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ABSTRACT

Supply chain researchers are confronted with a dizzying array of research questions, many of which are not mutually independent. This research was motivated by the need to map the landscape of research themes, identify potential overlapping areas and interactions, and provide guidelines on areas of focus for researchers to pursue. We conducted a three-phase research study, beginning with an open-ended collection of opinions on research themes collected from 102 SCM researchers, followed by an evaluation of a consolidated list of themes by 141 SCM researchers. These results were then reviewed by 10 SCM scholars. Potential interactions and areas of overlap were identified, classified, and integrated into a compelling set of ideas for future research in the field of SCM. We believe these ideas provide a forward-looking view on those themes that *will* become important, as well as those that researchers believe *should* be focused on. While areas of research deemed to become most important include big data and analytics, the most under-researched areas include efforts that target the “people dimension” of SCM, ethical issues and internal integration. The themes are discussed in the context of current developments that the authors believe will provide a valuable foundation for future research.

Keywords: Survey, Research Themes, Research Trends, Supply Chain Management

INTRODUCTION

Supply chain management (SCM) is often noted by scholars as one of the most rapidly changing management fields. Researchers have noted the plethora of predictions and forecasts related to significant technological and managerial changes that accompany

the discipline's development (including Melnyk et al. 2009; Sanders et al. 2013; Economist Intelligence Unit 2013; Handfield et al. 2013; The Global Supply Chain Institute 2013; Kersten et al. 2014). While many studies predict rapid change in the world of supply chains, only a handful have sought to note how academics *are* responding, as well as projecting how they *should* respond to these rapid changes (e.g. Kouvelis et al. 2006; Stank et al. 2011; Vallet-Bellmunt et al. 2011). Given the lag effect and the lack of recent updates to many of the shifts in the global supply chain ecosystem, the time is ripe for an exploration of how the momentous changes in the global economic environment of the last four years will be reflected in the tenor of future academic research. In recent years, supply chain managers have experienced a major global recession, a rapid expansion of global footprints into emerging countries, suffered major disruptions, and have been called on to produce major improvements in sustainability, cost savings, and regulatory compliance (Handfield et al. 2013). An updated review of academic research directions in SCM is not only timely, but indeed warranted.

Research that seeks to identify future research themes has typically relied on literature reviews. However, looking backwards to predict the future (i.e., using literature reviews as an extrapolation method), provides limited insights into the trajectory of research in a field. We believe soliciting researchers' judgments (Meyer and Booker 1991) can lead to more insightful outcomes, as this approach maps out not only what thought leaders believe will become important, but also identifies areas where they believe insufficient work has occurred and more focused work is needed. Reporting on the data collected from 141 SCM researchers, this research seeks to address the following questions: (1) What are the future dominant research themes in SCM? (2) What are the most fruitful research areas when linking these different themes?

In order to provide an adequate answer to these questions, we employed a research approach that consisted of a two-phase survey and an additional explorative in-depth analysis (phase three). In the survey, we collected opinion polls on whether researchers distinguished between the themes they believe *will* become important versus the themes they think *should* become important. This approach led to initial insights as to whether the SCM research boat is sailing in the right direction. We "drilled down" into the *should*-become-important themes and sought to explore the potential overlaps and interactions between these themes, thereby identifying a secondary set of research areas that combine important research themes in a new way.

The resulting set of insights provides a compelling set of guidelines for future editors, researchers, Ph.D. advisors and their students to consider as they map the trajectory of their individual research agendas for the next decade. Our findings provide young researchers important insights into the future direction of our discipline, while also serving to guide well-published researchers with the opportunity to reflect on their

current and future contributions to the field as recognized by their peers. Reflection at the right time has been shown to be one of the most critical components of learning (Di Stefano et al. 2015). Pausing to reflect on one's own accumulated knowledge may lead to greater learning than the accumulation of additional knowledge. Finally, our research points to the need for a more holistic view of supply chain themes, as our analysis points to the strong linkages that exist among these core research questions.

