Supply Chain Involvement in Business Continuity Management: Effects on Reputational and Operational Damage Containment from Supply Chain Disruptions

DOI:
10.1108/SCM-08-2019-0304

Supply chain involvement in business continuity management: Effects on reputational and operational damage containment from supply chain disruptions

Arash Azadegan
Rutgers Business School, New Jersey, USA

Tahir Abbas Syed*
University of Manchester, Manchester, UK

Constantin Blome
University of Sussex, Brighton, UK

Kayhan Tajeddini
University of Sheffield, UK

* Corresponding Author - tahirabbas.syed@manchester.ac.uk

This is the author version of the manuscript, which has been accepted for publication at the **Supply Chain Management: An International Journal.** Please do not replicate or forward without author consent

Supply Chain Involvement in Business Continuity Management: Effects on Reputational and Operational Damage Containment from Supply Chain Disruptions

1. Introduction

Much is written about the benefits of integrating supply chain departments with other firm activities (Swink and Schoenherr, 2015, Flynn et al., 2010). Much less is known about the possibilities of integrating supply chain activities in risk and disruption management efforts. Effective integration includes information sharing and involvement (Song and Parry, 1993, Riley et al., 2016). Whereas information sharing includes the mere exchange of data, involvement requires the exchange of expertise, and collaboration among the parties (Gupta et al., 1985b). Supply chain involvement, defined as the extent of inclusion of departments engaged in supply chain management with other firm activities (Mentzer et al., 2001), can be of potential value in managing risks and disruptions.

Business continuity management (BCM) is a holistic management program for identifying risks that could impact operations and for providing a structure for developing capabilities in effective mitigation and response to disruptions (Blos et al., 2012, Engemann and Henderson, 2011). Many believe that BCM can offer a viable approach to addressing challenges facing organizations (Kildow, 2011, Blos et al., 2009). As will be detailed later, BCM has distinguishing characteristics that differentiate it from risk management and organizational resilience. BCM refers to a framework, including risk assessment and mitigation, continuity planning, and disruption recovery plans (Azadegan et al., 2019).

Deciding on whether to focus on effective risk and disruption management efforts such as BCM is particularly important for firms that are vulnerable to risks and disruptions. Supply chain vulnerability is the susceptibility and exposure of the company's supply network to disturbances that can lead to the obstruction of flows and to the breakdown of its operations (Pettit et al., 2013, Wagner and Bode, 2009). Such vulnerability can be the result of the firms' infrastructure, operation and management, market and technological turbulence, and other supply chain-related factors (Gualandris and Kalchschmidt, 2014, Asbjørnslett, 2009, Wagner and Neshat, 2012).

Empirical evidence in support of the effectiveness of BCM, or involvement of different departments in BCM, is not well-substantiated (Gosling and Hiles, 2009). Debates on the benefits or hindrances of BCM seem mixed, and absent of sound theoretical basis (Lindstedt, 2007). Similarly, supply chain involvement in BCM (SCiBCM) can offer a broader and informed picture of firm processes and objectives in risk-related efforts. However, SCiBCM can not only be a costly endeavor but can also prove to be unrewarding (Zsidisin et al., 2005). The additional resources placed in cross-functional meetings, command coordinating, and sharing team status from many departmental groups may not be worth the effort (Homburg and Kuehnl, 2014, Turkulainen and Ketokivi, 2012).

