) project. CMR is "an emergent and systematic inquiry process, embedded in an agreed-upon partnership between actors" (Pasmore et al., 2008), whose origins trace back to action research (AR) (Shani et al., 2004), "an informed investigation into a real management issue . . . resulting in an actionable solution" (Thorpe and Holt, 2007). As an action research approach, CMR is "especially suited for an applied field such as logistics" (Näslund, 2002). Our first CMR project lasted two years and included 41 qualitative interviews, 3 panel discussions, and 4 questionnaires (with 356 questions total). (HiddenAuthor, 2010, p. 89–95)

Table 1: Steps followed in the development of CSAR (2006–2014) (Continued in next page)

Second CMR project (2009–2010)	A second CMR project was conducted with a distribution company. The project lasted seven months, and included 22 qualitative interviews, 3 panel discussions with a team of 24 managers from different functions in the firm, 3 smaller panel discussions with sub-teams of 8 managers from different functions in the firm, and 2 questionnaires (with 83 questions total) sent to 25 individuals. (HiddenAuthor, 2010, p. 96–136)
Validation projects (2011–2014)	A series of smaller projects were conducted after 2010, to further validate and refine the approach. These included two short projects with U.S.-based convenience store chain and an supranational peacekeeping organization, and longer projects with a world-class corporation (discussed later, in p. 31) and with a global semiconductor manufacturer.

Table 1: Steps followed in the development of CSAR (2006–2014) (Continued from previous page)

context and the environment. This definition is in line with the tacit definition of SCS given in Stevens (1989) and the explicit definition given in Narasimhan et al. (2008).

Thinking in multiple dimensions

One of the defining qualities of the study of supply chains is its close attention to the interdependence among various organizational functions as well as multiple organizations in the supply chain. Such interdependence among function renders a complex-system like quality to supply chain strategy (Choi et al., 2001, Rivkin and Siggelkow, 2007). Thinking about supply chain strategies requires us to consider multiple dimensions. The first and most obvious dimension runs from *supplier to consumer*. The overall task of a supply chain strategy along this dimension is to successfully match demand and supply.

A second dimension cuts across all the supply-chain relevant functions of the business, along what we call the *thematic range*. The overall task of a supply chain strategy along this dimension is to harmonize the efforts of all the supply-chain relevant functions towards the fulfillment of the business strategy.

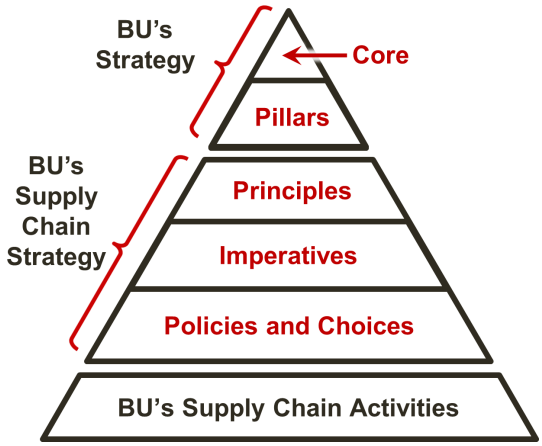

Figure 1: Levels of abstraction

A third dimension we must consider runs from the top down, from lofty statements of the business strategy all the way down to the activities and operations of the supply chain, along what we call the *strategy-operations continuum*. The overall task of a supply chain strategy along this dimension is to serve as a logical bridge between the overall business strategy and the activities of the supply chain.

Levels of abstraction

We divide the strategy-operations continuum into a series of *levels of abstraction*. These are presented in Figure 1. In the business strategy, we identify — at a minimum — concepts in two levels of abstraction: a brief core statement, which we call the Strategy *Core*, and a set of three to five general statements of strategic intent, which we call the Strategy *Pillars*. In the supply chain strategy, we usually arrange concepts in three levels of abstraction: a level of general objectives (which we call *Principles*) in different supply-chain relevant functions or areas, a level of specific objectives (which we call *Imperatives*) that support the principles above them, and a level of more concrete decisions (which we call *Policies and Choices*) that implement the imperatives above them. The policies and choices are then executed in the form of *Activities* throughout all the supply-chain relevant functions and areas.

