THE IMPACT OF SUPPLY RISK ON SUSTAINABILITY MONITORING PRACTICES AND PERFORMANCE

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INTRODUCTION

Trends of outsourcing and global sourcing have increased supply chain complexity for many organizations (Bode and Wagner 2015). At the same time, competition places pressure on firms to keep supply chain costs low and provide excellent customer service, while offering products and services with flawless quality. In navigating the challenges of global supply chains, every organization faces a variety of risks associated with the acquisition of goods and services from suppliers. Such problems can affect costs, customer service and investments in inventory. Consequently, a critical aspect of supply management is the ability to identify possible sources of supply disruptions and manage risks. Research on supply risk has traditionally focused on operations risks related to costs (e.g., increased prices, foreign exchange exposure), delivery (e.g., delays due to extended global supply chains, supplier capacity constraints), and quality (e.g., defects, use of out-of-spec raw materials) (Zsidisin and Ellram 2003). Moreover, research has shown that supply chain disruptions can have a significant effect on firm profitability and shareholder value (Hendricks and Singhal 2003; Ritchie and Brindley 2007).

More recently a new layer of complexity has been added to how companies manage their supply chains. Motivated by a variety of factors, including consumer pressures, government regulations and a desire to reduce their environment impacts, organizations are embracing sustainability. Firm performance is no longer solely measured by the income statement and balance sheet – organizations are also paying close attention to their environmental and social performance, which when considered jointly with financial performance is termed the triple bottom line (TBL) (Elkington 1998).

This research examines the relationship between elements of supply risk (e.g., operations and sustainability risk), supplier sustainability monitoring practices, supply improvement initiatives and firm sustainability performance. In doing so, the research makes three primary contributions. First, the supply management literature contains several studies that examine supply risk and its impact on the firm. However, this body of research has tended to focus mostly on operations risks, while research on supply sustainability risk management has not been adequately addressed. Drawing from agency theory, this study advances supply risk literature by
exploring the effects of supply sustainability risk on the use of monitoring practices to manage supplier environmental and social behavior. We find evidence that increased sustainability risk affects both social and environmental monitoring of suppliers.

Second, we seek to better understand the association among operations risk and supplier sustainability monitoring practices. Specifically, we propose that supply operations risk prompts supply improvement initiatives and that such initiatives promote increased social and environmental monitoring. While previous supply research has explored a variety of approaches to managing the effects of supply risks, this is the first study to explore the mediating effects of supply improvement initiatives on sustainability monitoring practices.

Lastly, several studies in operations and supply chain management have examined the association among environmental practices, environmental performance and financial performance (e.g., Montabon et al. 2007) and the relationship between social practices and firm performance (e.g., Klassen and Vereecke 2012). However, absent from the literature is research that examines the relationship between sustainability monitoring practices and firm sustainability performance. This research uses a combination of survey and archival data to independently assess the implications of sustainability monitoring practices on firm sustainability performance. In doing so, the research provides a methodology for evaluating the impact of sustainability monitoring practices on the TBL in supply chain management.

