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Efficiency meets accountability: Performance implications of supply chain configuration, control, and capabilities☆

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ABSTRACT

The public increasingly holds firms accountable for social and environmental outcomes, such as product toxicity problems and human rights violations, throughout their global supply chains. How can companies improve the social and environmental performance within their supply chains, particularly as other competitive pressures, such as cost and quality, continue to escalate? Starting from an efficient versus responsive supply chain framework, we develop an integrative model that blends together elements of supply chain configuration, stakeholder management, and capability development. Specifically, we spotlight the dimensions of control and accountability that collectively determine stakeholder exposure, and show how this new construct affects the linkages between supply chain capabilities, configuration, and performance. In particular, this analysis reveals that the nature of stakeholder exposure determines how social/environmental technical and relational capabilities impact social and environmental outcomes. We conclude with implications for research and practice, discussing how current supply chain theories must be extended to incorporate external stakeholders, to clarify strategies and identify potential pitfalls, and to better predict performance outcomes.

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1. Introduction

Nike is vilified for the behavior of its overseas subcontractors. Dell is besieged by college activists for its indifference to the disposal of electronic waste. Home Depot is targeted by consumers for purchasing lumber from old growth forests. Coca Cola is picketed for receiving water diverted from public sources in India to its bottling operations. Mattel is confronted by parents about toys that contain high levels of lead in paint and poorly designed magnet components.

Events like these, increasingly frequent occurrences in recent years, represent an important trend in managing supply chain partners and external stakeholders. In many ways, one could argue that these examples implicate well-managed firms with efficient or market responsive supply chains. Yet, the problems not only involve the firm's activities, but also those of upstream suppliers and the behavior of customers after product purchase. Consumers, activists and other stakeholders now demand accountability for behaviors that encompass several tiers of supply chain partners, over which the firm has varying degrees of control. Should managers have predicted these controversies, and should anticipatory changes have been introduced into their supply chains?

It is well established in the scholarly and managerial literature that firms can configure their supply chains for efficiency or responsiveness (Fisher, 1997), but it is much less clear how the configuration of a supply chain affects environmental or social performance. Moreover, the two key literature streams that could inform this issue – supply chain configuration and stakeholder management – have unfolded largely independent of one another. Suppliers, customers, and operational issues are rarely discussed in stakeholder theory (Freeman, 1984; Donaldson and Preston, 1995). Recently, there has been growing research in sustainable supply chain management (e.g., Carter and Jennings, 2004; Pullman et al., 2009; Mollenkopf et al., 2010). However, with few exceptions (e.g., Pagell and Wu, 2009; Reuter et al., 2010), this research does not explore the origins of stakeholder demands or supply chain characteristics best suited to address these issues. Further complicating the situation, the constructs of control and accountability have often been blurred in both streams.

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Given this gap, our paper integrates a stakeholder management approach with familiar supply chain concepts to elaborate a framework that links supply chain configuration with control and accountability. Our framework employs the capabilities literature to bridge this gap, by considering how technical and relational capabilities developed within a supply chain configuration can lead to social/environmental capabilities, and how these impact performance. The model specifies variables that create exposure to stakeholders along the supply chain, relates supply chain configuration (i.e., efficient versus responsive) to capabilities, and suggests that these capabilities interact with stakeholder exposure to affect the triple bottom line: economic, social, and environmental outcomes.

While our work connects to the expansive literature on Corporate Social Responsibility (CSR), we take a focused approach, incorporating social and environmental issues that are relevant to supply chains. Although moral and ethical considerations are important (Jones and Wicks, 1999; Waddock, 2004), we stress operational motivations and outcomes. In this way, we expand on previous research on sustainable and green supply chains (e.g., Zsidisin and Siferd, 2001; Klassen and Johnson, 2004; Corbett and Klassen, 2006; Linton et al., 2007; Srivastava, 2007) that considered the impact of supply chains on environmental performance. We build on this work by also considering social outcomes, by focusing on capabilities rooted in the configuration of the supply chain, and by introducing a stakeholder perspective.

This paper proceeds as follows: we begin building our model by reviewing how supply chain configuration is linked to performance through technical and relational capabilities. We then define and discuss the antecedents of stakeholder exposure, control and accountability. We synthesize these ideas to create an integrative model in which stakeholder exposure moderates the capabilities-performance link. We develop propositions for our model to trace the logic connecting capabilities and stakeholder exposure to social, environmental, and economic performance. We conclude by discussing implications for scholarly research and managerial practice.

2. Supply chain configuration and capabilities

A classic perspective from which to view the configuration and development of supply chains draws from the seminal work of Fisher (1997). Depending on the characteristics of the product or service, two distinct supply chain configurations offer competitive advantage: one based on efficiency and a second based on market responsiveness. Competitive advantage is derived from developing capabilities that allow a firm to match the pattern of demand and rate of innovation with the supply chain configuration. Predictable markets with commodity-like products that have infrequent innovations are best served with efficient supply chains, whereas highly differentiated, fast moving markets are best served with responsive supply chains. Fig. 1 presents the initial linkages in our model, which are elaborated in the following sections.

2.1. Efficient versus responsive supply chain configurations

The purpose of efficient supply chains is to coordinate the flow of materials and services and thereby minimize inventory and maximize efficiency of the manufacturers and service providers in the chain (Fisher, 1997). Predictable demand for functional products permits high capacity utilization and minimal inventories in both the firm and its supply chain partners, while simultaneously offering high service levels to cost-oriented customers (Iyer et al., 2009). To fully leverage this configuration, product designs also are stable, new introductions are infrequent, and variety is limited. Combined, these factors allow managers to configure a highly efficient, low-cost supply chain.

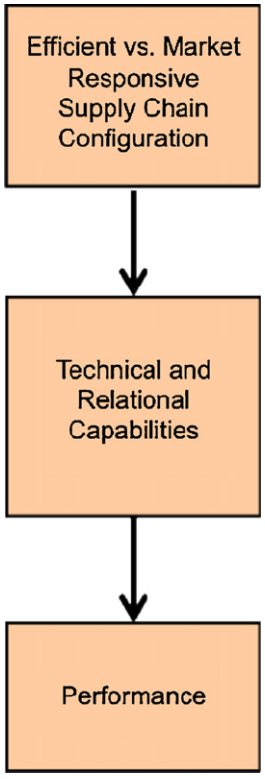

Fig. 1. Supply chain configuration, capabilities, and performance.

In contrast, market responsive supply chains are configured to react quickly to changes in the marketplace by investing in additional capacity, having flexible suppliers, or carrying inventories that allow the supply chain to hedge against variation and uncertainty in demand (Fisher, 1997). Responsive supply chains also accommodate or exploit markets that require customized products, have frequent new product introduction, or unpredictable demand. As a result, market mediation costs are incurred to match supply and demand (Iyer et al., 2009), but the timely response allows for higher margins. Other factors that contribute to configuring supply chains are product variety and complexity (Christopher and Towill, 2000).