METHODOLOGY

Survey sample selection

Emerging research themes were identified based on data collected from informed researchers selected from within the SCM field through our 2013/2014 SCM Research Survey. To identify the sample of potential researcher respondents, we first selected four leading journals related to SCM, representing both the methodological and theoretical breadth of the discipline: *Journal of Business Logistics*, *Journal of Operations Management*, *Journal of Supply Chain Management*, and *Production and Operations Management*. In a second step, a list containing all authors having published in these journals between January, 2010 and September, 2013 was compiled. After deleting duplicate entries the final list contained 1,075 entries.

Phase 1 of data collection: Identifying a set of themes

The survey process consisted of two phases of data collection. In the first phase (November/December 2013), the targeted sample researchers were asked in an open question format to name up to three emerging themes that will be the subject of SCM research in the next five years. A total of 102 researchers responded to this question in the first phase of data collection, yielding 254 identifiable themes.

Phase 2 of data collection: Evaluating the importance of themes

A consolidated list of these themes was presented to the participants in the second phase of data collection (April/June 2014). This list contained all themes that were mentioned more than three times in the first phase of data collection, yielding a total of 24 themes. Synonymous terms were grouped together based on logical deduction (e.g. "behavior issues" and "behavioral SCM"), whereas themes that were simply related were kept as separate entries (e.g. "risk" and "resilience"). This grouping was independently conducted by three SCM researchers. An additional quality check was conducted for themes that were mentioned less than three times (a total of 58 themes). For each of these 58 themes, six SCM researchers were asked to evaluate on a 5-point Likert scale whether they think the theme was likely to become an important research direction (1 = do not agree at all; 5 = totally agree). If the average agreement value was greater than 3.5, the theme was kept in the questionnaire. This yielded an additional 11 items. The 1,075 SCM sampled researchers were asked to evaluate if a theme *will* become an emerging theme, and if it *should* become an emerging SCM theme. For both questions a

7-point Likert scale (1 = do not agree at all; 7 = totally agree) was used. The order of the themes was individually randomized to reduce any bias. A larger number of responses occurred in the second phase of data collection (141). The findings of our research are based on the analysis of 141 survey responses in the second phase of the survey.

Phase 3 of data collection: Linking the most important themes

Following this analysis, an additional in-depth analysis was conducted (July/August 2015). In this phase a data collection table – an empty version of Table 2 – was prepared, with 6 clusters of the 10 highest ranked *should*-become-important themes on each axis. Clustering of topics was carried out by grouping closely related themes. In specific, “sustainability”/“environmental issues”, “risk management”/“disruption” and “people dimension of SCM”/“behavioral issues” were grouped together. The table was sent to 13 SCM researchers. These researchers were selected based on (1) the significance of their research publication record and (2) the overlap between their research fields and the themes identified in the survey. Moreover, we sought out a core group of researchers whose publication record focused on at least one or more of the themes, and to also ensure that each theme had coverage by at least two researchers. All selected researchers had publications in one of the four journals or other leading journals that are related to the six themes. They were asked to complete a detailed response in answering a single question for each cell of the table: “What are the future research potentials when linking these two themes in SCM research?” Ten researchers returned the completed table within the allotted scheduled time.

POTENTIALLY UNDER- AND OVERESTIMATED RESEARCH THEMES

From the data, we first calculated the difference between the *should*-become-important score and the *will*-become-important score for each theme. In some cases there are interesting gaps between what the surveyed researchers believe *will* become an important theme and what they believe *should* become an important theme. (The latter category essentially represents a latent but unmet need in the literature.) We assume that it is possible to classify themes as either “in need of greater study by researchers”, or alternatively, “not worthy of the attention they’ve received”, based on their relevance to supply chain ecosystem dynamics. We first briefly discuss some research themes that respondents believe need more attention, followed by research themes that seem to get more research attention than they deserve. These results are summarized in Table 1. A positive difference score indicates that the *should*-become-important score is larger than the *will*-become-important score and the theme is thus expected to be underestimated in future SCM research projects; a negative difference score indicates that a theme is potentially overestimated.

