

WHY RESEARCH IN SUSTAINABLE SUPPLY CHAIN MANAGEMENT SHOULD HAVE NO FUTURE

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In the last two decades, the topic of sustainability has moved from the fringes of supply chain management research to the mainstream and is now an area of significant research activity. In this paper, we argue that while this increase in acceptance and activity is welcome and has led to a greater understanding of sustainability, our present knowledge is not sufficient to create truly sustainable supply chains. We build on this insight to identify five main issues that future research needs to address. We argue that when it comes to the theory of sustainable supply chain management, previous research has focused on the synergistic and familiar while overlooking trade-offs and radical innovation. These theoretical issues are compounded by measures that do not truly capture a supply chain's impacts and methods that are better at looking backwards than forwards. The paper concludes by proposing a series of recommendations that address these issues to help in the development of truly sustainable supply chains.

Keywords: sustainability; supply chain management; sustainable supply chain management

INTRODUCTION

In the mid-1990s, Steve Melnyk gave one of us (Mark Pagell) a great opportunity to be the research assistant on an early project that examined environmental issues in an operational/supply chain context. Mark mostly wasted that opportunity because he paid too much attention to naysayers who told him he would hurt his career by working on such a "fringe" topic.

In the intervening two decades, sustainable supply chain management (SSCM) has moved from being a fringe topic that many of us were actively discouraged from studying, to the mainstream. So mainstream that

many of the same people who discouraged such research 20 years ago are conducting it today.

Given the importance of addressing a host of environmental and social issues, this progress from fringe to mainstream is welcome. But, this paper's main argument is that while such progress increases the odds of supply chains becoming *more* sustainable, the question of how to create *truly* sustainable supply chains remains unanswered. This question will not be answered until researchers no longer treat SSCM as a separate stream of SCM.

Seuring and Müller (2008, p. 1700) define SSCM as:

the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements.

And Pagell and Wu (2009, p. 38) define a truly sustainable supply chain as:

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To be truly sustainable a supply chain would at worst do no net harm to natural or social systems while still producing a profit over an extended period of time; a truly sustainable supply chain could, customers willing, continue to do business forever.

Building on these definitions, SSCM is the designing, organizing, coordinating, and controlling of supply chains to become truly sustainable with the minimum expectation of a truly sustainable supply chain being to maintain economic viability, while doing no harm to social or environmental systems. These definitions and many others share a focus on the triple bottom line of economic, environmental, and social performance and examining this performance over an extended period of time.

We use the term SSCM in its broadest fashion to encompass any research that accounts for both the economic and noneconomic impacts of a supply chain. SSCM, in this context, includes all SCM research that addresses the environmental or social components of performance, including research that has been labeled as green, responsible, or ethical supply chain management.

The existence of SSCM as a separate stream of research means that while it is now mainstream enough to have its own tracks in conferences and departments in journals, SSCM is still somehow a novelty or a nice to have, not the focus for the typical researcher. For instance in the last year (v48, i4 to v49, i3), JSCM, a journal that is supportive of the topic and whose editors work extensively in the area, published 27 articles of which three were clearly SSCM articles. And at the 2013 EUROMA conference in Dublin, approximately 20% of the papers and presentations were clearly on SSCM. In sum, 80% of the papers at EUROMA and about 90% of the papers in JSCM did not address sustainability.

This separation of SSCM means that at best, the majority of ongoing research overlooks the environmental and social consequences of supply chain actions and at worst is research on unsustainable or irresponsible supply chain management. We recognize this comment is somewhat facetious, but the point remains: research on un-sustainable supply chains is, to a great extent, still the norm.

However, creating truly sustainable supply chains is no longer a nice to have. The planet's ability to provide some natural resources is running out at the same time that many stakeholders are demanding action on a range of issues from climate change to working conditions in supplier factories in developing countries. In response, many organizations are striving to create truly sustainable supply chains as evidenced by initiatives such as Interface's Mission Zero (Interface, 2013). Moreover, today's leading practitioners of

SSCM have supply chains that are not yet truly sustainable. True sustainability remains an aspiration. This necessitates a change in how supply chains are managed. Sustainability is at its core about long-term survival. Most supply chains in existence today will not survive unless they change practices and business models to address their negative social and environmental impacts. For research to help in the creation of truly sustainable supply chains, the separation of SSCM needs to end.