This dichotomy of efficiency versus market responsiveness has been leveraged in subsequent work to help explain the development of relational capabilities (de Leeuw and Fransoo, 2009) and the impact of supply chain variability and organizational structure on performance (Germain et al., 2008). Identifying the point in the supply chain where product modularity should be introduced has been an important outcome (e.g., Yang et al., 2004). Moreover, as products mature and markets change, supply chain networks can be expected to evolve (Li et al., 2010) with corresponding changes in capabilities. To incorporate environmental performance, a comprehensive analysis must take interactions between multiple stakeholders into consideration, leading to a broadly integrated supply chain (Seuring, 2004).

2.2. Configuration drives capabilities

While not always fully realized, firms develop distinct capabilities based upon their supply chain configuration. We define capabilities as learned routines that firms use to convert inputs to outputs, typically combining both tangible and intangible resources

(Winter, 2003). Two types of capabilities are particularly relevant for managing supply chains: technical and relational. Technical capabilities are the set of organizational routines based on an understanding of the science and technology involved in producing and sourcing goods and services (Teece et al., 1994; Helfat and Raubitschek, 2000). Technical capabilities allow firms to better specify sourced materials and components, and evaluate and share knowledge with suppliers (Krause et al., 1998; Petersen et al., 2005). In contrast, relational capabilities include the ability to design contractual and informal mechanisms to align incentives, share information, increase commitment, and generate common goals between the firm and other entities (Williamson, 2008; Holcomb and Hitt, 2007). These capabilities facilitate coordination, collaboration, knowledge transfer, and adaptation across the supply chain, including both customers and suppliers (MacNeil, 1978; Dyer and Singh, 1998).

It should be emphasized that technical and relational capabilities develop in both efficient and responsive supply chains, but they are significantly different. In efficient supply chains, firms emphasize technical capabilities that are specifically developed to support operational objectives, such as cost reduction and capacity utilization. Process improvement skills are particularly important for identifying opportunities to tighten inventories and increase throughput from a limited resource base. Firms also develop skills in understanding how components interact, to optimize designs and reduce total costs. This requires an understanding of the overall production system, including the firm's and suppliers' processes (Brusoni et al., 2001).

From a relational standpoint, supplier evaluation and monitoring skills are important to ensure continuous improvement in supplier's processes to maintain quality while reducing costs. Evaluation can include third party certification, audits, and written scorecards comparing suppliers (Dyer, 2000; Petersen et al., 2005) that can uncover problems and use comparisons to bolster suppliers' efforts. In addition, the relatively stable demand underpinning an efficient supply chain configuration enables managers to craft detailed, long term contracts that clearly specify cost and quality targets, particularly for basic materials and components. Due to the nature of functional products and a resulting emphasis on reducing cost, firms in efficient supply chains are more likely to use competitive bidding processes and multiple suppliers.

In contrast, firms in responsive supply chains develop quite different capabilities around supply chain management. Due to the need to react quickly to market changes, successful firms will excel in product improvements that make both incremental and substantial changes to meet customer demands. This involves a broad based understanding of their own products as well as those of customers and suppliers in order to enable innovation, customization, and flexibility. Rather than focus on a specific part or component, these firms strive to understand the broader supply chain system, how their products are used, and the technological trajectory of their products in order to anticipate customer needs.

Market responsive firms will also develop different relational capabilities, as compared to firms in efficient supply chains. Collaboration skills are a key capability, since these firms must communicate frequently with suppliers to develop new products in response to customer needs. To promote innovation, supplier–buyer partnerships are likely to deepen and include extensive collaborative supplier development efforts, such as frequent consultation and exchanges of engineering personnel (Krause et al., 1998; Dyer and Nobeoka, 2000).

2.3. Implications for social and environmental performance

The alignment of supply chain configuration with market and product characteristics is generally acknowledged to offer superior operational outcomes and improved competitiveness (Fisher, 1997). Less clear are the implications of using either an efficient or responsive configuration – with its concomitant technical and relational capabilities – for social and environmental performance. Limited evidence is beginning to emerge that technical capabilities and social/environmental expertise covary. For example, Christmann's (2000) work on complementary capabilities suggests that process expertise was required for environmental initiatives to result in superior performance. Pil and Rothenberg (2003) observed that advances in environmental performance in automotive paint lines drove improvements in quality, and vice versa, suggesting learning spillovers between these areas. Vachon and Klassen (2008) also reported evidence that collaboration and communication regarding environmental issues improved quality, delivery, and flexibility. Finally, a number of studies of lean production and its environmental effects also support synergistic effects, e.g., "lean and green", as summarized by Berchicci and King (2007).

Technical capabilities provide the basis for developing innovative solutions to social and environmental challenges. By focusing on the technical aspects, firms can harness the creativity and skills of their suppliers, emphasizing their common objectives rather than their differences (Pagell and Wu, 2009; Petersen et al., 2005). Firms that are open to ideas from suppliers have found them to be an important source for novel ideas and process improvements (Mayer and Teece, 2008; von Hippel, 1988). For example, Geffen and Rothenberg (2000) demonstrated that product and process innovations by suppliers led to environmental improvements. Likewise, Rusinko's (2007) study of carpet manufacturers indicated that more sustainable suppliers improved a buyer's innovation performance.

A related argument can be advanced for strong relational capabilities. Strong relational capabilities include the ability to fashion incentive mechanisms that are more likely to ensure positive upstream social and environmental performance (Corbett and Klassen, 2006; Vachon and Klassen, 2008). Since relational capabilities fuel ongoing relationships, the risk to future business if a partner is caught cheating provides an incentive to conform (Heide and Miner, 1992). Moreover, the ability to share credible information, another hallmark of strong relational capabilities, facilitates supplier performance evaluation.

However, as shown by the introductory examples of Home Depot, Mattel, and Dell, a well-configured efficient or responsive supply chain with significant technical and relational capabilities does not necessarily deliver strong environment or social performance. This apparent disconnect provides the impetus to elaborate upon a critical key missing construct – stakeholder exposure – to tease out contingencies in the connection between supply chain configuration and capabilities. In essence, stakeholder exposure is derived from a combination of control and accountability in the supply chain, which is developed in the following section.

3. Control, accountability and stakeholder exposure

3.1. Defining key constructs

3.1.1. Control

Unfortunately, neither control nor accountability has a widely accepted definition in the stakeholder or supply management literature. Here, control is defined in a focused way that, while consistent with current thinking, also provides clear points of linkage to supply chain capabilities. For supply chains, control stems from the direct or implied influence that a firm has regarding particular issues, business decisions, or outcomes (New, 2004; Klassen, 2009). To control an outcome is to be the party that *caused it to occur*.