The above arguments suggest that not only is there ambiguity on the effectiveness of BCM and SCiBCM in facing risks and disruption, empirical evidence on the matter is also missing. Moreover, whether such efforts are useful to firms that show more considerable vulnerability is unclear. This offers motivation for our study. Focusing on major supply chain disruptions (SCDs), we ask our research questions: *How do BCM, and SCiBCM, help organizational efforts to contain the damaging effects of major SCDs? How does supply chain vulnerability affect these relationships?*

--- Insert Table 1 About here ---

To explain the relationships noted above, we apply explanations provided by Simons' levers of control framework (LOCF) (Simons, 1995, Simons, 1994). Levers of control are systems by which managers align organizational efforts with their objectives. According to LOCF, whereas diagnostic controls are formalized procedures that are used for monitoring and control, interactive controls build capabilities that allow the company and its departments to move beyond the typical operating routines. We argue that as diagnostic controls, tools offered by BCM help monitor and report on response and recovery efforts during SCDs, which help contain any reputational damage. As interactive controls, SCiBCM improves response and recovery efforts and helps in containing the operational damage caused by SCDs. We then argue that with a rise in vulnerability, the effectiveness of BCM and SCiBCM is increased. Based on these explanations, we develop and empirically validate a set of hypotheses using questionnaire responses from 448 European manufacturers.

The work presented here offers multiple contributions to the literature. Except for less than a handful of previous studies, robust empirical evidence on the effects of BCM or involvement of other departments in BCM on performance is limited (cf. Ojha et al., 2013, Prud'homme, 2008, Azadegan et al., 2019). Given the ever-rising attention on supply chain risk and disruptions, explaining *how* firms can effectively address and limit damages from disruptions can provide important insights for practitioners and researchers. Second, supply chain management research has generally neglected investigating internal integration. Such neglect, often because of internal integration in its varied forms, is overshadowed by interest in studying external integration (Flynn et al., 2010, Wieland et al., 2016). This study theoretically and empirically demonstrates the role played by internal integration, in the form of SCiBCM.

2. Literature review

2.1 Business continuity, risk management, and organizational resilience

BCM is a holistic management system that addresses risk and disruptions by helping to prevent risks, mitigate risks, respond to actual disruptions, and recover from actual disruptions (Engemann and Henderson, 2011, Azadegan et al., 2019). As related to preventing and mitigating potential disruptions, specific activities within BCM, such as risk identification, and business impact analysis (BIA) help understand and address the risks facing a company before they lead to disruptions. As related to response to and recovery from actual disruptions, BCM includes activities that are meant to lessen the severity of damage from SCDs once they occur (Engemann and Henderson, 2011). For instance, a crisis response plan develops and documents actions necessary in response to disruptions (Engemann and Henderson, 2011). Response and recovery activities advocated by BCM take front and center stage during an actual disruption.

It seems important to decipher BCM from risk management and from organizational resilience. The International Organization for Standards (ISO) has developed definitions for each of the three concepts and three distinct standards for each. ISO defines risk management as "coordinated activities to direct and control an organization with regard to risk" (Gjerdrum and Peter, 2011; page 11). ISO 31000 offers a list of suggestions on how to deal with risk. These include avoiding the risk, accepting or increasing the risk in order to pursue a justified opportunity, removing the risk source, changing the likelihood, or consequences of the risk and sharing the risk with another party (Purdy, 2010). ISO's definition and focus on risk aligns quite well with what the literature in supply chain highlights (Tang, 2006, Sodhi et al., 2012, Manuj and Mentzer, 2008, Tummala and Schoenherr, 2011). For instance, in their thorough review of the literature on risk management, Ho et al. (2015) highlight how the focus of a majority of work in supply chain risk management has been on identification, assessment, and monitoring of risks. The above suggests that the focus of supply chain risk management is on the potential for events that have yet to occur.

ISO defines organizational resilience as the ability to absorb and adapt in a changing environment to enable the organization to deliver its objectives (Blades, 2017). The ISO standard 22316 on resilience provides guidance by proposing principles, attributes, and activities contributing to effectively "weathering the storm" (Butler, 2018; pg 103). Here again, the ISO definition falls in line with much of what the literature on supply chain resilience suggests (Pettit et al., 2013, Ponomarov and Holcomb, 2009, Wieland and Wallenburg, 2013). For instance, Tukamuhabwa et al. (2015) define resilience as the adaptive capability to prepare for and/or respond to disruptions, to make a timely and cost-effective recovery.