Table 1: Scholars' perceptions of underestimated and overestimated emerging research themes in the next five years.

++++ INCLUDE TABLE ABOUT HERE +++++

- **The “people dimension of SCM”:** Only a few studies explore the behavioral dynamics of consumers, managers or other individual actors within a supply chain system. It seems like too often research in our field is conducted on the (inter-)organizational level of analysis; processes and relationships on the (inter-)individual level are often neglected or assumed away. Feedback from participants notes that supply chains are not “soulless machines”, but complex sociotechnical systems involving cognitive elements and impacted by face-to-face negotiations and conversations. For example, recent research demonstrates that human agents and governance-influencing properties of supply chain systems mutually influence each other over time (Tangpong et al. 2014). Such observations call for SCM researchers to devote greater effort on exploring the roles of individual actors and groups in decision-making models as well as conducting multi-method research that, for example, includes behavioral biases and influences on outcomes.
- **Ethical issues along the supply chain:** Recent disasters in the Bangladeshi fashion industry (Wieland and Handfield 2013), the European horsemeat scandal (Lawrence 2013), and revelations of cruelty across angora fur supply chains (PETA 2014) have given rise to discussions on the importance of ethical sourcing in the supply chain. One of these areas of interest is a predictive model for better understanding what drives labor unrest in major offshore supply chain parties. Potential events may include wage levels in a region relative to the price of food and housing, raw material supply etc. Under certain conditions, based on common thinking, many of today's low cost country supply chains are ripe for labor issues and disruptions.
- **Internal integration between departments:** In reviewing latent dimensions of supply chain integration considered in previous research projects, it became apparent that many conceptualizations of integration are incomplete, “leaving out the important central link of internal integration” (Flynn et al. 2010, p. 58). This is a surprising observation, particularly in light of the fact that prior research demonstrates external and internal integration practices have a synergistic effect on performance if they are jointly used (Droge et al. 2004). Indeed, respondents to our survey indicated that internal integration between different departments of an organization turns out to be a neglected theme. Do we put too much emphasis on the external rather than internal supply chains?
- **Big data and analytics:** Conversely, big data and analytics are assumed to be among the dominating research themes in the next years, but the answers to the question of whether these themes *should* get more attention was a bit less

enthusiastic. These two themes were the only two themes with substantially *negative* differences between desired and expected importance values, suggesting that there has been perhaps too much “hype” around these issues. As we will discuss later, analytical approaches are certainly important in SCM, but researchers need to distinguish between the real potential, the “value”, and the social media marketing of these themes created by consultants, software developers, and infrastructure providers. Managers should re-examine the temptation to call everything “big data” that is somehow related to any type of data analytics. Further, the ability to manipulate large data sets to create unique insights is also limited. Many companies seem to find themselves in the state of “big data, but small math”.

RECOMBINING IMPORTANT THEMES: RECOGNIZING FUTURE RESEARCH POTENTIALS

Next, we identified suggestions made by 10 active SCM researchers (6 professors [including two former and one current editors of leading SCM journals], 1 associate professor, 3 assistant professors; located in the U.S. [4], Germany [2], Ireland [2], Denmark [1] and the UK [1]). Their input suggested a set of compelling interactions that exist after reviewing the *should-become-important* themes when they are linked to each other. Table 2 depicts an overview of some of the areas with the greatest potential for “interesting” research. A number of these highlighted areas are now further discussed.

Table 2: Some future research potentials when recombining the research themes.