We stress that control need not be due to actions. It also includes ignoring warnings of concerns, failing to undertake due diligence, choosing not to act, and neglecting to act.

In a supply chain context, control for a particular firm is derived from having the authority to make decisions independently, and thus create pressure on suppliers or customers (Maloni and Benton, 2000). In essence, the firm has control because it can affect conditions (either through action or inaction) that result in specific outcomes. Naturally, control can include legal obligations and ethical overtones. The extent to which the focal firm can exert influence over supply chain partners is the critical determinant of control (New, 2004). Firms exert two basic forms of influence, economic and non-economic, and either form can extend across multiple tiers of the supply chain.

Economic influence, or market power, is derived from industry conditions and firm characteristics. For example, as consolidation occurs in a mature industry, few buyers remain and each is likely to have greater market power, providing them with greater influence over suppliers as their dependency increases (Pfeffer and Salancik, 1978; Porter, 1980; Maloni and Benton, 2000). Similarly, increased vertical integration can increase economic influence, as the focal firm possesses both greater market power and production knowledge that provide leverage in negotiations or other interactions with suppliers and customers (Harris and Wiens, 1980; Harrigan, 1986). Finally, the reach and complexity of the supply chain – either locally or globally – has implications for the availability of alternatives for sourcing and flexibility in markets, which in turn affects pricing and market power.

Non-economic influence can also be used to control supply chain partners. A focal firm can use industry norms or extend idiosyncratic practices developed in partnership with a particular supplier to shape the behavior of others (Macaulay, 1963). Informal meetings with suppliers combined with evaluation programs can also motivate improvements. Over time, trust can develop between buyers and suppliers such that suppliers will strive to perform up to buyer expectations to maintain the relationship (Zaheer et al., 1998; Lawson et al., 2008). Finally, firms that are well-established industry leaders will attract and retain suppliers who want to associate with highly reputable and legitimate customers (Dyer and Nobeoka, 2000; Kang et al., 2009).

3.1.2. Accountability

In the context of supply chains, accountability captures the extent to which firms are required or expected to *justify* their decisions and actions for product design, sourcing, production or distribution to stakeholders. Thus, a wide range of stakeholders might have a central role. They can initiate action, force dialog, and act as interested parties to whom firms must present their explanations. Importantly, firms held accountable for an environmental or social outcome must answer for and explain outcomes *even if little control exists*. Accountability implies sanctions and redress (Valor, 2005), even when the firm in question did not cause the negative outcomes. Thus, there can be an element of perceived unfairness that attends accountability.

Note that control is associated primarily with stakeholders who have a direct economic interest in supply chain outcomes, primarily suppliers and customers. Accountability, by contrast, can be derived from a much broader set of stakeholders, including suppliers and customers, but also social and environmental activists, the media, regulators, and other groups outside the physical flow of products or their subsequent use.

Accountability originates from *stakeholder salience*, i.e., the importance of a particular stakeholder to the firm. These stakeholders must be cognizant of a firm's activities and are willing, able and likely to take action either in support of (e.g., buy local) or against (e.g., boycott child labor) the firm. In a well-cited article, Mitchell et al. (1997), describe three dimensions that characterize stakeholder salience and involvement: power, legitimacy, and urgency. As the number and level of these dimensions increases, so does the salience of that stakeholder – and its propensity to hold the focal firm accountable for outcomes.

Stakeholders as disparate as the state, activists, and the media can exercise considerable power (Hendry, 2006; Phillips and Caldwell, 2005; Vogel, 2005), whether coercive, as when the state mandates action through regulation, or utilitarian, as when activist groups threaten boycotts to undermine profits for the focal firm. Stakeholder power creates accountability for focal firms by clearly linking them to supply chain behaviors that demand action – even against the wishes of the firm. Legitimacy can be viewed as "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman, 1995: p. 574). If legitimate stakeholders question actions and policies, companies need to account for these actions, regardless of where they occurred in the supply chain. Finally, the urgency of a particular issue – the degree to which stakeholder claims call for immediate action – elevates prospects of greater accountability.

It is important to note that firms have some latitude to affect stakeholder salience, and therefore their own accountability for supply chain issues. Interactions with stakeholders often include efforts by the firm to influence the views and actions of others (Awaysheh and Klassen, 2010). Firms that are large, visible to consumers, and have well established brand names are closely scrutinized by stakeholders, and this scrutiny usually extends to supply chain partners. One strategy that has been widely studied is to collaborate with external stakeholders, such as NGOs (Huegens et al., 2002; Welcomer et al., 2003; Butterfield et al., 2004; King, 2007). Such collaboration can promote dialogue and learning to avoid conflict typically associated with calls for accountability.

4. Stakeholder exposure combines control and accountability

Control and accountability jointly determine stakeholder exposure, a pivotal construct in our model. Within a supply chain, the levels of control and accountability vary based on the influence of the focal firm and the salience of stakeholders, as shown in Fig. 2. Although both control and accountability are continuous variables, for expository convenience this paper focuses on the four combinations shown in Fig. 3, with the severity and risk of the potential stakeholder exposure increasing with the quadrant numbers. Note also that control and accountability, and thus stakeholder exposure, are specific to a particular issue and time period.

When both dimensions are low, the social and environmental issues present along the supply chain are minimal, as in Quadrant 1. For this quadrant, configuring the supply chain defaults to the recommendations of Fisher (1997), whose work did not address stakeholder exposure. This situation also is consistent with the straightforward connection between configuration, capabilities, and performance shown in Fig. 1. Many supply chains that are simple and local fit into this quadrant. Consider, for example, the case of community-supported agriculture where households purchase locally grown produce from a variety of small farms (Brown and Miller, 2008). Such a supply chain embodies few control or accountability issues. The motto of Local Harvest (2010), the leading web-based resource for organic and local food is "real food, real farmers, real community," reflecting the notion that such foods can be accepted without reservation by consumers. For these and like situations, the issue is "Inconsequential."