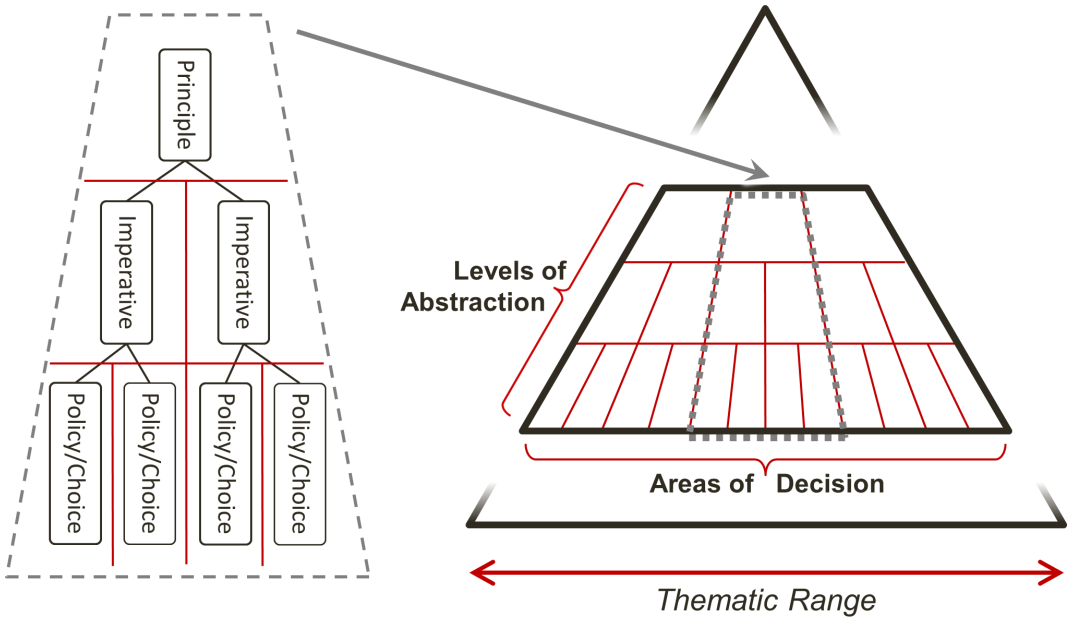

Figure 2: Levels of abstraction, areas of decision and the thematic range

SCS as a conceptual system

The number of concepts multiplies as we move down the levels of abstraction, by a factor — in our experience — of between two and four, as illustrated in Figure 2. As they multiply, the concepts become more concrete and specific, addressing a wider range of topics relevant to the supply chain. This fanning out of topics or themes is what we have called the *thematic range*. It is useful to identify in the thematic range several *areas of decision*, which can themselves include sub-areas as needed. As opposed to other approaches, such as SCDD — which prescribe a predetermined list of areas, and even a sequence for these areas (Schnetzler et al., 2007) — CSAR lets the areas of decision to be dictated by the realities and priorities of the business unit, given its strategy, context, and environment.

SCS as a logical bridge

We consider the supply chain strategy of a business unit as a logical bridge between its business strategy and the activities of its supply chain. Each concept at a lower level of abstraction enables the one(s) it is connected to in the immediately higher level. Thus, for example, each supply chain *activity* enables (at least) one *policy* or

choice, which in turn supports (at least) one of the *imperatives* for the supply chain. Conversely, each concept at a higher level of abstraction provides guidance to one or more concepts it is connected to in the immediately lower level. Thus, for example, each *pillar* of the business strategy provides guidance about one or more *principles* of the supply chain strategy, which in turn suggest the appropriate *imperatives* for the supply chain.

In the next section, we provide an example of this hierarchy of concepts at the heart of CSAR's model, using as an example the case of Lamynix (pseudonym), one of the companies we worked with during the development of the model presented here.

Illustration of CSAR terminology: Case of Lamynix

Lamynix is a business dedicated to the manufacture of laminates, i.e. thin films with special chemical properties (HiddenAuthor, 2014). Lamynix recently built in China the largest laminate extrusion plant in the world. Operating this huge plant is a distinctive supply chain advantage that can be logically connected with Lamynix's business strategy through the company's supply chain strategy. The logical connection, illustrated in Figure 3, goes as follows: Lamynix 'operates the largest extrusion plant in the world' (*activity* A), as an implementation of their policy of 'manufacturing exclusively in large-scale plants' (*policy* B); that policy seeks to 'exploit economies of scale in manufacturing' (*imperative* C), in order to 'minimize the per-unit manufacturing cost' (*principle* D); this, in turn, is done to help 'minimize the final cost of the delivered product' (*pillar* E). That pillar of Lamynix's business strategy was set to support its core strategy: to 'remain the leader in the laminates market', in terms of cost, quality and product availability (*core* F).

Notice that the concepts near the strategic end of the continuum (such as F and E in Figure 3) are more strategic in focus, more abstract in nature, more about purpose, and wider in scope; while the concepts near the operational end of the continuum (such as A and B in Figure 3) are more operational in focus, more concrete in nature, more about practice, and narrower in scope. Bridging the gap between strategy and activities

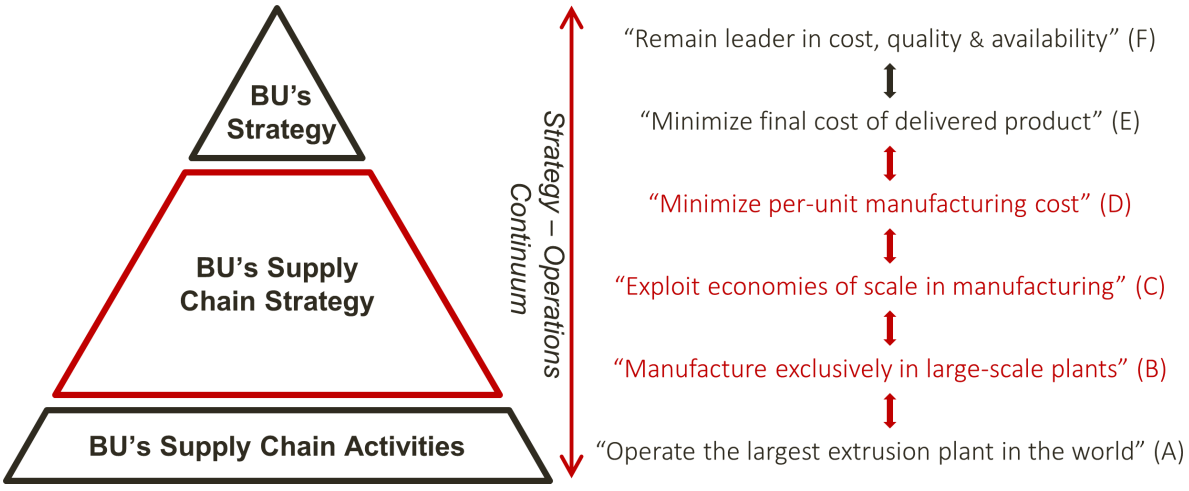

Figure 3: Ideas along the strategy-operations continuum

is a series of three concepts that belong to Lamynix's supply chain strategy (B, C, and D).