++++ INCLUDE TABLE ABOUT HERE +++++

- **Accepting that SCM decisions are inherently imperfect:** Traditional supply chain models have often simply transferred management practices from the system “organization” to the system “supply chain”. However, given the globalized, multi-cultural and interlinked nature of supply chains – as Amaral and Tsay (2009) put it: “Real-world supply chains are messy” – a supply chain is usually much more complex than a company. Cognitive human capacity limitations are often the biggest boundary to overcome in supply chain decision-making frames. In the human decision-making context, traditional management approaches tend to fail. In other words, the supply chain context cannot assume that an objective and rational decision maker has transparent access to all the information required to operate a network. Rather than trying to optimize each link in the system, SCM needs to be more robust in assuming irrational agents, missing visibility and complex decision-making. For example, rather than trying to identify all possible risk sources along

the end-to-end supply chain, managing supply chain risk should focus on building resilient product and supply chain designs to cope with multiple unexpected and non-transparent sources of disruption (Pettit et al. 2010).

- **Redesigning supply chains to manage risk and improve sustainability:** One way to cope with this new reality is by redesigning supply chains. The structure of a supply chain can have a huge impact on how vulnerable it is. In particular, by eliminating complexity from a supply chain, managers may also be able to reduce waste, emissions and risk (Bode and Wagner 2015; Durach et al. 2015). Analysis might reveal a possible link between the complexity of a supply chain and the frequency of disruptions that occur. Recent research has already highlighted that supply chains need to be redesigned by creating more resilience across the entire system rather than managing various risks at a local level. It is also possible that some forms of complexity (e.g., certain types of redundancy) could also reduce disruptions. SCM research needs to consider the appropriate design that facilitates value creation and reduces the likelihood of disruption under differing network ecosystems.
- **Making sense of the “sea of data” along the supply chain:** With the emergence of data science, predictive analytics and big data (Waller and Fawcett 2013), supply chain managers are increasingly being empowered to interpret data collected through the “Internet of Things”. By integrating data from all parts of the supply chain and presenting them on a smart phone, dashboards will enable consumers to have more knowledge about the entire system and guide them in making more holistic and sustainable buying decisions. Also, managers can employ visual data graphics to better interpret important and less important signals, and to use new metrics to measure risk, sustainability and total cost. In general, the promise of data to generate new insights on the supply chain and to reduce complexity is exciting, but is still very much a misunderstood area. More data has not always equated to more information that aids decision-makers. It is up to researchers to explore how analytical frameworks can bring us closer to the dream of real end-to-end supply chain integration. In any case, supply chain management has finally reached the stage of end-to-end thinking beyond the first tier.
- **Improving decision support tools in SCM:** An important element of this new supply chain world could be the creation of improved decision support tools that make integrated supply chain data available for decision making. Although we need to understand that irrationality cannot be eliminated entirely, such tools can help to make decisions at least more objective. In this manner, rational decision making can be supported to better interpret information from other supply chain members, to better adjust objectives of supply chain members and to understand how organizational decisions could affect the entire supply chain system. This includes forecasting, early-warning and real-time applications (e.g., identifying disruptions

before they occur based on social media data). Recent events suggest that supply chain managers of the future will increasingly become “analytical decision makers” rather than “hands-on optimizers”.

- **Dealing with resistance to supply chain innovations:** Introducing new systems, processes, organizational structures, organizational cultures or regulatory standards may already be a difficult task to deploy within a single department or company due to social and cultural traditions. Organizational resistance becomes even much more challenging to manage in a supply chain that crosses organizational boundaries. In theory, it may make sense to introduce an innovative decision support platform that integrates data from multiple tiers and organizations in the supply chain. But how can suppliers and retailers be convinced to share their confidential data? The touchy subject of intellectual property and confidential concerns are often “assumed away” by researchers seeking to optimize multi-echelon networks. New research is needed to drill down into interpersonal and trust-related issues that are underlying inter-organizational integration efforts.