Quadrant II presents the situation when control is high, but accountability is low. One example is related to product safety. A

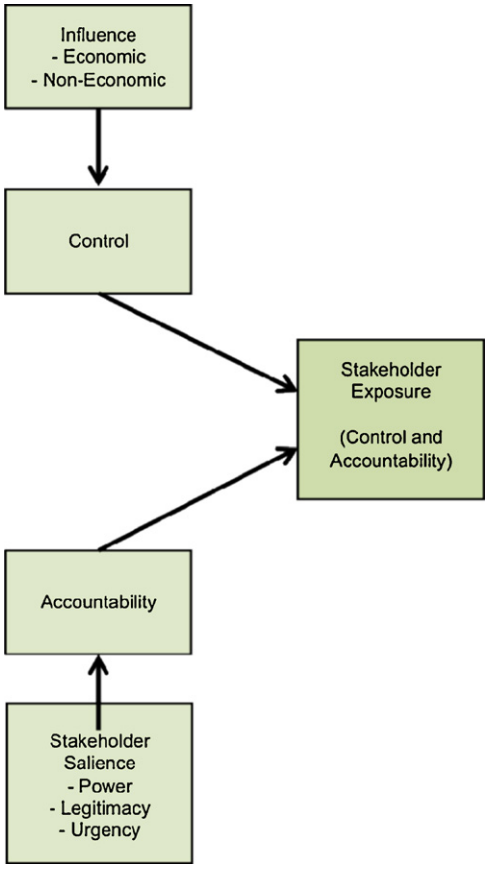

Fig. 2. A model for stakeholder exposure in the supply chain.

firm may have a number of strong management systems in place to ensure its products are designed to minimize customer risk downstream, as well as to specify benign materials upstream. However, depending on local laws and the level of public scrutiny, there may be little obligation to justify and report what materials are in the product, or provide detailed guidance for use or disposal. Concerns regarding the use of cellular phones while driving are worth noting. Given that at least five countries and 30 U.S. states now ban cellular phone use while driving, a possible outcome may be pressure on manufacturers to use technology that disables use while driving. Signaling this potential, the Governors Highway Safety Association lists technological solutions among its recommended approaches (GHSA, 2010). Nokia and other cellular phone manufacturers have the necessary control over their suppliers and their own production to implement these solutions, but they currently are not held accountable for drivers' accidents, although this may be on the horizon. Thus, we term issues in this quadrant as "Emergent."

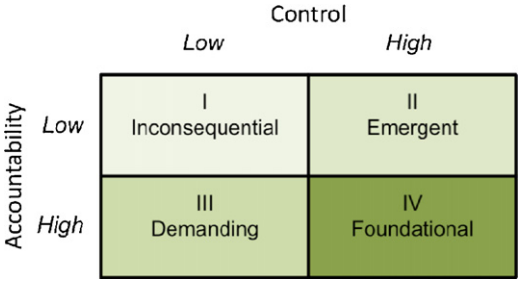

Fig. 3. Stakeholder exposure: control and accountability for social and environmental issues in the supply chain.

When the focal firm is held accountable for a situation over which it has little or no control, as in Quadrant III, we term the issue "Demanding." Consider the case of palm oil, 90% of which comes from Indonesia and Malaysia where deforestation is a key concern (USDA, 2007; Schwartz, 2010). Stakeholder activists are pushing General Mills for more sustainable sources of this key ingredient and are holding it accountable for rainforest damage. However, this firm's total purchase of palm oil represents only 0.1% of the world market (Schwartz, 2010). There are considerable obstacles to switching to alternative ingredients or better verifying sourcing, which General Mills estimates will take five years to resolve. This illustrates a relatively low degree of control for this firm, although it continues to be held highly accountable.

Finally, Quadrant IV illustrates the crucial situation when both control and accountability are high. Here, issues are "Foundational," and indicate a clear imperative for action. It is important to note that, as elsewhere in Fig. 3, the focal firm can manage the situation poorly or skillfully. At times, companies knowingly tolerate abusive conditions in their operations, and so are directly responsible and increasingly accountable for these practices. An example is the recent spate of worker suicides at Foxconn, one of Apple's key suppliers (Balfour and Culpan, 2010; Wong et al., 2010). Excessive overtime, unacceptable living conditions, and deplorable treatment, such as prohibiting conversation and bathroom breaks, all contributed to this tragedy. Although Apple has known about these conditions for several years, and even dispatched monitoring teams in 2006, it is still struggling with how to enforce socially responsible labor management practices across Apple's supply chain. For example, one "solution" presented by Foxconn was to install nets below dormitory windows, which clearly isn't in the spirit of a socially enlightened workplace. Quadrant IV issues must be addressed. If ignored or mismanaged, these issues can damage brand equity, elicit boycotts, and harm economic performance.

Thus, firms and their supply chain partners must consider how stakeholder exposure can affect their actions and subsequent performance. The apparent paradox is that greater exposure does not necessarily lead to poorer performance; some firms are highly competent at addressing these issues and perform well. Capabilities related to social and environmental expertise will be vital in these cases. Thus, the need is evident for an integrative framework that details the linkages between supply chain configuration, capabilities, stakeholder exposure, and triple bottom line performance.

5. An integrated model of capabilities, stakeholder exposure, and performance

Our proposed integrative conceptual model draws together supply chain configuration and capabilities in the context of stakeholder considerations (Fig. 4). The focal firm's efficient or responsive supply chain configuration prompts the development of specific social/environmental technical and relational capabilities that can be deployed to meet social and environmental imperatives. These capabilities drive social and environmental performance, which in turn affect economic performance, and vice versa. But this proposed chain of causality is moderated by stakeholder exposure. Collectively, this model and the underlying literatures point to several research propositions, explained in the following section.

5.1. How supply chain configuration impacts social and environmental capabilities

As mentioned earlier, firms strategically develop and exploit different technical and relational capabilities based upon their supply chain configuration (Fisher, 1997; Hill and Jones, 2008; Reuter et al.,

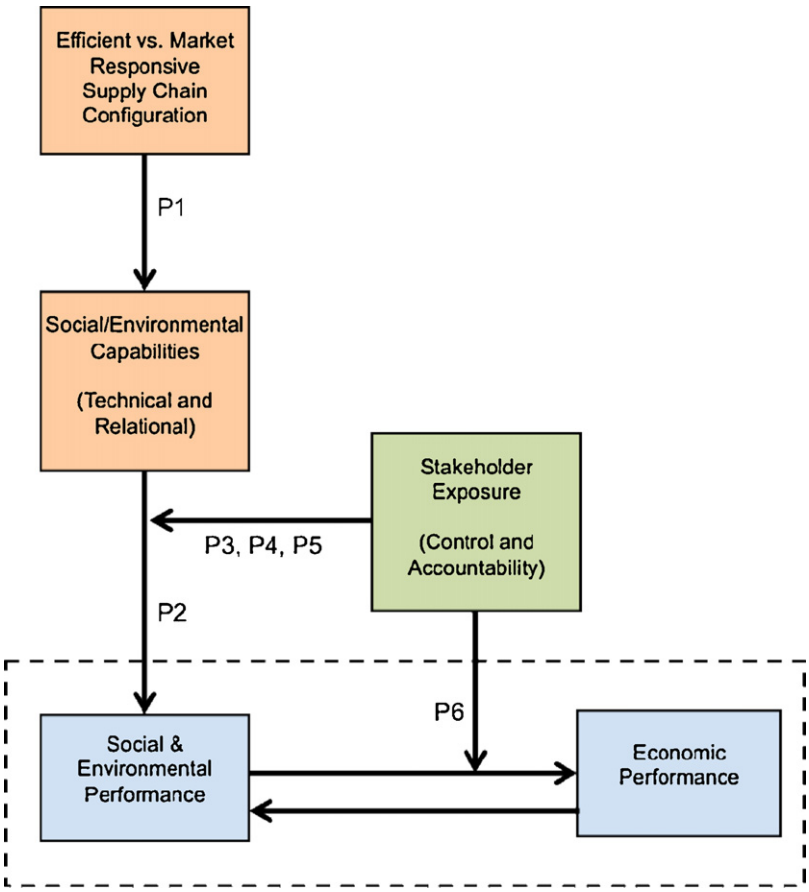

Fig. 4. An integrated model of configuration, stakeholder exposure, capabilities and triple bottom line performance.