CONCEPTUAL DEVELOPMENT

Supply sustainability risk and sustainability monitoring practices

In recognition of the growing importance of sustainability risks in the supply chain, firms are increasingly incorporating supply chain sustainability risk assessments as part of their supplier management activities. Harwood and Humby (2008) observed that, for more than one-fifth of firms surveyed, sustainability risk was rated as their largest supply risk and more than one-quarter of respondents required suppliers to follow their social and environmental standards. In a principal-agent relationship, information asymmetry and misaligned interests may provide an incentive and opportunity for the agent (supplier) to behave inappropriately. Supplier environmental and social sustainability practices represent one form of moral hazard for the buyer, whereby it is difficult to verify the behavior practices of suppliers. In the context of a global supply chain, information asymmetry and the moral hazard problems may be exacerbated by the distance between the buyer and supplier, as a result of cultural differences, alternate perceptions on governance, and weaknesses in legal infrastructure and enforcement of sustainability regulations (Steven et al. 2014). To overcome these problems, agency theory proposes that the principal select between two types of contracts to govern the principal-agent relationship: behavioral-based contract (e.g., monitoring) or outcome-based contract (Eisenhardt, 1989). Outcome-oriented activities emphasize results, regardless of how they are achieved (Eisenhardt, 1989). In the context of supply management, outcome-oriented mechanisms represents a focus on supplier performance (e.g., on-time deliveries and defect rates), without intervention into the operations of the supplier. This approach is appropriate when uncertainty is low (Zsidisin and Ellram 2003). In contrast, behavior-oriented activities focus on evaluating the agent’s processes and activities. Examples of behavior-oriented approaches in previous research include supplier quality certification, supplier quality audits and target costing. Specifically,
previous research has found that firms increase behavior-oriented techniques as supply risk increases (Zsidisin and Ellram 2003).

Monitoring is a key element of buyer-supplier relationships (Carr and Pearson, 1999) and partner-specific experiences facilitate adjustments in monitoring mechanisms that form the basis of long-term collaborative relationships (Krause et al. 2007). Furthermore, research in the sustainability field has found that monitoring suppliers is an effective means of reducing irresponsible supplier behavior (Lee and Klassen 2008; Hill et al. 2009). For example, in order to verify that suppliers meet established requirements as set forth in their Responsible Sourcing Program, Walmart conducts regular supplier factory assessments. The company conducts more than 20,000 audits each year (Walmart 2014 Global Sustainability Report). Consequently, our expectation is that supply sustainability risk will affect the level of firm investment in behavior-based resources, and we propose:

Hypothesis 1a: As perceived supply sustainability risk increases, the use of supplier environmental monitoring practices increases.

Hypothesis 1b: As perceived supply sustainability risk increases, the use of supplier social monitoring practices increases.

Operations risk, supply improvement initiatives and sustainability monitoring practices

Several studies dating back two decades have examined supply improvement initiatives, with the objective of providing insights about trends and the future direction of supply (e.g. Carter and Narasimhan 1995; Trent and Monczka 1998). However, the benefits of supply chain improvement initiatives extend beyond reductions in supply risks. Such initiatives improve the overall firm performance through enhanced visibility within the supply chain and better working relationships with suppliers (Johnson et al. 2007). Exchange of information can also help align interests of the buyer and supplier. Consequently, we posit that investment in supply chain improvement initiatives lays the foundation for building collaborative buyer-supplier relationships by reducing barriers to behavior-based approaches to supplier sustainability practices as prescribed by agency theory. For example, Jiang (2009) argued that collaboration with overseas suppliers has a positive impact on suppliers’ compliance with codes of conduct. From a principal-agent perspective, supply chain improvements can reduce information asymmetry, which decreases the risk of moral hazard. Therefore, we expect that implementation of supply chain improvement initiatives can lead to better buyer-supply relationships, improved supply processes and more effective measurement systems, which in turn reduces barriers to supplier monitoring. More recently, research has found that supply improvement initiatives are also directed towards reducing sustainability related incidents (Johnson and Leenders, 2012). For example, supplier evaluation, including auditing for sustainability conformance, have been found to affect supplier sustainability performance (Foerstl et al. 2010). Similarly, investments in new technologies targeted at decreasing the environmental footprint of the supply chain have been found to reduce sustainability risk (Roehrich et al. 2013). Consequently, our expectation is that supply operations risk will have an indirect effect on supplier sustainability monitoring practices through investments in supply improvement initiatives. As a result, we propose:
Hypothesis 2a: Supply improvement initiatives mediate the relationship between supply operations risk and supplier environmental monitoring practices.

Hypothesis 2b: Supply improvement initiatives mediate the relationship between supply operations risk and supplier social monitoring practices.