CONCLUSIONS

Our discipline is facing a series of changes. In a volatile fast paced ecosystem in which disruptive events are the norm, familiar supply chain tenets are rapidly being challenged. Several recent developments suggest that a new “era” of supply chain challenges is upon us:

- Rising geopolitical tensions, higher labor costs in traditional low-costs countries and the emergence of innovative technologies such as 3D printing and improved robotics may soon create production supply chains that will be located closer to sales markets, for example in Europe and North America.
- The “smile of value creation” (Mudambi 2008) is further moving towards the “end points” of the supply chain. The implication is that companies are focused in two extremities of the value chain: (1) controlling customer data and (2) focusing on R&D and product innovation. The implication is that manufacturing and even engineering processes are outsourced to third parties, with a relative shift in emphasis on sourcing, product engineering, and marketing analytics.
- The movement towards driverless vehicles and new types of partnerships in the automotive industry suggests that vehicles may soon be offered by data-driven technology companies from Silicon Valley, not traditional engineering-focused organizations from Detroit, Germany or Japan.
- The Paris Declaration contains ambitious sustainability goals that will lead to entirely new business models and, eventually, supply chain models. The Rana Plaza building collapse has already changed the way the apparel industry deals with social responsibility and it seems that this new mindset is spreading to other industries.

In all of these developments, SCM plays a key role – maybe even a more crucial role than in the past. The rapid changes in the global operating ecosystem offer fascinating opportunities for SCM researchers to immerse themselves in problems that are completely new, many of which can be linked to solid research approaches that can not only supplement these new operating models, but will also require researchers to set aside conventional thinking.

Our work in this research has singled out many new important themes in SCM. These identified research themes emphasize that the issues of sustainability, risk, humans, innovation, analytics and complexity cannot be studied in a void. Rather, these themes require strong interdisciplinary thought and rigorous approaches to consideration of these factors on supply chain outcomes. Further, our proposed list of high potential research themes provides a number of benefits for readers of this journal. Editors of leading SCM journals can benefit from the results of this study by allowing papers that fall in the group of underestimated research themes to receive priority in publication queues (Table 1). The themes may also be suitable for special issues dedicated to in-depth research in these themes identified in the cross table of *should-become-important* themes (Table 2). Academics may also wish to hold special sessions at future professional meetings dedicated to the discussion and exploration of themes in these areas.

The identified research themes and their assessment of whether they are over- or underestimated should also provide insights to well-informed researchers. The findings of this study can be used by researchers to reflect on their own research trajectories. If researchers find their own intended research stream is validated by our findings, this may serve to further validate their intended efforts in this direction. If researchers observe that a gap exists between their intended direction and those identified as important in our research, there may be a need for evaluation of the research agenda, which may cause some to modify or re-direct the course of their individual research agendas. It may not be comfortable to shift research themes in mid-stream, but we encourage readers to not limit themselves to problems that are already well-studied, and to jump into the void of new problems with little developed theoretical bases.

Like any research initiative, our results are not without limitations. We acknowledge that the sample taps into researchers who have published in some of the most visible journals. We have, however, omitted other journals in our field, such as the *International Journal of Physical Distribution & Logistics Management*, *Journal of Purchasing & Supply Management*, or *Supply Chain Management: An International Journal*. We also did not include researchers who are on the cusp of new discoveries or doctoral dissertations that have not yet been published and are entirely new. The omission of these outlets and the possible omission of some important insights from other researchers are mentioned here as a possible limitation to this study.

We also note that in spite of substantial differences between the answers to questions on themes that *should* be and that *will* be important, the largest of these differences was 0.69. All of these themes were clearly evaluated as important on both scales. As part of this forward-thinking article, our results should be perceived as directional in nature. In particular, we do not believe that big data and analytics are unimportant themes or that the other mentioned themes have been entirely overlooked. Readers should keep in mind that these results are based on the answers of SCM researchers. Surveying researchers from other fields may have led to a different set of conclusions (e.g., IT-related researchers with more knowledge may have emphasized big data more).

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Table 1: Scholars’ perceptions of underestimated and overestimated emerging research themes in the next five years.

