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The Trials and Tribulations of Supply Chain Management Research

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Without question, it's a great time to be a supply chain researcher. The discipline is enjoying unprecedented attention and growth. Industry is driving much of this new-found fame for supply chain management (SCM). Senior executives are often carrying the label in their job titles, annual reports cite the strength and flexibility of companies' supply chains, and service providers touting their specialization in supply chain management can be found at nearly every commercial break of major sports broadcasts. These developments reflect the commonly held view that competition no longer takes place merely between two manufacturers, but rather between the two manufacturers' supply chains.

This movement in industry is reflected in the adoption of supply chain management in the academic environment as well. Consider that academic departments are adding "Supply Chain Management" to their titles, new academic programs and curricula are focusing on the discipline, an increasing number of journal articles address the topic, and special issues and even entire journals are now dedicated to the subject. So, yes, it appears to be a great time to be a contributor to the burgeoning discipline of supply chain management. However, it is not without its trials and tribulations. This piece focuses on some of the many challenges facing supply chain management researchers, including the very meaning of supply chain management, the call for respectability in a newly formalized discipline, and conducting valid research across a broad scope of business conduct.

What is Supply Chain Management?

To begin, it seems reasonable to ask "What is a supply chain?" and "What does it mean to 'manage' one?" Most will agree that a supply chain is composed of multiple companies working together to provide an output valued by end customers. Meredith and Shafer (2007) refer to a supply chain as "all activities involved in supplying an end user with a product or service" and add that the image of companies linked together makes the chain analogy quite appropriate (p. 271). Lambert (2006) states that a supply chain is "not a chain of businesses with one-to-one, business-to-business relationships, but a network of businesses and relationships" (p. 2). In refuting the "chain" analogy, Lambert points to the complex network of business relationships that compose most supply chains. His distinction is also important because it alludes to the supply chain as embodying more than the physical flows of inventory among companies; it also includes the *relationships* among the companies, of which exchanges in inventory, information, and cash are important aspects.

So, then, what does it mean to manage a supply chain? This is a matter of great confusion among practitioners and academics alike. Four sample definitions follow:

1. Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and

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collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies (source: Council of Supply Chain Management Professionals (CSCMP)).

2. Supply Chain Management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders (source: Lambert, 2006)
3. Supply chain management… concerns the process of trying to manage the entire chain from initial receipt of the ultimate consumer's order all the way back to the raw materials providers and ultimate delivery back to the consumer (source: Meredith and Shafer, 2007).
4. Supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed in the right quantities, to the right locations, and at the right time, in order to minimize systemwide costs while satisfying customer level requirements (source: Simchi-Levy et al., 2002).

Two important similarities among the definitions are the broad scope of supply chain management activity and the concept of integration. All of the definitions underscore the multi-company perspective and the premise of working together to create output desired by end customers. The obvious challenge to cooperative behavior across companies is the fact that shareholders do not buy stock in supply chains—but rather in individual companies, each pursuing the interests of their own shareholders. That much said, it is commonly believed that companies with excellent relations with customers and suppliers will yield greater long-term profitability prospects than rivals with less favorable relations among key trading partners. Toyota is an excellent living example of this belief.

Beyond the cooperation that transpires among companies in the supply chain, many of the definitions speak of integration across functional areas of the individual firm. The CSCMP definition names the areas of sourcing and procurement, conversion, and logistics management (the activities previously labeled "physical flow management" activities). Yet, the closing line describes the integration of "supply and demand management within and across companies" which suggests that SCM involves not only the functions responsible for fulfilling customer orders but also the functions associated with generating and capturing demand (i.e., sales and marketing). This is entirely consistent with the view of the Global Supply Chain Forum at The Ohio State University and its holistic view that integrates all of the functions within a firm into business processes that manage the links across intra- and inter-company boundaries (Lambert, 2006).

With that in mind, is SCM the domain of researchers in operations management, logistics management, or purchasing management? The answer is all of the above, but it is not limited to these functions associated most closely with physical flow management. The areas of marketing, strategy, finance, accounting, human resources, new product development, and engineering can make equally valid claims to elements of supply chain management research. While they may not offer expertise in physical flow aspects of the relationship, they offer significant expertise for the broader view of business conduct among the entities that make up the supply chain. In fact, the expertise of these so-called "outsiders" is essential for a comprehensive understanding of business relationships. It is the rare individual who can claim expertise in these diverse business disciplines. The implication for SCM research is the inclusion of collaborators from diverse business disciplines. The more promising areas of cross-disciplinary research include:

- Defining supply chain strategy and its implications for forming business relationships
- Performance measures for intra- and inter-company supply chain activity
- Mechanisms for sharing the risks and rewards of cooperative engagement among companies in the supply chain
- Power influences in supply chain relationships
- Organizing for effective cross-functional teams
- Continuous improvement initiatives across company lines.