The series of six statements shown on the right side of Figure 3 (p. 17) is but one thread in a larger tapestry: we can identify many other supply-chain relevant activities, in areas like procurement, sales, logistics, etc., each one with logical connections with Lamynix's business strategy. This large group of concepts interact with each other, and should work together to achieve the common goal of sufficiently supporting the business strategy in a harmonious and comprehensive manner. This is what we call a *conceptual system*. CSAR is built upon the idea that it is useful to think of supply chain strategy as a conceptual system (HiddenAuthor, 2010).

In the next sections, we describe how this framework can be applied to capture, evaluation, and reformulation of the supply chain strategy of a business unit.

4. Capturing an as-is supply chain strategy

One of the fundamental tasks in the study and evaluation of supply chain strategy is to identify and articulate the extant supply chain strategy of a business unit. For almost two decades, the received view of supply chain strategy has used *categorization*, based on a few types (Fisher, 1997, Lee, 2002, Cigolini et al., 2004, Frohlich and Westbrook,

2001, Aitken et al., 2003), taxa (Narasimhan et al., 2008, McKone-Sweet and Lee, 2009) or other predefined configurations (Martinez-Olvera and Shunk, 2006). Although such categorization can be useful for the academic study of several supply chain strategies simultaneously, it is not particularly useful for practitioners trying to rethink the supply chain strategy of their own firm as it fits its unique context. Therefore, we strive to *characterize* each supply chain strategy in terms of its own peculiar features. Whereas categorization simplifies the features in order to find commonality, characterization seeks to represent each feature with sufficient detail to be actionable.

Building a conceptual map

CSAR's approach to capturing a supply chain strategy is to characterize it as a conceptual system, i.e., as a set of interrelated ideas. We represent the conceptual system graphically in the form of a *conceptual map*, which is basically a collection of statements written inside boxes, with lines connecting the boxes of closely related ideas. We have prepared an example based on a teaching case, "*Zara: Fast Fashion*" (Ghemawat and Nueno, 2003, p. 8–12), specifically on the passages on design, suppliers & manufacture, and distribution. An illustrative fragment[3] covering the area of Suppliers & Manufacturing is shown in Figure 4.

The process for capturing a supply chain strategy as a conceptual system is explained in detail in HiddenAuthor (2016), along with an actionable protocol that can be followed by practitioners or academics. Below, we summarize the process: (a) identify, through interviews and other means, the distinctive supply chain activities of the business unit; (b) work out, for each activity, the logical connection to the business strategy; (c) write down all the concepts involved clearly and concisely, starting with a verb, inside a box, with lines linking boxes involved in a logical connection; and (d) arrange the concepts along the thematic range (e.g. horizontally) according to their theme or subject.

[3]The resulting conceptual map is too large for a journal-sized page, so we have made it available online at http://zirie.com/ZaraFSM.pdf