Rank	Research Theme	Difference
1	People Dimension of SCM	0.65
2	Ethical Issues	0.63
3	Integration (Internally between Departments)	0.44
4	Transparency/Visibility	0.39
5	Human Capital / Talent Management	0.39
6	Co-opetition	0.30
7	Humanitarian Issues	0.30
8	Reverse Logistics	0.29
9	Behavioral Issues	0.27
10	City Logistics	0.25
11	Complexity	0.24
12	Volatility/Turbulence	0.23
13	Sustainability (Ecological, Economic, Ethical, Social)	0.22
14	Disaster Relief / Emergency Management	0.22
15	Innovation	0.20
16	Resilience	0.18
17	Environmental/Green Issues	0.18
18	Disruption	0.17
19	Coordination	0.12
20	Integration (Externally between Firms)	0.10
21	International/Global Issues	0.10
22	Multi-tier Management	0.09
23	Health Care	0.09
24	Real-time Information	0.08
25	Networks	0.06
26	Backsourcing/In-sourcing	0.05
27	Servitization/Services	0.03
28	Finance	0.03
29	Risk Management	0.03
30	Emerging Markets	0.02
31	Information Security	-0.03
32	Re-shoring/Backshoring	-0.04
33	IT/Digitalization	-0.08
34	Analytics	-0.34
35	Big Data	-0.69

Note: The “difference” score was calculated as the difference between the *should*-become-important score and the *will*-become-important score. A positive [negative] score indicates an underestimated [overestimated] research theme.

Table 2: Some future research potentials when recombining the research themes.

	Sustainability	Risk Management	People and Behavior	Innovation	Analytics
Risk Management	<ul style="list-style-type: none"> • Including the broader context into SCM (e.g. laws, trends). • Considering social and ecological issues as reputational risks. • Including sustainability in supply chain risk models. 				
People and Behavior	<ul style="list-style-type: none"> • Managing perceptions of sustainability in the supply chain. • Influencing culture to increase sustainability in supply chains. • Closing the attitude-behavior gap of sustainability. 	<ul style="list-style-type: none"> • Managing risk preferences and risk perceptions. • Managing biases and heuristics in risk identification. • Optimizing the supply chain structure to manage risk. 			
Innovation	<ul style="list-style-type: none"> • Exploring/exploiting SCM potential of sustainable products. • Using smart technologies to create sustainability. • Relationship between innovative and sustainable firms. 	<ul style="list-style-type: none"> • Linking disruptive innovations and supply chain risk. • Reducing product recalls for innovative products. • Using the Internet of Things to reduce risk in the network design. 	<ul style="list-style-type: none"> • Dealing with resistance to supply chain innovations. • Managing irrational decision making in the innovation process. • Investigating culture of inter-organizational innovation. 		
Analytics	<ul style="list-style-type: none"> • Driving metrics to create end-to-end visibility. • Measuring social/ecological footprint along supply chain. • Predicting impact of real-time events on CO₂ footprint. 	<ul style="list-style-type: none"> • Improving early-warning systems. • Providing advanced risk metrics. • Analyzing and predicting impact of decisions on supply chain resilience. 	<ul style="list-style-type: none"> • Improving decision-support tools in SCM. • Enabling better interpretation of SCM information. • Involving social media data in SCM analytics tools. 	<ul style="list-style-type: none"> • Utilizing technology to anticipate potential data inputs. • Analyzing and predicting multi-channel options. • Improving category optimization and spend analytics. 	
Complexity	<ul style="list-style-type: none"> • Redesigning supply chains to improve sustainability. • Reducing waste by managing supply chain complexity. • Investigating impact of complexity on sustainability initiatives. 	<ul style="list-style-type: none"> • Redesigning supply chains to manage risk. • Extending risk management beyond tier one. • Managing complexity in order to manage risk. 	<ul style="list-style-type: none"> • Accepting that SCM decisions are inherently imperfect. • Handling complexity when making joint SCM decisions. • Managing talents to better deal with complex situations. 	<ul style="list-style-type: none"> • Managing innovation projects with complex supply chain interactions. • Using technologies to reduce network complexity. • Investigating “Manufacturing 4.0” 	<ul style="list-style-type: none"> • Making sense of the “sea of data” along the supply chain. • Supporting real-time supply chain decision making. • Enabling true end-to-end supply chain integration.

Note: A similar but empty table was sent to 13 SCM researchers and used as an instrument to collect the data.