The broad scope of SCM also begs the question "Where is the most appropriate place to publish SCM research?" Is it necessarily limited to SCM journals or does it also have a place in marketing, accounting, finance, strategy, and other business journals? Given the boundary spanning nature of the discipline, it is entirely possible that SCM research may be found in any business outlet, though one must determine where a given work is likely to generate the greatest impact. In some instances, this will be a field-specific journal while in others it will be in a journal dedicated to supply chain management. This debate is occurring in many academic settings as supply chain management forges its position among the more established business disciplines.

The Challenges of Conducting Supply Chain Research

Before supply chain management research can be published, however, it must be conducted. The broad nature of the discipline often makes it difficult to determine how to best approach a research question. For instance, what should be the unit of analysis in supply chain research—the individual firm, a dyadic relationship among firms, a web of relations between two tiers of the supply chain, or the whole supply chain? Depending on the research question, the research scope and unit of

analysis may take on any one of these orientations. Different methods will find relevant application under different research scopes and units of analysis. The next several sections identify common methods of research with their relative advantages and disadvantages in the supply chain domain.

Case Research

Case studies offer a viable method of supply chain research for several reasons. First, cases support the logic of discovery, where the objective is to uncover phenomena through observation and speculation. Discovery leads to the development of hypotheses, laws, and theories, which is appropriate for a field of inquiry lacking a sound base of existing theories (Hunt, 1991). Yin (1989) adds that case studies are "the preferred strategy when 'how' or 'why' questions are posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context." These conditions fit the dynamic environment of supply chain management, where the effect of one actor's actions on another is of particular interest and isolating effects is difficult or impossible. Case studies may also be appropriate for supply chain management research given the ability to capture the richness of inter-company dynamics across multiple tiers.

One limitation associated with case research is its reluctant acceptance in many academic journals fixed on empirical confirmation of theory. While it is true that case research conducted on a casual basis is merely observational, properly conducted case research need not lack the methodological rigor most often associated with empirical testing. While generalizability of findings will be limited by focus on a single supply chain, soundly conducted case research can achieve internal validity unparalleled by other methods and advance the cause of discovery.

Survey Research

In keeping with Hunt's (1991) paradigms of research, the logic of justification is that which the researcher uses to explain and predict phenomena as well as empirically test relationships through scientific methods. Survey methods offer a common means for collecting data on observed phenomena for the sake of empirical theory testing. Survey research is a widely accepted method in most business disciplines. However, survey research in supply chain management poses interesting challenges.

A primary challenge is the difficulty associated with collecting sufficient information from the multiple parties involved in a "supply chain phenomenon." Many of us are finding it challenging enough to generate sufficient response today for surveys directed toward a limited sample frame, say, one level of the supply chain. When the unit of analysis expands beyond a single firm, involving a key customer and/or a key supplier to a focal firm, then the challenge of collecting sufficient data for this broader scope is almost prohibitive. This is particularly true when situation-specific information is sought and the key informants are limited to a select few individuals.

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Collecting a large number of supply chain samples for sufficient statistical power makes it difficult to focus on anything more than a single firm in the supply chain. Relying on a single party in the supply chain can be very risky, though, when the unit of analysis is multi-company. In addition, given that supply chain management is cross-functional in orientation, it can be difficult to access the few members of any given organization who possess sufficient knowledge and experience across the milieu of functions that may be of interest in the research.

Optimization Research

Optimization and mathematical modeling are techniques found throughout all business disciplines, and find frequent application in supply chain management today. The most common applications are those directed toward resource allocation in the production and delivery of products and services as well as the determination of optimal physical structure for supply chain networks. Optimization offers the best collection of tools for solving problems dealing with inventory planning, transportation scheduling, and location analysis. It can also prove insightful on matters of product pricing though it is typically applied to matters of efficiency in physical flow management.