Future SCM research will have to treat a supply chain's social and environmental performance as equally or more valid than economic performance. Our argument is that if SSCM research is to realize the change, most of its proponents claim it is aimed at, all SCM research, not just one stream, must address the social economic and environmental impacts of the supply chain.

All SCM research being SSCM research is then the end point we believe the field needs to be working toward. But we also believe that, while significant progress has been made toward this goal, there is a long way to go before the SSCM moniker can be retired.

Our aim in this paper is to help move the field from studying how to manage unsustainable supply chains in a more sustainable manner, to managing truly sustainable supply chains.

We start by briefly reviewing what is known about SSCM. In the process, it becomes clear that we know far more about how to adapt known practices to make a supply chain more sustainable than we know about what new practices and processes are needed to create truly sustainable supply chains. This insight allows us to identify five main issues that future research needs to address to provide some guidance as to how these changes could come about.

REVIEW – WHAT DON'T WE KNOW ABOUT SSCM?

The field of SSCM has been the subject of numerous special issues and multiple robust reviews (e.g., Carter & Easton, 2011; Seuring & Müller, 2008). This previous work does an excellent job in describing what we know and reinforces the point that the field has made significant progress.

But our interpretation of the literature suggests that to reach the point of no longer separating SCM and SSCM research, researchers need to address five critical and related issues. When it comes to the theory of SSCM, we argue that previous research has often focused on the synergistic and familiar while overlooking trade-offs and radical innovation. And, we believe these theoretical issues are compounded by measures that do not truly capture a supply chain's

impacts and methods that are better at looking backwards than forwards.

Issue One – Harm Reduction is not Harm Elimination

Because most supply chains are not presently sustainable, extant SSCM research has been focused on harm reduction in unsustainable supply chains. When researchers ask questions such as “does it pay to be sustainable?” what they are effectively asking is: “does being more sustainable than other unsustainable supply chains improve economic performance?” Similarly, when researchers ask if a practice can simultaneously have positive impacts on economic and environmental outcomes (e.g., King & Lenox, 2002; Zhu & Sarkis, 2004), the positive environmental outcomes are often a reduction, not elimination in harm.

For example, there is evidence that the adoption of lean will also mean less harm to the environment because lean practices lead to better use of resources and a reduction in emissions (e.g., King & Lenox, 2002). Except this, reduction in harm is often coming from supply chains whose products or services would use resources faster than their rate of replacement, even if there were no emissions during production. An extremely lean automobile supply chain that creates no environmental harm in the production of vehicles is still creating a product that uses a significant amount of nonrenewable resources in its lifecycle. Absent a radical change in business models, these supply chains will hit the productivity frontier where no further reduction in environmental or social harm is possible before they are truly sustainable.

Extant research has mainly focused on making unsustainable supply chains and business models less unsustainable. It offers limited insight into how to create an economically viable supply chain that at a minimum creates no harm and may even have positive or regenerative impacts on social and environmental systems.

Issue Two – a Limited Stakeholder View – the Primacy of Profits

As seminal works by authors such as Russo and Fouts (1997) and Klassen and Whybark (1999) first appeared, numerous authors have addressed the question of “does it pay to be green (sustainable)?” in a variety of ways. Enough studies have been carried out on this topic for Golcic and Smith (2013) to conduct a meta-analysis where they conclude that it does pay to be green.

Given the topic’s historical treatment, the focus on the economic implications of being sustainable was initially understandable. Evidence that addressing environmental or social issues positively impacted

profits was a way to gain legitimacy in a field where it was assumed that such actions often harmed profits (i.e., Walley & Whitehead, 1994) and that the social responsibility of a business was to be profitable (Friedman, 1970). But, that we are still debating the economic value of sustainability today is indicative of outdated assumptions and a very limited stakeholder perspective in much of the SCM/SSCM literature.