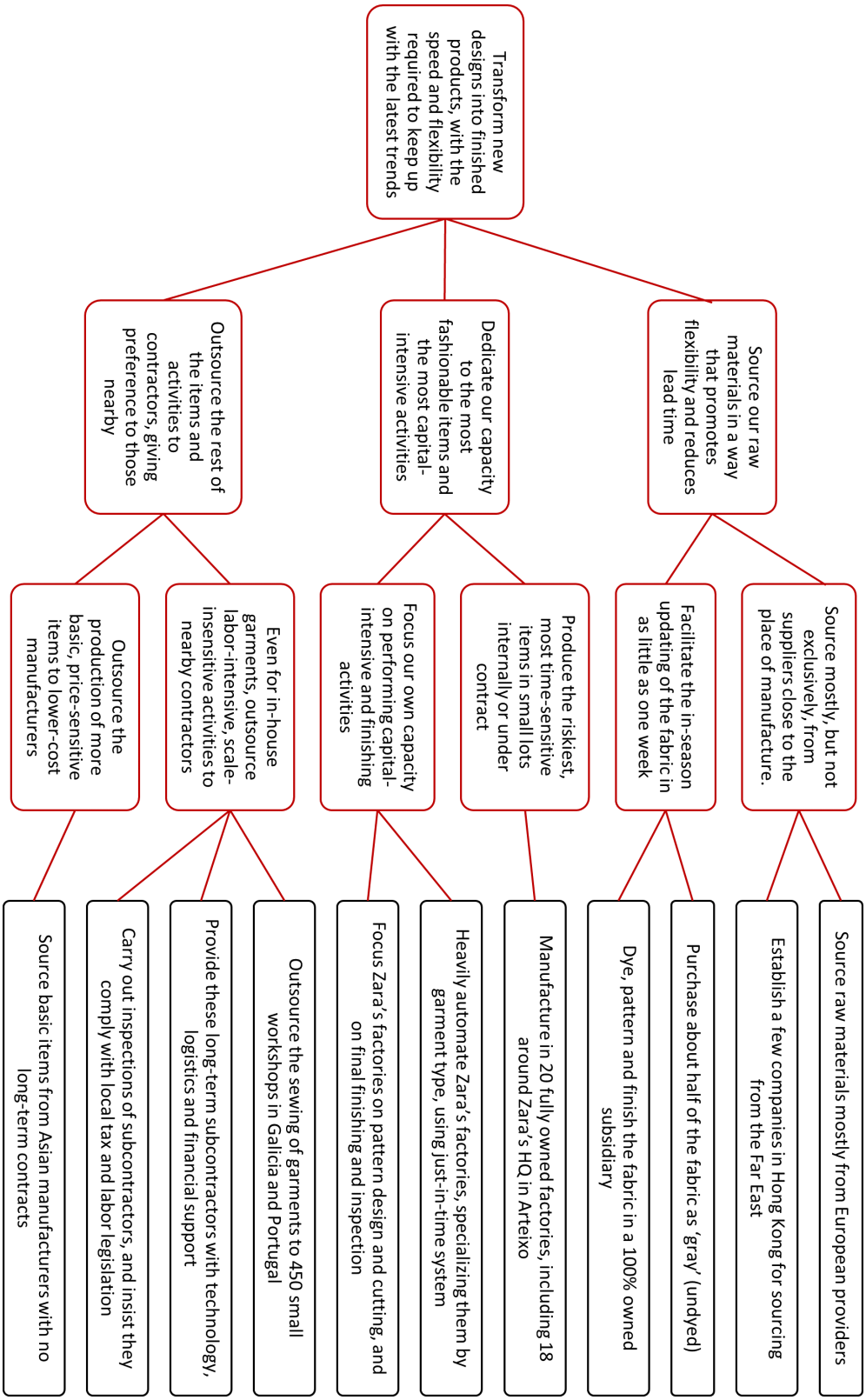

Figure 4: Fragment of Zara's map, for the area of "Suppliers & Manufacturing"

Nominal vs Executed

In a map, nominal concepts express the strategic intent of those leading the business unit and its functions, whereas executed statements reflect how things are currently being done. Nominal concepts are the *statements of purpose*; they tend to be near the strategic end of the continuum. Executed statements are the *statements of practice* and tend to be near the operational end. A useful approach to capturing the supply chain strategy of a business unit is to map the nominal concepts *from the top down*, and to map the executed concepts *from the bottom-up*. An example of this way of building a map is provided in HiddenAuthor (2016). Capturing the executed concepts of a supply chain strategy from the bottom-up takes significant time and effort. However, this provides a grounding in reality for the subsequent evaluation and reformulation of the current supply chain strategy.

5. Evaluating a supply chain strategy

Decades ago, Rumelt (1979) posed what he called an "idealized problem" as a preamble to his work on the evaluation of strategy in organizations. Rumelt's problem can be reworded in terms of supply chain strategy, as follows:

> Suppose one is given reasonably comprehensive descriptions of a business unit, its business strategy, its supply chain and its context and environment; suppose one is also given a supply chain strategy for consideration. What are the legitimate grounds for evaluating this supply chain strategy and to what theories, knowledge or models can one turn for help in making such an evaluation?

This version of Rumelt's problem is another way to ask "How can we *evaluate* whether a given supply chain strategy is good / right for a particular business unit and setting?" Evaluation is about assessing to what extent a given supply chain strategy works in a given setting towards supporting a given business strategy. The goal of the

evaluation exercise is to develop an awareness of the strengths and weaknesses of the current supply chain strategy.

CSAR's approach to supply chain strategizing relies on what we call *external wisdom*, *internal wisdom*, and *tailored practices*. *External wisdom* are claims to knowledge that have been derived outside of an organization, either as the result of empirical studies or just as the expert opinion of respected practitioners. *Internal wisdom* refers to the knowledge that an organization can distill from its own experience, from bringing its own experts together and discussing, with the help of neutral facilitators, the nature of the challenges and opportunities facing the organization and the relative merits of the options available. Finally, *tailored practices* are the common operational practices tailored to a company's practices to its particular situation: its culture, its strategy, its business environment. Instead of either blindly copying what others have done elsewhere or ignoring all the lessons of the past and reinventing everything from scratch, *tailored practices* take the middle ground of learning from what other have done (i.e., *external wisdom*) and applying the lessons to design the operational practices to suit an organization's own particular situation as known to its managers (i.e., *internal wisdom*). Of course, practitioners need to stay abreast of the latest findings in the field of supply chain management to learn from best practices and external wisdom published by experts and researchers in the field. But equally importantly, organizations need to take advantage of their own internal wisdom and tailored practices at the time of rethinking their supply chain strategy.

CSAR's Goodness Criteria

In his work on strategy evaluation, Rumelt (1979) proposed a series of "evaluation criteria" that "can and should be used in evaluating the strategy" of an organization, criteria "that are context-free–that are always valid." In the same vein as Rumelt, CSAR proposes several criteria that can and should be used in evaluating a supply chain strategy, once it has been captured as a conceptual system. These criteria are, to put it in Rumelt's words, *context free* and *always valid*: because of their general nature,

they apply to supply chain strategies (and other functional strategies) irrespective of the industry of the business unit or its position in the larger supply chain. These criteria are derived from the model of supply chain strategy presented earlier and are summarized in Table 2. The criteria are described briefly below. The interested reader is referred to HiddenAuthor (2010) and HiddenAuthor (2016) for an explanation of how these criteria were generated, along with examples of their use.