Optimization and mathematical models are less effective, though, when applied to the behavioral aspects of supply chain management. Even with the accommodation of uncertainty and the application of adaptive learning algorithms, optimization struggles to capture the dynamic realities of supply chain relationships. By relying on the assumptions built into model parameters, the output of a mathematical model can only prove as robust as the input. Given the virtually limitless number of variables at work in supply chain phenomena, the research problem must be limited to a manageable scope and dimension for analysis. While this criticism is true of any empirical model of reality, it is often leveled on optimization. So, while optimization offers keen insights beyond the realm of our limited ability to solve complex problems, optimization alone is not sufficient for most large problems in supply chain management, and particularly those with significant behavioral implications.

Simulation Research

Like optimization, simulation uses mathematical models to reflect real-world settings and estimate outcomes given a set of situational characteristics (Closs et al., 1998). Unlike optimization, however, simulation does not yield a single, optimal solution to a problem given its ability to incorporate variance across a static or dynamic planning horizon. Simulation is preferred over optimization when the analysis incorporates multi-echelon or multi-channel distribution formats or when emphasis is placed on the dynamic nature of operational activity. For these reasons, simulation is gaining a significant foothold among supply chain researchers for addressing issues of supply chain strategy and other "what-if" scenarios.

Most simulation research, however, is notional in orientation and lacks the grounding of an actual supply chain environment. A notable exception is the blending of case methods with simulation, where one can benefit from the internal validity offered by case methods and the external validity advantages of simulation. In fact, simulation can serve as the living laboratory for supply chain research by incorporating the full scope of a supply chain (from dirt to dirt), examining the effect of one focal variable on another. Of course, with large-scale problems, model assumptions must be made in order to make the problem manageable. Similar to optimization, the quality of the output is regulated entirely by the quality of the input.

Parting Shots

Supply chain management offers one of the richest domains for business research today. Practitioners are interested and, indeed, hungry for the contributions that academics can lend as they deal with an ever-complex myriad of challenges, as they try to make the vision of SCM a reality. Academic journals likewise are seeking to fill their pages with the offerings of supply chain researchers. We must address these needs, but with consideration of the many issues brought forth in this piece. Here is a brief recap:

- The very meaning of supply chain management remains ambiguous with several competing definitions available. Until consensus understanding is reached, authors must identify a specific definition within which they are working, and any new definitions must be substantiated thoroughly to prevent muddying the waters further.
- SCM research is not the domain of "SCM" researchers only. Rather, we need multiple perspectives to conduct the best work; this will also accelerate recognition of the discipline by all business researchers. To this end, SCM research should embrace the extant literature in the various fields. In turn, SCM research can offer significant contributions to the "outside" fields.
- SCM research can be found in journals specializing in supply chain management but should not be limited to these outlets. Work should be directed to the outlets that will allow for the greatest impact, as measured not only by potential for exposure and thought development among fellow academics, but also for the consumption and benefit of today's business practitioners.
- No single research method is without weaknesses in the SCM domain. Supply chain management will call upon the merits of multiple methods, sometimes in combination, to offer the appropriate level and depth of analysis required for a given research focus.

In sum, supply chain management offers rich opportunities for contribution as we develop the discipline. As a result, there is much seminal work that remains to be done as the discipline emerges from darkness and defines its own identity. To the extent that we can conduct valid, relevant, interesting research, we advance not only the thought and practice of supply chain management but the discipline itself. We must overcome the trials and tribulations to achieve anything of significance.

References

Closs, David J., Roath, Anthony S., Goldsby, Thomas J., Eckert, James A., & Swartz, Stephen. (1998). An empirical comparison of anticipatory and response-based supply chains. *International Journal of Logistics Management*, *9*(2), 21-34.

Council of Supply Chain Management Professionals, definitions available at: http://www.cscmp.org/Website/AboutCSCMP/Definitions/Definitions.asp.

Hunt, Shelby D. (1991). *Modern marketing theory: Critical issues in the philosophy of marketing science.* Cincinnati, OH: South-Western.

Lambert, Douglas M. (2006). Supply chain management. In *Supply Chain Management: Processes, Partnerships, Performance* (2nd ed.). Supply Chain Management Institute, Sarasota, FL.

Meredith, Jack R., & Shafer, Scott M. (2007). *Operations management for MBAs* (3rd ed.). Hoboken, NJ: Wiley & Sons.

Simchi-Levy, David, Kaminsky, Philip, & Simchi-Levy, Edith. (2002). *Designing and managing the supply chain.* New York: McGraw-Hill/Irwin.

Yin, Robert K. (1989). *Case study research: Design and methods.* Newbury Park, CA: SAGE Publications. ■

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