Sustainability monitoring practices and sustainability performance

As discussed earlier, firms are increasingly held accountable for the behavior of their suppliers. Performance is no longer exclusively measured on the balance sheet and income statement, but through the concept of the TBL, which is comprised of three Ps of people, profit, and the planet. The goal is to maintain a healthy financial cash flow without compromising on social (e.g., labor rights, well-being of employees) and ecological (e.g., waste generation, eco-friendly products etc.) principles (Kleindorfer et al. 2005). Consequently, sustainability performance has become an important component of overall firm performance.

We posit that socially responsible firms emphasize monitoring of supplier sustainability processes to augment their own sustainability performance. Effective monitoring requires a certain skillset to gauge the appropriateness of actions and behaviors being scrutinized and firms develop such capabilities through continuous learning that results in improved performance. Thus, we propose:

Hypothesis 3a: As monitoring of supplier environmental practices increases, firm sustainability performance improves.

Hypothesis 3b: As monitoring of supplier social practices increases, firm sustainability performance improves.

METHODOLOGY

Data collection and Sample

The relationships among supply risk, supplier sustainability monitoring practices, supply improvement initiatives, and firm performance were explored using a combination of survey and archival data sources. The inclusion of sustainability performance data from the Environmental, Social and Governance (ESG) databases respectively, reduced the effective sample to only large U.S. firms. Of the 623 potential respondents, 183 completed surveys were returned, resulting in a response rate of 29.4%. In the process of merging sustainability performance data from secondary sources, another 34 responses had to be dropped from the sample, resulting in final sample size of 149 firms and an effective response rate of 23.9%. rigorous tests were carried out for possible non-response bias and common method bias based on suggestions of Podsakoff, MacKenzie, Lee, & Podsakoff (2003). We employed confirmatory factor analysis (CFA) using AMOS v21.0.0 and the ML estimator to evaluate the validity and reliability of the resulting multi-item measurement scales (Anderson and Gerbing 1988). The fit statistics for the measurement model indicate a good fit ($\chi^2 = 192.36, df = 124, p < 0.001$; $\chi^2/df = 1.55$; CFI = 0.952; GFI = 0.880; RMSEA = 0.061) (Kline 2011). We assessed the reliability of each multi-item scale using the CFA standardized factor loadings and calculating the composite reliability.
Use of Secondary Data & Control Variables

One of the contributions of this study is the simultaneous use of primary and secondary data in the model to validate its hypotheses. In order to link supply risk to sustainability performance of firms, we used the Environmental, Social and Governance factors (ESG) database provided by Morgan Stanley Capital International (MSCI Sustainability Indices 2013). All financial archival data was extracted from the COMPUSTAT database.

Two sets of control variables namely firm-level and industry-level control variables were added to the analysis. Consistent with previous research, the firm-level control variables included leverage and prior performance related measures (Hull and Rothenberg 2008; Lanier et al. 2010, Jayachandran et al. 2013). For industry-level controls, we employed three commonly used metrics – environmental munificence, environmental dynamism, and environmental complexity (Fernhaber and Patel 2012).

RESULTS

We carried out path analyses of the hypothesized model (Figure 2) using the statistical software package Amos 21.0.0. Path analysis is used when there are multiple predictions of multiple variables in a model. Since, the focus of analysis was on the relationships, we replaced each construct with the average of its scale items. This is also appropriate, given the number of constructs, hypothesized relationships, and sample size. This estimation method has been employed in earlier operations management studies (e.g. Paiva et al. 2008) where reliability of constructs is high, as is the case in our study.

The structural model results indicate good model fit ($\chi^2 = 27.00$, df = 18, p = 0.079; $\chi^2$/df = 1.50; CFI = 0.989; GFI = 0.970; RMSEA = 0.058) (Kline 2011). The results of our statistical analyses provided support for several of the hypothesized relationships in our proposed model. The first set of hypotheses (H1a and H1b) explored the influence of supply sustainability risk on supplier sustainability monitoring practices. Sustainability risk was found to be significantly and positively related to both dimensions of supplier sustainability monitoring practices, signifying that firms that assessed sustainability risk from suppliers to be high, tended to engage in higher environmental monitoring ($\beta = 0.416$, p < 0.05) and social monitoring ($\beta = 0.446$, p < 0.001).