The first four criteria—namely *clarity*, *feasibility*, *sufficiency*, and *parsimony*—specify the desired quality of an individual concept. They specify that each concept must be easily and unambiguously understood, feasible, and satisfied with the least amount of resources possible. The next three criteria—namely *coverage*, *compatibility*, and *synergy*—describe the qualities desired in a set of multiple concepts, generally at the same level of abstraction. They specify that all the concepts at each level of abstraction, together, should address all *areas of decision* that matter to the company's supply chain strategy; that they should be compatible with each other; and ideally, they would complement each other. The last criterion—*support*—pertains to the quality desired in each concept in relation to the concepts in the level of abstraction above it. It asserts that each concept in the strategy map should have some purpose, i.e., support at least one of the concepts in the level immediately above it.

In practice, we evaluate a business unit's supply chain strategy according to these criteria by seeking input from its executives in the supply chain and other relevant functions. For each criterion, the executives are asked to answer one question, first individually and then discuss as a group. The questions are specific to the criteria. For example, to assess *sufficiency*, the executives are asked to answer for each *principle* whether it is sufficiently enabled by the *imperatives*, whether each *imperative* is sufficiently enabled by the *policies and choices*, and so on. As another example, the *compatibility* between all *principles* is assessed by asking the executives to assess, for every pair of *principles*, if an increase in one will either increase, decrease or have no effect on the benefit obtained from the other. A matrix populated by taking an average of all executives' evaluations is used to display the level of compatibility among all

principles in a given supply chain strategy. A similar exercise can be used to assess the *compatibility* between all *imperatives* or *policies and choices* in a given *area of decision*.

6. Reformulating a supply chain strategy

Another fundamental question of practical importance is how can a firm *reformulate* its existing supply chain strategy to better fit a given business unit, its strategy, and environment? Using the model of supply chain strategy presented earlier, we have developed an approach to reformulating the supply chain strategy of a business unit, called *Progressive Formulation*. Below we present its key ideas.

Prerequisites. Before embarking on reformulation, a firm may need to *capture* its existing supply chain strategy, develop an understanding of the context and environment of the business unit: its market, industry and overall business environment, and have an agreed-upon *business strategy* for the business unit, that is well-thought, clearly stated and compatible with the understanding we have of its setting.

Visioning. Sun et al. (2009) and Qi et al. (2011) have shown that environmental uncertainties must be considered when deciding on a supply chain strategy. If the time horizon chosen for the new strategy is long relative to the *clockspeed* (Fine, 1998) of the industry where the business unit operates, it is conceivable that important changes may take place in the market, the industry and the world. For long time horizons, a *visioning* exercise, such as scenario planning (Phadnis et al., 2014, Sodhi, 2003), may be useful. Visioning is about anticipating the future business environment where the business unit and its supply chain may have to operate, its future challenges and opportunities.

Progressive Formulation

Progressive Formulation is a structured activity to reformulate a supply chain strategy, conducted with a team of experts from the business unit, and run by a neutral and knowledgeable facilitator. The team is composed of people that were involved in

Clarity	Each concept in the system must be *clear* to those working with it. Clarity refers to *unambiguity* in meaning, and does not imply specificity: a high-level concept can be both clear and general.
Feasibility	Each of the concepts in the system must be *feasible*, i.e. must be possible within the constraints of the setting and resources of the business unit. A feasible concept is one that can be realized in practice.
Sufficiency	Every concept in the system should be satisfied, i.e. fulfilled or realized, by the combined net support it receives from concepts under it.
Parsimony	A concept in the system should only use the *necessary* resources to provide the desired support level. *Ceteris paribus*, when two alternatives provide the same support, the one requiring fewer resources is better.
Coverage	The thematic range of a conceptual system must address, or *cover*, each and every one of the areas of decision that matter for the supply chain strategy of the business unit. Lacking coverage leads to blind spots.
Compatibility	Each concept in the system must be *compatible* with every other concept in the system. That is to say, any two concepts in the system must be able to co-exist as far as possible. (Compare this criterion with *Coherence* and *Synergy*.)
Synergy	It is desirable for a concept in the system to *reinforce* and augment, whenever possible, the support that other concepts provide to the system; especially if this positive reinforcing relationship is reciprocal. This is an extension of *compatibility* in that two concepts not just coexist but also enhance the value of each other.
Support	Every concept in the system must *support*, i.e. must enable or help realize, at least one concept in a higher level of abstraction. A concept that supports no other concept above it should be eliminated.

Table 2: CSAR's goodness criteria for evaluating a conceptual system

the capture, evaluation, and visioning exercises, and who are familiar with the business strategy, and the market, industry, and environment of the business unit.

The starting point for a Progressive Formulation exercise is the conceptual map of the current supply chain strategy. In terms of the *strategy-operations continuum*, Progressive Formulation is done from the top down, working at one *level of abstraction* at a time. Within each level, we work on one area of decision at a time across the *thematic range*. Table 3 lists the six main tasks of Progressive formulation in the recommended sequence. It is possible to go back to higher levels of abstraction, and repeat tasks as needed: doing multiple iterations of the tasks is not only possible but encouraged.

Areas and sequence. In Progressive Formulation, the team defines the areas of decision for the new strategy (Task 1), as well as the sequence in which these areas will be considered (Task 2). This approach stands in stark contrast with the approach of Schnetzler et al. (2007), which prescribes a predetermined list of areas, in a predefined sequence.

Preserving good features. For each area of decision and level of abstraction, the team discusses whether the CSAR evaluation criteria listed in Table 2 are satisfied for each concept (Task 3). This is akin to asking: "Is the current concept good enough, or should we try to do better?" If the criteria are satisfied, the concept can be kept. This also contrasts with the approach of Schnetzler et al. (2007), which makes no provision for retaining good features of the *status quo*.