2010). In addition to these capabilities, our framework introduces capabilities specifically related to social and environmental objectives, which we define as learned routines that combine resources to affect social or environmental outcomes (Russo and Fouts, 1997; Aragon-Correa and Sharma, 2003, Pullman et al., 2009). Traditional and social/environmental capabilities are not entirely independent or mutually exclusive, although the latter have not received the same degree of attention (Hart, 1995; Vachon, 2007). When presented with challenges arising from social and environmental imperatives, firms can be expected to develop new capabilities based upon their existing endowment of capabilities (Sharma et al., 2007; Reuter et al., 2010). However, the historical accumulation and path-dependent nature of technical and relational capabilities (Dierickx and Cool, 1989), developed to effectively support an efficient or market responsive supply chain, may not align with required social and environmental capabilities.

Merging the ideas of efficient vs. responsive supply chains, along with requisite technical and relational capabilities, enables the construction of a four-cell typology of social/environmental capabilities (Table 1). For illustrative purposes, exemplar capabilities are noted for each configuration. The critical underlying logic is that firms will have different portfolios of social and environmentally oriented capabilities based on their existing supply chain configuration. This will affect the available repertoire of capabilities that can be used to address a firm's stakeholder exposure on a specific social or environmental issue.

5.2. Technical capabilities

In efficient supply chains, continuous improvement skills are vital technical capabilities that enable a firm to improve its quality and better utilize materials, labor, energy, and capital. The social and environmental capabilities derived from such an endowment can apply science and technology to address social or environmental issues related to production processes, both upstream and downstream. For example, carbon footprint analysis is highly technical in nature, demanding the use of material science and life cycle analysis (Graedel et al., 2009). Developing less polluting or safer manufacturing techniques also requires technical expertise in production and operations (Christmann, 2000; Darnall et al., 2008), similar to other aspects of process improvement.

In contrast, responsive supply chains might be more likely to emphasize the development of technical capabilities directed toward product design improvements. Thus, capabilities for 'design for environment' (Allenby, 1991) and 'cradle-to-cradle' design (McDonough and Braungart, 2002; Lee, 2010) follow as a natural extension. Here, too, designing low-impact products is a tech-

Table 1
Supply chain configurations and representative social/environmental capabilities.

Efficient supply chain	
Technical (process improvement)	Relational (monitoring)
Pollution prevention	Developing metrics
Carbon footprint reduction	Auditing
ISO 14001	Tracking
Safer manufacturing methods	
Market responsive supply chain	
Technical (product improvement)	Relational (collaboration)
Removing hazardous materials	Forging effective partnerships
Material substitution	Developing compliance plans
Designing for "cradle-to-cradle"	Convening educational conferences
"Servicizing"	

nical task such that socially and ecologically conscious design builds upon strong conventional design skills. Dematerializing the product is another product oriented technical skill that is accomplished by removing bulk from constituent parts and replacing higher-impact parts with more benign replacements. At the limit, a product can be "servicized" – replaced with a service that meets customers' needs without direct material ownership (Reiskin et al., 2000; Pagell and Wu, 2009). These product based technical capabilities are built upon solid conventional capabilities like engineering skills, design expertise, and product knowledge (Helfat and Raubitschek, 2000; Parmigiani and Mitchell, 2009). For example, Hewlett-Packard's superior product design capabilities allowed it to develop printer cartridges that facilitated re-use.

5.3. Relational capabilities

A similar parallelism occurs for relational capabilities that focus on forging proper incentives, sharing information, and setting common goals. In efficient supply chains, a central relational skill involves effective monitoring, such as through auditing and third-party certification. Firms that excel at monitoring are able to secure and use information to foster continuous improvement in a supplier's processes to maintain quality while reducing costs. They use incentives to align behavior between supply chain partners. Such capabilities can be deployed to address social and environmental imperatives in several ways. Chief among these is the development and use of social and environmental metrics and reporting within supply chains. With highly evolved forms of evaluation, it is easier for these firms to create metrics for social and environmental assessments. Wal-Mart's superior evaluation capabilities allow it to develop exemplary methods of auditing and tracking supply chain S&E impacts. Thus, rather than adopt third party standards for toxics content in toys, Wal-Mart developed its own product safety standards and monitors supplier conformance to them (Pereira and Stecklow, 2008).

Relational capabilities developed by firms in responsive supply chains reflect the ability to collaborate and exchange knowledge to promote flexibility and innovation. This can translate into long term agreements with a relatively small number of suppliers, thereby promoting deeper relationships and trust, which facilitates knowledge transfer (Krause et al., 2007; Ireland and Webb, 2007; Pagell et al., 2010). Collaboration with supply chain partners can also be an important social and environmental capability that drives triple bottom line performance (Vachon and Klassen, 2008). Trust can fuel investments in relationship-based assets, such as recycling practices or remanufacturing equipment, that promote social and/or ecological stewardship, even if those assets are not highly valued by other downstream partners. Den Hond (1998) found that such cooperation along the vehicle dismantling chain was a key ingredient in successful recycling programs. Collaboration toward long term goals also reduces incentives for short term opportunistic behavior, such as the covert use of underage labor, short-changing workplace safeguards, using banned substances or improperly disposing of materials.

The differing experiences of Starbucks and Kraft with respect to coffee sourcing illustrate the supply chain distinctions drawn here. Starbucks' responsive supply chain focused on obtaining the highest quality beans, buying in smaller lots and repeatedly inspecting incoming shipments. Kraft designed its efficient supply chain to stress low costs, subject to minimum quality standards. To address stakeholder exposure to sourcing, including environmental practices and economic equity for growers, Starbucks chose a collaborative route. It worked with Conservation International, sending teams to Chiapa and other coffee-growing areas and eventually developing an in-house standard (Austin and Reavis, 2004). Kraft also worked with an NGO, Rainforest Alliance, but chose to depend on that organization's judgment of proper operations, as well as their existing certification standards. Each firm's approach reflects its endowment of traditional capabilities and its development of social/environmental capabilities.

The preceding theoretical development and examples leads to two propositions:

P1. The supply chain configuration (i.e., efficient versus market responsiveness) drives the development of distinctive portfolios of social and environmental capabilities.