The “does it pay to be sustainable?” question contains a normative assumption that profits are the ultimate assessment of supply chain performance and that managers and shareholders are the most important stakeholders in a supply chain. Carter et al. (Carter & Dresner, 2001; Carter & Rogers, 2008) claim that if a practice has a negative impact on the economic bottom line, it is not sustainable, no matter how beneficial it is for environmental or social performance. Hence, the focus of a firm should be on environmental or social practices that are beneficial for economic performance, “...of course, the social and environmental dimensions of [SSCM] must be undertaken with a clear and explicit recognition of the economic goals of the firm” (Carter & Rogers, 2008). This approach can be traced back to pioneering work of Carroll (1979), who emphasized the importance of economic sustainability, claiming its priority over other dimensions of the triple bottom line.

However, the literature offers numerous cases of companies who face trade-offs between economic and noneconomic performance (e.g., Kolk, 2012; Lee, 2010; Wu & Pagell, 2011). In addition, many authors note that supply chains often have no choice but to adopt new practices that have a negative or uncertain impact on the economic bottom line (e.g., Hahn, Frank, Pinkse, & Preuss, 2010; Pinkse & Kolk, 2010; Winn, Pinkse, & Illge, 2012; Wu & Pagell, 2011). Furthermore, sustainability research grounded in stakeholder theory (Clarkson, 1995; Eesley & Lenox, 2006; Mitchell, Agle, & Wood, 1997) does not predicate the introduction of new practices based on their positive economic impacts. This alternative view supports the adoption of costly new practices that improve environmental or social performance in the following way: supply chains often have to satisfy the demands and needs of their stakeholders; many of whom, such as NGOs, governments, or communities, are not interested in the chain’s economic performance, but rather are focused on the chain’s impact on society or the environment. This view implies that by focusing only on those practices that are economically beneficial a supply chain would not be able to respond to all of its negative social or environmental impacts and hence not be sustainable. According to this view, adoption of nonsynergistic practices is sometimes required. By focusing on synergies, the SSCM

literature offers limited insight into what to do when environmental or social concerns cannot be addressed in a synergistic manner (Figge & Hahn, 2012; Hahn & Figge, 2011).

While other literature gives primacy to stakeholder claims other than profits (see for instance Burch, Dixon, & Lawrence, 2013; Maertens & Swinnen, 2009), in the SSCM literature there is broad, albeit often implicit acceptance of the supposition that profits are the ultimate gauge of supply chain performance. And because the preponderance of SSCM research (including much of our own) has been based on this norm, which research has also mainly dealt with looking for evidence of synergies, with little research dealing with trade-offs. Future research will have to explicitly recognize the claims of stakeholders without an economic stake in the chain, treat these claims as equally valid to economic claims, and start to focus on ways to deal with situations where synergies cannot be created.

Issue Three – a Focus on the Familiar

Focusing on synergies seems to partially underpin the third issue with extant research: a focus mainly on the familiar when examining the practices associated with SSCM. The focus on the familiar is clear in studies that ask questions such as how does a practice such as lean impact environmental (King & Lenox, 2002) or social outcomes (Longoni, Pagell, Johnston, & Veltri, 2013) or how do we update an existing tool such as supplier portfolios to deal with changed expectations (Pagell, Wu, & Wasserman, 2010). But the familiar is also the foundation for most other work in SSCM. For instance, studies on green sourcing build on previous work in certification and supplier development (Klassen & Vachon, 2003). Similarly, practices such as commitment to employees (Pullman, Maloni, & Carter, 2009) and ethical procurement (Carter & Jennings, 2002) can be traced back to the work of Deming (1986).

Our intent is not to denigrate this research; far from it. But as these practices were often developed to achieve certain economic goals, they tend not to have a negative impact on the economic bottom line of a firm.

By mostly limiting research to confirming the role of these familiar practices in SSCM, researchers are likely missing critical new practices, because the set of practices that have positive economic and noneconomic impacts on chain performance will always be smaller than the set of practices that may improve some but not all of the triple bottom line. The end result of this limited solution space is that studies such as Pagell and Wu (2009) or Wolf (2011) that explicitly set out to examine what is different about SSCM practice are rare.