According to ISO 22301, BCM is defined as "documented procedures that guide organizations to respond, recover, resume, and restore to a pre-defined level of operation following a disruption." (Svata, 2013; pg 26). The intended purpose of ISO 22301 is to enable organizations to protect against, reduce the likelihood of occurrence, prepare for, respond to, and recover from disruptive incidents when they arise (Estall, 2012, Wong and Shi, 2014, Zawada, 2014). In comparing BCM to risk management, Ferguson (2019) explains how BCM incorporates mitigation strategies and recovery plans beyond what is generally included in risk management. Also, while resilience seems to aim at recovery from disruptions, response and recovery are a subset of the scope of BCM (Azadegan et al., 2019).

From a practical standpoint, BCM includes a clear structure for program implementation. BCM includes a series of steps starting with hazard and preparedness assessment, and then onto response and recovery plans that include the structure and objectives of response and recovery, and finally completes the program by establishing institutional practices and means of assurance for the program's effectiveness (Hiles, 2010, Burtles, 2015, Watters and Watters, 2014). BCM offers a clear structure and a holistic approach to managing both risks and recovery from disruptions (Herbane, 2010).

2.2 Supply chain involvement in BCM

Specific to supply chain integration, the literature suggests that collaboratively managing internal processes allow for effective and efficient flows of products and services, information, money, and decisions, to provide maximum value to the customer (Flynn et al., 2010, Wong et al., 2011, Huo, 2012, Zsidisin et al., 2015). Focusing on hospital operations, Riley et al. (2016) explain how internal integration, as measured by collaboration across organizational boundaries, helps enhance warning capabilities.

A handful of studies decipher integration into information sharing and interaction between the parties (Song and Parry, 1992, Gupta et al., 1985a). Information sharing captures aspects that focus on the exchange of objective data, and information (such as test-marketing results, and regulatory and legal restrictions). Involvement focuses on the interaction between parties, how they work together, and how they share knowledge and expertise (Gupta et al., 1985b). In supply chain integration literature, a few have focused on the significance of supply chain involvement (Schoenherr and Swink, 2015, Ye et al., 2018). For instance, Feng and Wang (2013) highlight how involvement is essential in improving NPD cost, speed, and market performance. Najmi and Khan (2017) explain how internal supply chain involvement sets the basis for establishing external involvement with suppliers and customers. Finally, we note the study by Brandon-Jones et al. (2014) that explains how purchasing involvement positively affects knowledge scanning.

Table A-1 (Appendix) provides an overall summary of the literature at the intersection of BCM and supply chain management. This review highlights how less than a handful of studies actually provide rigorous empirical evidence on the beneficial effects of BCM in addressing disruptions or on firm performance. In this study, we aim to offer empirical evidence towards addressing these gaps in research.

In the remaining sections of the paper, we evaluate the effects of BCM and SCiBCM on how well firms can contain the damage from SCDs. We focus on two particular types of damage. Damage to operations is particularly concerning because operations encompass the fundamental activities of any enterprise that fulfill customer expectations. Moreover, literature has demonstrated that operational costs are particularly important during SCDs, showing that containing the operational damage is important (Chang et al., 2015). Second, damage to the organization's reputation can be particularly concerning. Reputational damage, in the form of loss of goodwill or credibility, as well as political or corporate embarrassment, can have detrimental effects on the firm's viability (Petersen and Lemke, 2015, Hiles, 2010). Research has yet to empirically test the effect of external factors on BCM and its integration with other departments. In the next section, we offer theoretically-based explanations that differentiate between how BCM, and SCiBCM, contain operational and reputational damage from SCDs.

3. Theory and hypotheses

BCM and SCiBCM are performance control mechanisms. According to LOCF, control mechanisms are information-based routines and procedures used to maintain and alter patterns in organizational activities as needed (Simons, 1994). Two main categories of controls are diagnostic and interactive controls. Diagnostic controls are formalized procedures that are primarily used to monitor and report on how well organizational objectives are met (Bühler et al., 2016). Examples of diagnostic controls include project monitoring tools, management-by-objectives, and goal setting mechanisms (Simons, 1994). In line with diagnostic controls, BCM offers tools that act as a feedback system that helps outline procedures that monitor for information handling, reporting, and correcting deviations during response and recovery.