P2. Stronger social and environmental capabilities will lead to greater social and environmental performance.

5.4. Stakeholder exposure plays a moderating role

Possessing particular social and environmental capabilities can yield salutary social and environmental outcomes. But the story is more complex and nuanced than this. The link between these capabilities and outcomes is moderated by the nature of the stakeholder exposure faced by the firm. The previously described elements that contribute to stakeholder exposure, namely control and accountability, determine the impact of social and environmental capabilities toward improving social and environmental performance.

Control and technical capabilities. When control is high, we expect that social and environmental technical capabilities (SETCs) are especially valuable to social and environmental performance. These capabilities allow the firm to understand the technical challenges faced by social and environmental demands, along with the process or product improvement skills to implement required changes. Thus, the greater the depth of these capabilities, the greater the ability to articulate and embed advanced social and environmental process and product capabilities within supply chain partners. A greater degree of control based upon economic and non-economic influence will enable the focal firm to mandate and direct meaningful change within the supply chain. Therefore, this combination of technical ability and the leverage to motivate change, will improve social and environmental compliance and performance.

Control facilitates "win-wins" for the supply chain in the presence of strong social and environmental technical capabilities. For example, final customers may demand a carbon footprint reduction, which will result in pressure to respond several tiers upstream. Strong SETCs on the part of buyers means less chance that upstream suppliers will waste time and energy installing substandard carbon accounting systems. The presence of strong technical skills for reducing toxic materials in products can facilitate the acceptance of suppliers of new formulas for products that they might not prefer under conditions of lessened control. SETCs may also ensure that the lowest cost and/or most expedient methods for toxic removal are being used. For example, when the Dutch government's regulators raised issues about cadmium in cables shipped with Sony's PlayStations that were intended for Christmas sales, Sony was forced to address the issue immediately. The company leveraged its economic influence and control over suppliers, along with its technical expertise, enabling Sony to quickly substitute less toxic materials for cadmium (Aston et al., 2005).

Control along with strong technical capabilities also raises the cost of poor behavior, as it is easier for focal firms to both detect and punish misbehavior. This deters cheating that can characterize upstream responses to social and environmental initiatives. For instance, a supplier contemplating the substitution of melamine for real protein in foods faces major risks when its buyer (a) has significant control, such that termination of its relationship with the supplier is a grave economic blow, and (b) has strong SETCs that make detection of cheating more likely. Similarly, the greater the

control exercised by a buyer, the greater the risks to an electronics supplier who half-heartedly or negligently complies with ISO14001 or other certifications (Krut and Gleckman, 1998; Mueller et al., 2009). In sum, strong SETCs, along with control, enable a firm to educate its suppliers and mandate their compliance. Hence,

P3. The greater the degree of control, the greater the impact of social/environmental technical capabilities on improving social/environmental performance.

Accountability and relational capabilities. The situation for accountability is different. Recall that accountability is defined by the extent to which firms are required or expected to *justify* their decisions and actions to stakeholders. But, like control, accountability is independent of supply chain configuration. For a focal firm that is being held accountable, obtaining accurate supplier information is critical even without control. Stakeholders demand credible evidence about the activities and impacts along the entire supply chain, with the onus typically falling on a small number of firms in any particular supply chain to provide this evidence (Phillips and Caldwell, 2005; Chatterji and Levine, 2006; Pullman et al., 2009). These focal firms must develop systems to trace goods from far upstream in their supply chains, and then evaluate multiple tiers of supply chain partners to ensure compliance.

Compared to traditional economic criteria, such as price or technical specifications, social and environmental criteria are more difficult to verify and satisfy, as these tend to be based upon processes, rather than on end products. Although process oriented third-party certification, such as ISO14001 (environment) or SA8000 (labor practices), might appear to be a robust tool for monitoring and enforcement, a study by King et al. (2005) found otherwise. Their evidence revealed that although greater geographic distance between a firm and suppliers was associated with greater likelihood of ISO14001 certification, use of that standard was actually associated with poorer environmental performance. This finding highlights the unfortunate difficulty in enforcing process standards and obtaining satisfactory outcomes; highly accountable firms cannot rely solely on industry standards. Instead, they must develop their own systems to monitor and evaluate suppliers to supplement institutional norms.

Social and environmental relational capabilities (SERC) are crucial in cases of high accountability, due to the importance of monitoring and collaboration. Demanding stakeholders will require traceability and transparency throughout the supply chain (Tapscott and Ticoll, 2003; New, 2010). This underscores the importance of developing appropriate metrics, as well as auditing and tracking social and environmental performance. Measurement will be most effective when buttressed by long term partnerships, as these provide social exchange incentives to preserve the relationships. As such, partners will feel and react to stakeholder criticism, due to their commitment to each other and shared values (Krause et al., 2007). Moreover, strong relationships will allow for the development of customized mechanisms for data collection and reporting, resulting in more timely and accurate data (Petersen et al., 2005; Krause et al., 1998). Note that there is negligible value from gathering information about such aspects as worker treatment in electronics plants or sources of palm oil for food ingredients if the downstream firm does not believe that the supplier provides honest and accurate information. Indeed, without strong SERCs, accountability problems are likely to be exacerbated, not attenuated.

Collaboration will also be critical, as stakeholders will require a long term commitment to improvement of social/environmental outcomes. As such, supply chain partners will need to cooperate and learn from each other and from outside stakeholders. Co-developing education programs and compliance initiatives will assist in addressing social/environmental issues requiring attention (Sharfman et al., 2009). These capabilities will enable firms to be more creative and proactive in their approaches toward social and environmental challenges, rather than relying on established routines. This may extend to forming partnerships between buyers, suppliers, and activist stakeholders to better understand the issues and possibilities for improvement (Welcomer et al., 2003; King, 2007).

Trader Joe's experience with Greenpeace illustrates the challenge of being held accountable and how social/environmental relational capabilities address this challenge (Frooman and Murrell, 2005). Greenpeace activists were disgruntled about genetically engineered ingredients contained in Trader Joe's products, so they picketed stores and instigated a consumer boycott. In response, the company set the objective of having its suppliers reformulate their products and submit to random testing within a year. This was a daunting task, given the complexity of the supply chain for food products and the difficulty of finding substitutes with similar price and quality attributes (Roth et al., 2008). But, Trader Joe's worked together with Greenpeace and suppliers to understand the issues and develop solutions. The company absorbed the additional costs and maintained shelf prices to keep volumes consistent. They have strong relationships with their suppliers; they are considered a "dream account" due to their transparency, lack of slotting fees, and high volumes (Kowitt, 2010). These partnership skills enabled them to develop plans with suppliers to comply with Greenpeace's demands. These arguments suggest the proposition:

P4. The greater the degree of accountability, the greater the impact of social/environmental relational capabilities on improving social/environmental performance.