Yet numerous authors have noted that sustainability is a fundamentally new way of thinking about supply chain management (e.g., Hart & Milstein, 2003) requiring radical innovations in terms of practice (Pagell & Wu, 2009). It is possible that lean, purchasing portfolios, and the like will be part of the tool kit in a future where we do not differentiate between SSCM and SCM. But it is also possible that an enhanced understanding of how to create truly sustainable supply chains will lead to the development of entirely new practices.

This problem would exist anytime practice undergoes change, but it is likely exasperated with sustainability. Creating sustainable chains will likely require changes in both what and how of providing value and a rethinking of what value means. This will require changes in both practices and supply chain business models.

Most SSCM research examines practices adopted within existing/traditional business models even though history suggests that radical innovations are more likely to come from new entrants rather than exiting organizations (Utterback, 1996). And even the notion of a supply chain motivated mainly by profit may be a limitation in a world where governments are starting to recognize entities such as Community Interest Companies (UK) or Benefit Corporations (mainly USA), which are set up with a mandate that makes profits necessary but secondary to other impacts. The limitations of studying mainly familiar practices are magnified when we study those practices in traditional supply chains.

If we continue to conduct research that mainly focuses on how variations on existing practices impact the ability of unsustainable supply chains to become less unsustainable, we will miss a critical opportunity to lead future practice and the development of new supply chain models.

Issue Four – the Limits of Empiricism as Most of us Presently Practice it

Arguably the largest shifts in supply chain practices in the last century involved the eventual understanding of systems such as quality management and lean production. These paradigm shifts were industry lead, academia followed. The inability of existing research methods, especially analytical methods, to deal with topics such as quality management was one of many reasons that the SCM field expanded from its historically analytical roots to include what is now a robust empirical research tradition (e.g., Buffa, 1980; Hayes & Pisano, 1996).

However, these empirical tools can still be an impediment to developing the knowledge needed to create truly sustainable supply chains. Many of the “most rigorous” empirical tools, especially tools that

would be classified by many as quantitative empirical tools, are much more suited to what (is the relationship) type questions as opposed to how (to become sustainable) questions and will likely overlook those very supply chains that are most likely to be radically innovating.

Researchers define rigor in numerous ways. But descriptions of high-quality empirical research often include a large sample size that is representative of an overall population and the use of (previously) validated measures. Absent these attributes results that are anything but what we would expect are rightfully, dismissed as likely artifacts of poor sampling or measurement. And such studies, regardless of whether they use survey or secondary data can generally answer questions such as “for the average supply chain does it pay to be green?” in a mathematically elegant and robust fashion. But studying average results provides limited insight, especially into how to achieve outcomes that are not average or how to create a supply chain that is different from the present unsustainable norm.

In fact, such studies are likely to overlook the radically different. Either these radically different supply chains will get averaged away in the large sample, or they will be explicitly eliminated as outliers. Research designs that rely on publicly held corporations for access to objective data, surveys that are limited to firms with more than 100 employees to ensure managerial expertise along with numerous other design decisions we take for granted can marginalize or eliminate the very organizations that are likely to be engaged in a radical rethinking of supply chain management.

Qualitative methods such as case studies can be focused on the supply chains that might be missed or dismissed in quantitative studies. However, most empirical research, including many qualitative studies, is by nature backwards looking. Even research, such as Pagell and Wu (2009), which set out to address what was different in SSCM, needed firms to change their practices so that researchers could then “discover” them. Sustainability is about change; yet the way, we presently do a great deal of research is to wait for firms to change and then “report” on it.

The acceptance of empirical research in the SCM realm has greatly expanded our understanding of how to manage supply chains. These tools have made significant contributions to the understanding of how to make existing supply chains more sustainable. Still, efforts to insure rigor and the fact that empirical research tends to be backward looking limit our understanding of how to create truly sustainable supply chains.

Issue Five – Measuring Supply Chain Impacts

Managers focused on profitability who are asked about their perceptions of social and environmental

issues are likely to give socially desirable but not necessarily valid answers. And their perceptions of what is acceptable/good performance in these realms may not match the views of other stakeholders.

Therefore, the field has done significant work in developing valid and more objective measures of the noneconomic outcomes associated with sustainability that are not based on managerial perceptions. Specifically, we have carried out an exemplary job of using secondary data to address what are often tricky constructs.