Concept generation. If the team is not satisfied with the current concept, they generate new concepts (Task 4) that are alternatives to the current one. The purpose at this point is to innovate: to propose as many new good ideas as possible regarding how to improve the supply chain strategy. The facilitator should foster innovative and creative thinking when performing this task.

Progressive Formulation starts at the highest level of abstraction that will be reformulated. Guided by the facilitator, the team will do the following tasks, working one level at a time:	
Task 1 *Identify relevant areas of decision*	Using the prerequisites as input, the team identifies the *areas of decision* that matter at this level of abstraction. Identifying all the relevant areas of decision is a first step towards satisfying the *coverage* criterion.
Task 2 *Sequence the areas of decision*	The team decides how to sequence these areas for decision-making. This is done based on their relative priority for the business strategy and the relationships of precedence and dependency that may exist among them.
Once the areas have been identified and sequenced, the team will do Tasks 3 through 5 in each area, working one area at a time, and starting with the first area in the sequence.	
Task 3 *Assess the current concept*	If the current SCS has a concept for this area and level, the team evaluates it in terms of the CSAR criteria. If the team is satisfied with the current concept, they can skip Tasks 4 and 5, and go to the next area.
Task 4 *Generate several new concepts*	Generation is about bringing innovative and creative thinking into the strategizing process. The team is asked to generate new concepts, as alternatives to the current concept in this area and level.
Task 5 *Select the best concept*	Selection is about bringing rigorous and selective thinking into the process. The team selects the *best* concept for this area and level — in terms of the CSAR criteria — from among those available
Go to next area	Once a concept has been agreed upon for this area, move to the next area in the sequence, and repeat tasks 3, 4 and 5 for that area.
Task 6 *Verify level-wide sufficiency*	When tasks 1–5 have been done for all areas in this level, examine whether the concepts at that level are sufficient to satisfy the ones in the level above. If they are not, revisit Tasks 1 through 5 as needed.
Go to next level	When we are done with that level, we move to the level below it. The same sequence of Tasks 1 through 6 is repeated for that level.
Once all tasks are complete for all the levels, the Progressive Formulation is complete.	

Table 3: Summarized sequence of tasks for Progressive Formulation

Concept selection. After enough concepts have been generated, the team is asked to select the *best* one among the options (Task 5), in terms of the CSAR evaluation criteria. This means that, in order to be selected, a concepts should be (a) *clear*ly defined, (b) *feasible* in the given context and environment, (c) *sufficiently* supported by the concepts in the level below, (d) more *parsimonious* in providing a given level of support than the alternatives, (e) *compatible* with every other concept already selected, (f) more *synergistic* with every other concept already selected than the alternatives, and (g)more *supportive* of the concepts above it and of the overall strategy than the alternatives. The purpose of selection is to replace all the weak or blind spots of the current supply chain strategy ones with new features, in a manner that is internally consistent and strategically aligned with the business strategy. The emphasis on supporting the business strategy stands in contrast with Martinez-Olvera and Shunk (2006), which does not consider the business strategy as an input in the reformulation effort. By design, the Progressive Formulation approach to reformulation is perfectly in alignment with its approach to evaluation, namely its goodness criteria.

From Specification to Elaboration

From our first-hand experience creating and applying the Progressive Formulation method in several projects, we have learned that even though the sequence of steps used in each level of abstraction is the same, the *way* the sequence is applied — more specifically, the way the concepts are generated and selected — at each level is *not* the same. The nature of the concepts change as we move down the strategy-operations continuum, and as such the process of rethinking these concepts *feels* different from level to level.

Since concepts in the higher levels of abstraction are more about purpose, generating and selecting concepts at these higher levels is about clearly stating the objectives that the business unit expects its supply chain strategy to fulfill. Taken together, these objectives specify the desired outcome and thus provide a definition of success for the supply chain strategy. We refer to this stage of the Progressive Formulation as

specification. Experts with strategic vision should be involved in this stage of the process. Likewise, since concepts in the lower levels of abstraction are more about practice, generating and selecting concepts at these lower levels is about deciding the means through which the supply chain strategy will support the objectives in higher levels. We refer to this stage of the Progressive Formulation as *elaboration*. At this stage, we decide on means for execution, and experts with knowledge about the supply chain operations should be included in this stage of the process.

7. Discussion

In this paper we have presented a new approach to supply chain strategizing—called *Conceptual System Assessment and Reformulation* (CSAR)—developed through a decade of collaborative management research. It is built upon the premise that it is useful to think of the supply chain strategy of a business unit as a conceptual system, i.e., a group of interrelated ideas that work together to achieve the common goals of supporting the business strategy of the business unit and bridging the gap between the overall strategy and the supply chain practices. This paper presents a a "structured approach" (Stevens, 1989) to supply chain *strategizing*, by providing a way to capture, evaluate, and reformulate a business unit's supply chain strategy. Such a structured approach also contributes to the larger research agenda of *strategy processes* in the management literature (Hutzschenreuter and Kleindienst, 2006, Mintzberg et al., 1976). This practice-motivated work has normative implications consistent with the recognition in the management literature that "strategy process research has to become more normative if it is to be of relevance" (Chakravarthy and Doz, 1992, p. 9).

A new paradigm for SC strategizing

The extant literature describes supply chain strategies as a matching of *types*, and evaluates their merits based on the goodness of fit between an ideal type and the particular instance of supply chain strategy. It perceives reformulation as a switching of one or other type with the objective of reaching a more favorable match. The seminal

framework of this approach, presented in Fisher (1997), has spawned a myriad of followers (Cigolini et al., 2004, Lee, 2002, Narasimhan et al., 2008). Other configurational approaches, such as Martinez-Olvera and Shunk (2006), do not count Fisher among their ancestors, but still fall squarely within the same type-and-match paradigm of supply chain strategizing. While these approaches enrich our understanding of supply chain strategy, they do not capture the interdependence and integration among the *supply-chain relevant* functions that are key defining characteristics of the SCM field (Cooper and Ellram, 1993, Stevens, 1989).