Capabilities are complementary in addressing stakeholder exposure. Stakeholder exposure affects the linkages between social and environmental capabilities and performance, because both SETCs and SERCs are necessary when overall exposure is great. In these situations, stakeholders view the focal firm as able to control outcomes and also hold it accountable for any problems that arise. SETCs provide specific knowledge to measure and improve social/environmental performance, while SERC promotes cooperation and learning (Holcomb and Hitt, 2007; Parmigiani and Mitchell, 2010). If exposure for an issue is great and SETCs are in place, but social/environmental relational capabilities are not, a firm will find it difficult to ensure that supplier behavior will match expressed commitments. Without a strong, cooperative partnership, the imposition of some programs, such as those involving unannounced plant visits, could damage supply chain relationships (Boyd et al., 2007). If the firm has strong SERCs but not SETCs, it will lack the wherewithal to create process and product innovations to address key issues. In either case, a bad outcome follows.

Consider the example of a high profile company with a captive supplier in a developing country where issues of human rights and the use of toxic materials in production create high levels of stakeholder exposure. Here, if the firm lacks SETCs, it will be difficult to develop products or processes to reduce or eliminate toxic materials and, if the firm lacks SERCs, it may resort to imposing third-party monitoring systems that are resented by the supplier, rendering them largely ineffective. In either case, its social and environmental performance remains at risk. Only a portfolio of strong and balanced SETCs and SERCs will allow it to confidently address foundational issues high in stakeholder exposure and improve performance.

An example of a company that blends social/environmental technical and relational capabilities is Hewlett-Packard. Its supply chain efficiencies produce cost advantages that allow it to remain the world's top seller of personal computers (International Data Corporation, 2010), yet it also is known for its "HP Way," which stresses "flexibility and innovation." (HP Alumni, 2010). When it

comes to foreign manufacturing sites, the company is well known to consumers and a very large player worldwide. Therefore, when addressing the issue of electronic waste, HP has high levels of control and is held highly accountable. HP's endowment of design capabilities and broad distribution network favored a competitive positioning that emphasized greater producer control, rather than centralized third party handling (Hewlett-Packard, 2010). When a firm is responsible for e-waste, superior product design skills are valuable in creating products that minimize the difficulty of disassembly and reuse. Further, material science knowledge can lead to greater reuse of parts, thereby extending their life beyond initial use.

At the same time, HP's social/environmental relational capabilities result in close supplier relationships. Describing HP's approach (Gecker, 2008), one manager stated, "If you have suppliers familiar with your company and have been working with you for a long time, they become an extension of your company and an additional resource you can tap. I have found that most times it's better to over-communicate." On its own initiative, HP recently undertook an 18 month project with Eastern European suppliers to institutionalize good practices beyond its first tier of suppliers (John, 2008). Recent indicators credit HP with strong social and environmental performance. *Newsweek* has rated it first among all large companies for sustainability (McGinn, 2009), and the firm continues to be a component of socially responsible funds, such as Calvert and KLD. This leads to our next proposition:

P5. The greater the degree of stakeholder exposure (both accountability and control), the greater the impact of social/environmental technical and relational capabilities to improve social/environmental performance.

Implications for economic performance. Our model ties improved social and environmental performance to greater profitability, and vice versa, based on a growing number of studies (Hart, 1995; Russo and Fouts, 1997; Elkington, 1997). In fact, the question of whether social and environmental initiatives pay off has spawned a separate literature so voluminous that it has merited a number of review articles. For example, Margolis and Walsh (2003) find a positive overall association between social and environmental performance and profitability, although the authors find some issues with the methodologies. In a meta-analysis of 52 studies of this connection, Orlitsky and colleagues (2003) broadly validate the social and environmental performance-profit link. This "triple bottom line" effect has been identified as an important concept for supply chain management (Kleindorfer et al., 2005; Carter and Rogers, 2008).

Despite accumulating evidence that social and environmental performance is a contributor to economic performance, several authors have suggested that the connection may be more complicated than a simple direct effect (e.g., Zhu and Sarkis, 2004; Berchicci and King, 2007; Etzion, 2007). Our model proposes that one of the critical complicating factors is stakeholder exposure, which moderates the connection between social and environmental performance and profitability. In essence, the greater the level of stakeholder exposure, the more strongly one might expect to see social/environmental performance drive economic performance.

Consider, for example, a situation in which stakeholder exposure is low. A small food company that is one of many companies purchasing cardboard containers would have low control. It is a company that is well within norms for the industry for sourcing and the issue does not generate stakeholder exposure, so that its level of accountability is low. In such a situation of low stakeholder exposure, the company may get scant economic benefit from developing and deploying the SETCs and SERCs that can create greater social and environmental performance. In contrast, when stakeholder exposure is high, greater social and environmental benefits can generate substantial economic opportunities. Examples include HP's leadership in printer cartridge recycling that has reduced waste and created a profitable new line of business for customers sensitive to this large source of office waste. Whole Foods' leadership in chain of custody stewardship for food products attracts customers that are concerned about food safety, as Whole Foods benefits from the lack of assurances by many of its mainstream competitors.

In these cases, high exposure coupled with strong social/environmental capabilities enabled stronger social/environmental performance, and subsequently, better economic performance. On the other hand, if stakeholder exposure is high and a company's social and environmental performance is poor, this mismatch is likely to foster poor economic performance. Stakeholders that care about social and environmental performance will retaliate by communicating a firm's misdeeds, thereby reducing sales and profits (Rowley and Moldoveanu, 2003; Wright et al., 2007). This leads to our final proposition:

P6. Stakeholder exposure moderates the connection between social/environmental and economic performance, such that the greater the stakeholder exposure, the stronger the effect of social/environmental performance on economic performance.

In sum, our conceptual model integrates the supply chain configuration, stakeholder, and capabilities literatures, and identifies how configuration affects the development of social/environmental technical and relational capabilities that are essential for social and environmental performance. Stakeholder exposure significantly affects the capability/performance linkage, as well as the connection between economic and social/environmental performance. These connections have implications for theory development, research, and managerial practice, which are discussed further.

6. Implications for research and practice

6.1. Research

The integrative, conceptual model presented here has implications for supply chain management and operations management. The addition of social and environmental performance to the established economic outcomes of price, quality, delivery, and flexibility means that efficiency or market responsiveness is necessary, but not necessarily sufficient, for supply chain effectiveness. As stakeholder exposure increases, and competition moves beyond firm vs. firm to supply chain vs. supply chain, understanding, assessing and demonstrating superior social and environmental performance can be a basis for differentiation and advantage over rivals (Ketchen and Hult, 2007). Firms that are trying to augment a historical emphasis on economic outcomes may find this task daunting. Building and maintaining strong supplier relationships becomes both more important and more demanding when incorporating social and environmental issues.