Nevertheless, these measures have two limitations: they generally are not measures of the full chain’s impact and they tend to have an artificial upper limit. For instance, numerous studies in the United States have used Toxic Release Inventory (TRI) data as an indicator of environmental performance (e.g., Klassen & Whybark, 1999; Pagell & Gobeli, 2009). However, TRI data are limited to emissions during production and do not capture a myriad of other supply chain impacts such as the loss of green-space in building roads and factories.

Toxic Release Inventory data and other similar measures such as accident statistics from safety regulators (e.g., Pagell et al., 2013) are also limited to one link in the chain. So when a study determines that reduced emissions are associated with higher profits, we are assuming reduced emissions are an indicator of better environmental performance for the chain. Except, reduced emissions at the focal firm may mean the outsourcing of pollution to a supplier. These measures do not capture the entire chain, and they focus on a limited set of impacts.

They also have another more subtle limitation: by focusing on impacts, these measures often place an artificial upper limit on performance. The best a company can perform when measuring worker safety with accident statistics is zero accidents. Yet many stakeholders view no harm (no impacts) as a lower limit of acceptable performance not an upper limit (e.g., ECCJ, 2013; OXFAM, 2013; Seuring & Müller, 2008). And many organizations have stated goals to have a net positive/regenerative impact on the environment or society.

Our existing measures can differentiate between the relative levels of harm created by a single link in the supply chain. But, with the exception of studies, such as Matos and Hall (2007), they generally do not capture the entire chain’s impact or allow for examinations of chains that have gone beyond no impact toward being regenerative or having positive impacts.

The five issues we raise are each individually important as well as interrelated. For instance, research on the unfamiliar requires new measures and hence is harder to publish. Additionally, it is difficult to study supply chains that are engaged in radically different

practices whether you do not know what these radically different practices are or how to measure them once you are aware of them. These five issues are individually and collectively impediments to describing what a sustainable supply chain looks like or prescribing what a sustainable supply chain does.

WAY(S) FORWARD

The solutions we propose require changes in norms, measurement, methods, and research questions. In the following, we address the issues raised above and for each proposed solution show some new areas of research that would then be possible.

Many of the issues we have raised have their roots in the norms of SCM research. It makes sense to mainly study the familiar when a critical metric of rigor is the validity of the measures used, and the easiest way to insure a measure is valid is to use one that has been previously validated. Similarly, it is easy to criticize research that focuses mainly on answering “what is the relationship?” type questions, but again our measures of rigor reward such research. There are then numerous institutional pressures to continue doing research in this manner.

Changing the norms and assumptions of a field is difficult, yet that journey has already begun. When JSCM started 50 years ago, it was a journal focused on purchasing practice, and rigorous research in the area was mainly analytical. Similarly, 20 years ago research on SSCM was almost unknown. So clearly, the field has evolved and will continue to do so.

But, the issues we raise require a combination of evolutionary and revolutionary change. Revolutionary changes, such as conducting research that leads practice, are always risky, especially for new researchers.

However, there are many evolutionary steps that researchers can take today that will help address these issues. The first evolutionary step is to start asking different questions. The question of “does sustainability pay?” is the wrong question moving forward. This question often ignores the equally valid claims of stakeholders without an economic stake in the chain and trying to answer it today, when few if any supply chains are truly sustainable, is highly misguided.

The critical question for today is *how* to create supply chains that are sustainable (Kleindorfer, Singhal, & Wassenhove, 2005). As part of this transition from “does it pay?” to “how to be sustainable?” we need to be much more open to asking what is different about creating a sustainable supply chain.

The adoption of more multi-disciplinary or trans-disciplinary (Hirsch-Hadorn, Bradley, Pohl, Rist, & Wiesmann, 2006) research that explicitly looks at the supply chain from the perspective of other stakeholders, such as governments, NGO's, communities, and

the natural systems where the chain operates, is a critical component of creating the understanding of how to become sustainable. Researchers in numerous other fields also study supply chains, but often from very different perspectives. For instance, many researchers of food supply chains are far more interested in the rural development implications of global sourcing (e.g., Burch et al., 2013) than they are in the profit implications of global sourcing. Similarly, poverty researchers have studied supplier certification from the perspective of certification's impact on wages in developing countries (Maertens & Swinnen, 2009). As business researchers, profitability or economic viability is a critical outcome. But by giving primacy to profits, we often ignore the views of other stakeholders, not to mention the growing number of supply chains that define their own success in terms that go beyond profits (Wu & Pagell, 2011).