Differing from this tradition, CSAR can be seen as a step towards a new paradigm in supply chain strategizing, which envisions a supply chain strategy as a conceptual system. This move away from configurations had already been anticipated, to a certain degree, in the general approach advocated by Stevens (1989), in the type-independent idea of a *techniques-tools matrix* of Cigolini et al. (2004), in the way Narasimhan et al. (2008) defines of supply chain strategy, and in the overall approach to supply chain strategy presented in Schnetzler et al. (2007). In this sense, CSAR has the potential to tie together many loose ideas about supply chain strategy that have emerged in the recent past. But CSAR goes much farther: in presents a whole new way to think about supply chain strategy as an *integral system* that connects the concrete *day-to-day supply chain activities* with the abstract *aspirations of the business strategy*. In addition, the practical nature of CSAR also enables one to to capture, evaluate, and rethink supply chain strategies in practice according to the core theoretical ideas of the method.

CSAR has similarities with the Balanced Scorecard Approach (BSA) used for monitoring business performance (Kaplan and Norton, 1992). They both link operational activities to the business strategy: in CSAR, supply chain strategy forms the bridge between the two; in BSA, the internal measures provide a guidance for choosing the operational measures critical for the company's success. They both take an extensive view of the firm's operations to safeguard against sub-optimization. CSAR identifies all the *areas of decision* relevant for a company's supply chain and incorporates them in the strategizing process, just as BSA provides a comprehensive collection of finan-

cial and operational metrics on a single 'dashboard' for managerial decision making. CSAR spotlights how various supply chain *imperatives* are met, just as BSA shows how financial results are delivered through multiple operational decisions. Finally, neither approach can "guarantee a winning strategy" (ibid, p. 77). The business' performance of a strategy depends on its implementation, execution, and fit with the external environment. However, the two methods also have some differences. In CSAR, the choice of *areas of decision* is left to the discretion of each company; this contrasts with BSA's prescription of four perspectives—namely, financial, customer, internal, and innovation and learning—on every company's balanced scorecard. Similarly, CSAR leaves the choice of supply chain *principles* and *imperatives* entirely to each company; in contrast, BSA seems to suggest some standard metrics for all companies to choose from, for example, goals for cost, time, quality, and performance and service as measures of the 'customer perspective.'

Comparison to alternatives

For characterization. Besides the type-based descriptions of Fisher (1997) and his followers, there are two alternatives to CSAR for the characterization of a supply chain strategy: Techniques-Tools Matrix and CPPR. As opposed to the *Techniques-Tools Matrix* (Cigolini et al., 2004), CSAR looks not only at the activities, but also at the objectives and policies of a supply chain strategy, and does so not only at the interface with other organizations but across all the supply-chain relevant functions throughout the business unit. Additionally, CSAR does not rely on a catalog of techniques and tools, but lets the team of experts characterize their supply chain strategy in their own terms. Certainly, techniques and tools can be brought into the reformulation exercise as *external wisdom*, but the team is not constrained to employ only those listed or as they are listed. It can create its own *tailored practices* by learning from this *external wisdom*. Similarly, in contrast to *CPPR* (Martinez-Olvera and Shunk, 2006), CSAR does not rely on a small number of predetermined configurations of supply chains or business models, and allows practitioners to characterize their supply chain strategy

in the terms that matter to their business unit, without relying on an external list of supply chain elements that may or may not apply to their particular business unit.

For evaluation. There is no alternative to CSAR in the literature for the *evaluation* of a supply chain strategy, other than the *matching types* paradigm of Fisher (1997) and others. However, the value of the most prominent type-and-match approach as predictor of good performance has been put into question by empirical studies (Qi et al., 2009, Selldin and Olhager, 2007). CSAR could be a more effective approach for evaluating supply chain strategies.

For reformulation. The extant literature presents at least two alternatives to CSAR for the *reformulation* of a supply chain strategy: SCDD and CPPR. They both suffer from some important limitations. *SCDD*, as described in Schnetzler (2005), does not attempt to understand and assess the *current* supply chain strategy of the firm, and makes no provision for retaining any of its good features. *CPPR*, as described in Martinez-Olvera and Shunk (2006), fails to consider the firm's overall strategy during the reformulation effort at all, let alone as the most important guiding principle that should give form to the supply chain strategy. CSAR's approach to reformulation suffers from neither of these limitations: it works to understand and assess the current supply chain strategy and to retain its good features, while at the same time giving the business strategy the role as the most important guiding principle for the reformulation of the supply chain strategy.

7.1. Independent application of CSAR in practice: ChemFirm

In 2011, ChemFirm (*pseudonym*), a world-class, Fortune 100 corporation decided to undertake a company-wide revision of the supply chain strategies of their almost one hundred strategic business units (SBUs). The company created a corporate-level Supply Chain Strategy Unit (SCSU). Members of this unit were trained by us on the theoretical and practical aspects of CSAR. The SCSU members then conducted a pilot project to rethink the supply chain strategy of a single SBU within the company, using the CSAR approach. For confidentiality purposes, the project was conducted

and facilitated entirely by SCSU members (which are employees of the company); our involvement was limited to giving methodological advice about CSAR. When the pilot project was completed, the SCSU members decided to create their own version of the CSAR approach, to adapt it to the internal culture of the company and bring it more in line with some other internal initiatives that the company was undertaking.