The second set of hypotheses (H2a and H2b) related to supply improvement initiatives acting as a mediator between supply operations risk and supplier sustainability monitoring practices. In order to find support for Hypothesis 2, three separate paths need to be tested. For H2a, the relationship between operations risk and supply improvement initiatives was found to be significant ($\beta = 0.312$, p < 0.001); the direct path between operations risk and supplier environmental monitoring was found to be non-significant ($\beta = -0.016$, p = N.S.), while the path between supply improvement initiatives and supplier environmental monitoring was also found to be non-significant ($\beta = 0.109$, p = N.S.). Therefore, we could not find support for H2a. For H2b, operations risk was found to be positively related to supply improvement initiatives ($\beta = 0.312$, p = 0.001) and supply improvement initiatives was found be significantly related to supplier social monitoring ($\beta = 0.210$, p = 0.001), while a relationship between operations risk and supplier social monitoring could not be established ($\beta = 0.042$, p = N.S.). Therefore, we found support for full mediation of supply improvement initiatives onto the relationship between
operations risk and supplier social monitoring. The Sobel test for mediation (Sobel, 1982) confirmed full mediation.

Hypothesis 3 related supplier sustainability monitoring practices of a firm to its sustainability performance. Environmental monitoring practices were found to be positively related to sustainability performance (H3a: β = 0.84, p < 0.05), but the impact of social monitoring on sustainability performance could not be established (H3b: β = -0.059, p = N.S.).

**DISCUSSION**

The empirical results point to several important findings that contribute to a better understanding of supply risk, monitoring of supplier sustainability practices and investment in supply improvement initiatives. The results strengthen the view that firms are increasingly becoming conscious of their responsibility towards various stakeholder groups, and that this responsibility has shifted beyond organizational boundaries, covering broader supply chain relationships. Furthermore, findings suggest that managers process operations risks and sustainability risks independently. Greater sustainability risk leads to increased sustainability monitoring, while greater operations risk leads to increased investment in supply improvement initiatives, which in turn leads to increased social monitoring. The study also established that supply improvement initiatives acted as a full mediator between operations risk and supplier social monitoring.

An interesting insight provided by the findings is the influence of prior sustainability performance on current sustainability practices of firms. Prior sustainability performance, indicated by KLD performance in year 2009 (refer to Table 3), was significantly related to the two dimensions of monitoring of supplier sustainability practices, which leads to two conclusions. First, firms who have invested in developing their sustainability programs demonstrate higher levels of emphasis on practices, which in turn results in further performance improvement. Second, a more general conclusion is related to path dependence. Path dependence theory suggests that as a firm accumulates knowledge and investment, this accumulation either constrains or opens up the available options that the company can choose in the future (Garud et al. 2010). Thus, a firm’s actions and behaviors carry a history with them and the set of capabilities acquired by firms are path-dependent.

The results of this study also have important managerial implications. It is interesting to note that among the two factors contributing to supply risk, supplier operations risk was rated higher, with a mean composite score of 3.84 (S.D. = 0.77), while supplier sustainability risk had a composite score of 2.55 (S.D. = 1.03). This finding indicates that large firms, which make up the sample of this study, place greater emphasis on risk arising from disruption in supplier operations as compared to supply sustainability risk factors. Despite the difference in assessment of supply risk factors, the correlation among the two is significant, suggesting that although firms put a different emphasis on each factor, generally when one factor is rated as high, there is an inherent realization that it will affect the other supply risk factor as well.

**REFERENCES AVAILABLE FROM THE AUTHORS**
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