We know this call for multidisciplinary research is a familiar refrain, but our motivation is different. Our interest lies in capturing new stakeholder perspectives and examining potential trade-offs. We believe that multi-disciplinary research is needed to make sure that noneconomic stakeholders are represented in supply chain research and that economic stakeholders are represented in other areas of research, so that all supply chain impacts are treated as equally important. Such research will not just measure impacts from multiple perspectives, but will also explore trade-offs as well as synergies and provide insights into how to manage the trade-offs that are identified.

Another familiar refrain is that we need to view outliers not as a source of statistical noise, but a potential source of insight (Singhal & Singhal, 2012). On reflection, studying a large sample of mainly unsustainable supply chains to learn more about creating sustainable supply chains seems imprudent, yet many existing studies (again including our own work) do just this. As we move forward, we need to follow authors, such as Guide, Harrison, and Van Wassenhove (2003), Seelos and Mair (2005), Yunus, Moingeon, and Lehmann-Ortega (2010), and Wu and Pagell (2011), and spend much more time studying the presently small number of supply chains that are trying new things that do not fit expected patterns and so on. In addition, we have to be open to studying small organizations, start-ups, various types of nonprofit and social purpose organizations and businesses in less developed parts of the world because these under-studied organizations could be sources of inspiration for how to do things differently. Research in these spaces could help identify what the business models of truly sustainable supply chains might look like.

These are evolutionary first steps. In the following sections, we address some of the more difficult

challenges we have identified, because while the above will get us closer to the normative goal of all SCM research being SSCM research, it will not be enough. And critically, the former suggestions would still leave the SCM research community lagging practice.

Measurement

We identified multiple problems with measurement. The three most important issues are a focus on a limited number of stakeholders and outcomes, measures that are artificially limited to amounts of harm, and measures that do not account for the entire chain.

The stakeholder problem is the easiest to address. Again, there are numerous other research traditions that also study supply chains from other perspectives. These other literatures are then a source of alternative ways to measure a supply chain's impact.

For instance in our own work, we have measured the safety of operational workers as a proxy for the social impact of a supply chain (e.g., Pagell et al., 2013). Safety at a focal firm is a small slice of workers' overall well-being and a tiny portion of the social impact of the chain. Creating measures of the well-being of workers that were more expansive would be relatively easy, in that validated measures exist for numerous other elements of worker-well-being including psychological safety (Edmondson, 1999; Siemsen, Roth, Balasubramanian, & Anand, 2009) and long-term health (e.g., McDowell, Newell, & McDowell, 2006).

The impact of a supply chain on multiple sets of stakeholders is more complex. But there are ways to measure a community's social (e.g., Christakopoulou, Dawson, & Gari, 2001; Helliwell & Putnam, 2004; Srinivasan, O'Fallon, & Dearry, 2003) or environmental (e.g., WHO, 2005) well-being. The stickier issue is determining the impact of any one supply chain on the well-being all of its stakeholders. As a starting point, we could follow researchers in diverse fields such as forestry and tourism (e.g., Beckley & Reimer, 1999; Getz & Jamal, 1994) by examining communities with a limited number of employers to better isolate the impacts of any one supply chain. Capturing a chain's communal impacts will be an important step toward conducting research that accounts for all stakeholders.

With such metrics, researchers could answer questions such as how to manage base-of-the-pyramid suppliers in a way that protected the suppliers and their communities. Similarly, such metrics would make it possible to re-examine issues such as the impact of global sourcing in a much more expansive fashion; perhaps by simultaneously looking at price and quality impacts on the supply chain and impacts on communities where production or consumption occur.