A second project was conducted by the SCSU members with another SBU, and was completed with minimal supervision and advice on our part. By the time the SCSU members were conducting the third project, our involvement was nominal. Six months later, when the SCSU team had completed more than a dozen projects, a progress meeting was conducted with the SCSU members. For confidentiality purposes, the team did not share with us the data of the current projects, but they provided enough details of the current version of the method to confirm that most of its key ideas could be traced back to CSAR. By their own estimate, their current method at the time was approximately 80% based on CSAR, with the remaining 20% being modifications they had done to the method in-house to adapt it to the company's culture and initiatives.

Two years later, we were informed that the SCSU team had completed supply chain strategy projects using their version of CSAR with 75% of their almost one hundred SBUs and that they expected to complete projects with all the remaining SBUs within the next six months. Although it is no definitive proof of CSAR's efficacy, its use as a starting point for a large scale supply chain strategy effort by a world-class company, over a span of several years and in dozens of SBUs, provides empirical evidence in support of our view that thinking about supply chain strategy as a conceptual system is a valid and actionable approach, with practical applications. The fact that the company was able to adapt CSAR to its own culture and needs also speaks to the adaptability and transportability of the approach.

Additional anecdotal evidence

CSAR was employed to capture and evaluate supply chain strategy of Unit-X (*pseudonym*), a producer of plastic extruded films used in automotive products. Unit-

X's Vice President (VP) of Supply Chain commented on the CSAR report: "You have hit the nail on the head... This is a very good crystallization of things." The *capture* and *evaluation* exercises had discovered that Unit-X was trying to achieve high asset utilization, high service levels, and low variable costs simultaneously. The VP noted, "You managed to find the key conflicts... The 3-way conflict is a very, very important item right now... Your system seems to be able to single out and capture the fundamental issues we're struggling with."

Libica (*pseudonym*), a distributor of pharmaceuticals, also employed CSAR to capture and evaluate the company's supply chain strategy. The company's Senior Vice President of Supply Chain commented that he got clarity about the company's supply chain practices from the *capture* and *evaluation* reports: "To me, it was like a light bulb went off... We are trying to do everything!" The key details of the CSAR reports of Unit-X and Libica, which contained the supply chain map for the firm and its evaluation matrix, can be found in the work of HiddenAuthor (2010).

The application of CSAR to capture, evaluate, and reformulate an organization's supply chain strategy requires extensive effort. The willingness of organizations to invest the time in the method's application suggests that they appreciate the merits of the CSAR approach. The *official comments* from the organizations who have completed the application of CSAR unanimously attests to CSAR's *actionable nature*, the method's first merit. The organizations state that the application of CSAR has "resulted in valuable insights that are expected to help [the organization] improve its supply chain strategy," "served as the starting point for the methodology that has been used over the last few years at [the organization's] Supply Chain Strategy Unit," or given the organization "a solid starting point to improve our supply chain strategy." The method's second merit, a *holistic view of supply chain strategy*, is evident in the comments that assert that the method has "helped bring clarity to the discussion of certain key strategic tradeoffs," or helped "develop a better understanding of our current supply chain strategy, which at the time [of CSAR's application] was not articulated explicitly."

7.2. Limitations

Perhaps the biggest limitation of the *Conceptual System Assessment and Reformulation* (CSAR) approach is that there is no definitive objective proof of its efficacy as an aid to supply chain strategizing. However, this is also true for all the alternatives to CSAR available in the literature, and, in general, is a limitation faced by the strategy process research (Hutzschenreuter and Kleindienst, 2006).

CSAR has been applied as an approach to rethinking a supply chain strategy in multiple collaborative management research projects—including the projects at Unit-X and Libica—at the time the approach was being developed, validated and refined. Anecdotal evidence from these projects strongly suggests that CSAR is a promising methodology. Although there is no definitive theoretical or empirical confirmation of CSAR's value, we argue that the large-scale deployment of a CSAR-based method for formulating the supply chain strategy at close to a hundred business units of *ChemFirm*, a Fortune-100 firm, attests to the practical value of CSAR. In addition, the fact that the Supply Chain Strategy Unit of *ChemFirm* was able to derive a method for formulating supply chain strategy *customized* to the company's practices based on the principles of CSAR suggests the generalizability of the method's key ideas.

Future work

There are many areas of future work related to the CSAR approach. The model we have proposed of supply chain strategy as a conceptual system could serve as a first step towards a theory of supply chain strategy. The current framework could also be extended into related domains. For instance, the ideas and methods of CSAR can be applied to the problem of rethinking an existing manufacturing strategy or formulating *from scratch a new* supply chain strategy. An empirical examination of the CSAR framework, to determine whether compliance with its goodness criteria correlates with superior performance, is another important direction for the future work. Researchers may also evaluate the merits of Progressive Formulation as a heuristic for conceptual system assembly using mathematical simulation.

In summary, CSAR has emerged as a promising approach for studying supply chain strategies through a nine-year action research study. The model has proven useful in capturing, evaluating and reformulating supply chain strategies of business units in our projects. It has been tested in multiple collaborative management research projects and has served as a starting point for an initiative to rethink the supply chain strategy of business units in a large world-class corporation. The model of supply chain strategy underlying CSAR can serve as a step towards a theory of supply chain strategy and guide the practical applications of supply chain *strategizing*.

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