Several provocative implications for supply chain theories must be explored. Transaction cost economics has generally spotlighted the transaction as the unit of analysis (Williamson, 1975). Do the types of supply chain issues that we have described fit well into this framework? Let's consider the example of the working conditions of an upstream supplier of electronics. Product components are near-commodities with many suppliers, so that hazards arising around small numbers or asset specificity are minimal. Instead, the main issues surround factors that Williamson (1975) associated with the human condition: bounded rationality and opportunism. Monitoring the behavior of a multitude of upstream suppliers is difficult and costly. And with limited monitoring, significant pressures develop to act opportunistically to force overtime, abuse workers, and otherwise cut corners. What is unique in this context is that vul-

nerability comes neither from the product being made poorly (e.g., opportunistically substituting poor quality inputs), nor supported inattentively (e.g., unrealistic promises about delivery), but instead from stakeholder exposure. Thus, if transaction cost economics was applied to this problem, theorists must include a broader set of safeguards that protect the purchasing company from behaviors of its suppliers, who have little to do with direct costs of the components or supply functions. This expanded basis for transaction costs indicates that ceteris paribus, there might be growing integration across the supply chain in response to social and environmental concerns. The rapid rise of private mechanisms for monitoring upstream behavior (O'Rourke, 2006) can be viewed as a way to try to retain the benefits of arm's length governance while addressing social and environmental issues.

Incorporating social and environmental risk due to stakeholder exposure has implications for other strands of supply chain management theory. From a capabilities-based perspective, managing suppliers becomes a more complicated endeavor, because firms also must develop skills in shaping the perceptions of outside constituencies. It could be that managing suppliers and external stakeholders are complementary skills, in that they bolster each other. Also, firms may learn how to engage some of these stakeholders effectively from their suppliers. Regarding the trust or relational literatures (e.g., Krause et al., 2007), adding stakeholder salience with respect to social and environmental issues means that firms may benefit from focusing on a smaller number of rich relationships with both suppliers and activists, as it will take more effort to manage these relationships cooperatively. Supplier selection also becomes more difficult as firms need to screen for alignment of social and environmental viewpoints.

Our framework builds on Fisher's (1997) prototypical efficient and market responsive configurations, but some recent efforts have tried to merge these archetypes in the form of agile or leagile (i.e., lean + agile) supply chains, (e.g., Christopher and Towill, 2000; Mason-Jones et al., 2000). The two configurations can be linked at a decoupling point (Krishnamurthy and Yauch, 2007), whereby the lean (efficient) portion of the supply chain is separated from the agile (i.e., responsive) portion of the supply chain by using product modularity combined with postponement of customization. Lead time in the supply chain for production and procurement has been proposed as a key factor differentiating when a leagile supply chain might be effectively leveraged (Christopher et al., 2006). However, both portions of the supply chain continue to rely on distinct capabilities related to efficiency and responsiveness.

Expanding this to include social and environmental issues, capabilities, and stakeholder exposure, suggests an interesting implication. This hybrid configuration and the associated multiplicity of technical and relational capabilities might naturally foster the development of a broader portfolio of social and environmental capabilities. The earlier example of Apple/Foxconn suggests that capabilities based upon responsiveness, such as product improvement and collaboration, may need to be supplemented with efficiency oriented capabilities, such as process improvement and monitoring, to satisfy demands for economic, social, and environmental outcomes. In some cases, firms may need to combine social/environmental capabilities derived from both efficient and responsive configurations to address stakeholder exposure.

6.2. Managerial practice

Drawing from the linkages between configuration, capabilities, and stakeholder exposure, several managerial implications emerge. First, managers must be cognizant of the dynamic nature of the portfolio of social and environmental issues that they face in the supply chain. Each issue has its own characteristic life cycle, and exposure can ebb and flow based on interconnected factors related to different stakeholders and critical events, such as governmental actions, consumer and media attention. Thus, firms and their supply chain partners need an evolving portfolio of capabilities to match these demands, understanding that these will be linked to their existing capabilities based upon their efficient vs. responsive supply chain configuration.

Second, firms must develop a social and environmental accounting system that allows them to track performance along their supply chains. Such accounting permits a comprehensive and longitudinal picture of where a firm currently stands and whether progress is being made. In addition, such a system can alert firms to potential problem areas where exposure might increase. For example, such reporting can help if a firm is either encouraged or pressured by external stakeholders to report on labor practices in upstream suppliers (such as occurred with Apple). In this instance, firms with these systems are in a better position to request information about these practices and arrange for audits. Both supply chain audits and measurement foster improved management of these issues. Fortunately, several social and environmental accounting systems are slowly receiving greater support, albeit mostly from larger multinationals. One such framework, the Global Reporting Initiative (GRI), is a comprehensive approach for improving accountability that explicitly involves working with stakeholders to identify how and for what the firm should be accountable. With the growing movement for transparency (New, 2010), firms have latent risks if they do not develop the means to effectively assess these issues.

Third, understanding social and environmental issues and developing relational capabilities becomes more challenging as distance increases. Distance makes it more difficult to establish trust and maintain rich exchanges of information. Moreover, distance is a multi-dimensional construct, encompassing geographic location, cultural differences, and number of organizational interfaces (Roth et al., 2008), which in turn increase complexity (Bozarth et al., 2009). Each form of distance can exacerbate the difficulties of coordination and collaboration. For example, customer and supplier plants may attach similar importance to workplace safety, despite being thousands of kilometers apart in Belgium and China, because they are both owned by parent firms located in the same country (i.e., small cultural distance). On the other hand, two neighboring Chinese plants may have very different views of workplace safety because one is owned by a U.S. firm, and the other by a Chinese parent (i.e., large cultural distance). This highlights the importance of supplier selection and implies benefits from a smaller supply base and greater vertical integration to improve control over social and environmental outcomes.

7. Conclusion

Globalization has created the means for companies to create vast networks of suppliers and distributors as they search for the efficiency promised by world class supply chains. That some social and environmental concerns will arise from these activities is inevitable. Thus, operating exemplary efficient or market responsive supply chain in the face of evolving social or environmental issues is a challenging prospect, given the complexity of the typical global supply chain. Firms need to play to the strengths inherent in their supply chain configuration. That is, they must leverage their existing technical and relational capabilities for their supply chains toward social and environmental issues. To develop the most critical capabilities, firms need to consider the stakeholder exposure to particular social and environmental issues across their supply chain, which includes control (the degree to which they cause or influence actions in the supply chain) and accountability (the degree that they must justify their actions). Increased stake-

holder exposure can exacerbate the challenges firms face in this effort. However, these challenges can be met through developing social/environmental technical and relational capabilities. The broad scale impact of social and environmental issues with the public and private domain means that firms cannot do this important work solely on their own; they must effectively leverage knowledgeable suppliers, customers, and outside third parties. Indeed, it takes a village to create an efficient, accountable, and sustainable supply chain.

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