To address the issue of measures that only capture degrees of harm, we can again look to other fields and managers for inspiration. For instance, geologists and hydrologists have long measured the water balance of a watershed, basically determining whether over time the amount of water is changing. Some companies (i.e., Pepsi, 2013) have applied similar thinking to measure their net impact on watersheds by measuring not just how much water they remove but also how much water they replace, and whether that water is safe for drinking. Similar thinking could be applied to the use of any other resource, although it would admittedly be difficult to apply to social impacts. Being able to capture both harm and regeneration would allow for research that identified chains that had net positive impacts. Once these chains were identified, they could be studied in detail to determine how they achieved such outcomes.

The final problem, measuring a single link in the chain not the impact of the entire chain, is the most difficult to address. This issue is not unique to SSCM research; most SCM research suffers from this problem because the costs of gathering such data can be prohibitive. Studying every link in the chain means trading depth for breadth in terms of sample size, a trade that limits researchers to specific types of questions and methodologies.

However, the assumption that in order to study the entire chain, we need to collect data from every link in the chain is in a sense a holdover from the assumption that we are measuring success or failure based on the economic performance of each link. There may be other ways to address the environmental and social impacts of a chain that would not require the same intensity of data collection.

For instance, it may be best to measure a chain's environmental impact based not on emissions at each link, but rather based on a life cycle assessment (LCA) of the product or service provided by the chain. For example, Tan and Khoo (2005) use LCA to determine how various supply chain configurations would impact the environment.

This would have two implications for future research. First, it would fundamentally change the level of analysis to the product or service that the chain delivers. Changing the level of analysis may allow new ways of thinking about supply chain practices and outcomes. A change in the level of analysis would give more space for research that included stakeholders such as customers, regulators, and communities as researchers would be measuring the impact (positive or negative) of the creation of value.

The second implication is that there would be greater scope to capture the entire chain. It is difficult to determine a chain's economic impact without gathering data from every chain member: data they may

be loathe to share. But in many supply chains, the environmental impacts of certain activities can be determined without actually collecting data from the entities that perform those activities. For instance, a product may move from China to Europe using numerous means of transport. And this transport can be arranged by a single 3PL or by multiple intermediaries. Estimating the profitability of each link for this one product would be a herculean task. But basic knowledge of the product's attributes and the method of transport are all that is required to estimate the environmental impact of transportation, regardless of who conducts it. Publically available databases, such as the European reference Life Cycle Database (ELCD, 2013), exist for just this purpose. Determining an entire product's impact does not require data from all members of the chain; much can be imputed.

What could not be imputed would be the steps in chains delivering similar products or services to customers that were carried out in unique ways. But as these would be the steps that truly determined the chains' relative environmental performance, they would be of greatest import to study in depth.

Getting Ahead of Practice

Asking what is different rather than what is the same and looking at supply chains from new perspectives will help expand our understanding of SSCM. But absent other changes, this research would still be mostly backwards looking. Research that directs rather than responds to practice will be a significant challenge, but there are two existing, although very different traditions that can give guidance.

First, we should be much more open to participatory/action type research (Westbrook, 1995). Like most of our suggestions, others have also called for this type of research, but it remains very rare in the supply chain field (Coughlan & Coughlan, 2002). And while some of what we envision is SCM researchers working with managers to create and test new practices, we also believe that other research fields offer a different way to participate in change efforts in a rigorous way.

Many research fields, such as ergonomics and public health, are based on interventions (e.g., Amick et al., 2003; Tompa, Dolinschi, de Oliveira, & Irvin, 2009). These fields tend to be ones where a new method is developed in a laboratory or controlled setting and then tried in practice. For instance, ergonomists have always carried out studies where a technique is first developed in a controlled setting and then tested in real workplaces, with the level of analysis being the intervention. Not only do these fields have a long history of "intervening" in practice to try and improve it, they also have a history of developing practices which work in the controlled settings but are not effective or

adopted in the workplace (e.g., Wandersman et al., 2008; Wells, 2009).

Supply chain researchers have traditionally avoided participatory research, yet one of the main ways to help supply chains become truly sustainable will be to engage in these types of activities. What is interesting is that many other fields are busy developing radical new process and product technologies that could help supply chains become sustainable. For instance, researchers have been working on edible packaging (Janjarasskul & Krochta, 2010), biocomposites derived from renewable resources (Mohanty, Misra, & Drzal, 2002) and using geographical information systems to plan the sustainable management of wood fuels (Masera, Ghilardi, Drigo, & AngelTrossero, 2006). These and related fields have a long history of participatory research, even though they may not use this term. Yet the practical impact of these studies is often limited because those conducting them do not fully understand management and supply chains.

The gap between the laboratory and the workplace in fields focused on interventions or introducing new technologies is often partially explained by noting that what is developed in the laboratory/controlled studies does not account for workplace realities (e.g., Wells, 2009). Partnering in such participatory studies would be a way for supply chain researchers to improve the odds of innovations moving from the laboratory to practice and hence to lead practice. Participatory studies could assist the process of developing new business models or developing new tools to measure the supply chain's impact.

Participatory research will, at least in the supply chain field, be very hands on and steeped in qualitative traditions. Engaging in intervention based research is in a sense a way to experiment with the supply chain.

Managers are, for good reason, wary of researchers who want to experiment with their supply chain. Yet simulations and analytical models, tools which are very familiar to supply chain researchers, also offer ways to experiment, if not with a real supply chain then with virtual approximations.

While it is sometimes possible to criticize simulations and analytical models for oversimplifying assumptions or a general lack of verisimilitude, they also offer another avenue for moving from studying existing practice to predicting future practice or business models. This is not just an opportunity for research in sustainability, but it seems especially suited to sustainability, where there are few if any truly sustainable businesses to presently study. Hence, researchers will have to look beyond collecting data from existing organizations, which analytical tools can accommodate.

For instance, multiple authors have used simulations to “test” the performance of various supply chain designs (e.g., Bottani & Montanari, 2010; Persson & Olhager, 2002). These studies only looked at operational outcomes, such as cost or quality, but it would be possible to add the other elements of the triple bottom line. In so doing, it would then be possible to test innovative supply chain configurations and business models before they were adopted in practice.

Similarly, analytical tools such as simulations (Davis, Eisenhardt, & Bingham, 2007) can be used to test assumptions about best practice. And critically, this can be carried out from the perspective of multiple stakeholders. So for instance, global sourcing is generally viewed as having positive impacts on a supply chain (Petersen, Prayer, & Scannell, 2000) but via simulations the impact of global sourcing on the chain and the communities in which it operates could be explored. Finally, analytical models can and are being used to answer a host of more constrained questions, for which empirical data do not yet exist, such as how best to price electricity for the charging of electric vehicles (Sioshansi, 2012).

Both participatory research and analytical tools provide the possibility for research that is ahead of practice. This allows us to start to answer the question of how to be sustainable now, rather than waiting for supply chains to do it first so we can discover it. A combination of action/participatory research and analytical models, perhaps even in the same study, may then be the path to leading rather than following practice.

As researchers, every design decision we make induces trade-offs. So we would be highly naïve whether we did not believe that what we suggest would not create trade-offs. But the point is that we would be changing the trade-offs in an attempt to learn something new.

CONCLUSION – A FUTURE WHERE ALL SCM RESEARCH IS SSCM RESEARCH

Our primary thesis is that while existing SSCM research has made significant progress, we are far from being able to direct managerial practice toward the creation of truly sustainable supply chains. Hence, the field still has a long way to go before the notion of SSCM research being separate from SCM research can disappear. We propose that the ultimate mark of success will be when we no longer treat SSCM as an other, but that this point will not be reached without significant changes in how we as a field conduct research.

We have identified problems with assumptions, norms, institutions, measures, and methods. Many of

these problems stem from a limited stakeholder focus, and our field’s norms of determining rigorous research. We believe we have done a good job in describing the challenges we face and we hope that some of our suggestions for change will be fruitful. And we recognize that these changes will take longer than we would like and will require leadership from senior scholars working in their roles as authors, reviewers, editors, and mentors.

Sourcing and SCM research can help lead the change to truly sustainable supply chains. Or we can continue to do research that looks backwards at what supply chain managers have already discovered about how to make their existing chain less unsustainable.

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