Interactive controls help build capabilities that allow the company and its departments to share knowledge and expertise in developing novel solutions. For instance, frequent meetings among managers and personnel from different departments can be important in developing new ideas that are outside their routine practices (Simons, 1987). In line with interactive controls, SCiBCM helps enhance risk and disruption management efforts by sharing knowledge and expertise across departmental boundaries (Pavlov and Bourne, 2011). In short, diagnostic control systems reflect the use of measurement as feedback or information-providing function, while interactive control systems are seen as performing the feedforward function allowing emergent actions and leading the development of new organizational processes in key areas.

A key concern for firms is how they manage environmental uncertainty. Uncertainties can pose threats or present opportunities as circumstances change (Daft et al., 1988). Specific to managing risks and disruptions, rising supply chain vulnerability extends the need for addressing uncertainty and ambiguity in the firm's operating environment (Pich et al., 2002). As will be detailed below, we leverage arguments suggested by LOCF to hypothesize that supply chain vulnerability extends the effectiveness of BCM and SCiBCM in containing the damage from major SCDs.

3.1 BCM and reputational damage containment of SCDs

Company reputation is the stakeholders' perception of the image, status, and popularity of the company (Lindgreen et al., 2009, Petersen and Lemke, 2015). Managing company reputation can be particularly difficult in the face of SCDs. SCDs can be ambiguous and confusing situations that can lead to speculations (Kim and Cameron, 2011). Effective crisis communication with stakeholders helps limit speculations, prevent damage to the company's brand equity, and possibly reverse possible reputational loss (Benoit, 1995).

BCM offers several tools that can enhance effective communication with external stakeholders in the face of SCDs. To start, BCM includes routinely scheduled status reports as part of a crisis management plan (Engemann and Henderson, 2011). Such reports not only provide up-to-date (or up-to-the-hour) information with the company spokesperson but also streamline information to what is important to share in the communication with stakeholders.

Second, effective communication requires reliable and validated information. BCM allows the firm to quickly and accurately understand the cause and scope of damage (Greyser, 2009). Well-developed hazard assessment, business impact analysis, and crisis management plans (all of which are tools designed as part of a comprehensive BCM), help determine the scope of the damage. The company is then able to swiftly decipher facts, frame the extent of the damage, and to communicate an accurate message in anticipation of what its stakeholders may need to hear (Elliott et al., 2010).

Third, effective crisis communication hinges on proactively sharing information to parties and on clearly explaining the situation in ways that are free from doubt (Ulmer et al., 2017, Marconi, 1997, Beldad et al., 2018). BCM allows the firm to monitor the response and recovery activities in the face of disruptions. Crisis response plans developed as part of BCM can help with the assessment of performance variables (i.e., recovery time objectives). This helps to more promptly report on the response and recovery progress (Henri, 2006), which helps better predict what type of information is to be communicated with the stakeholders.

Following the depiction from LOCF, all such tools are forms of diagnostic controls that can help in monitoring and reporting how organizational objectives are met. In short, by enhancing effective crisis communication, BCM makes it possible to improve the way in which reputational damage of major SCDs is contained. Hypothesis 1 captures this argument:

> **Hypothesis 1.** BCM is positively related to reputational damage containment of major SCDs.

3.2 Supply chain involvement in BCM and damage containment

As we noted earlier, supply chain departments include boundary-spanning activities that can offer a broader and systemic view of the effects of the disruption. SCiBCM makes the company better aware of risks and threats in its own and its suppliers' (Norrman and Jansson, 2004). SCiBCM helps limit the operational damage from major SCDs by offering knowledge and expertise beyond what may be included in BCM policies and procedures. For instance, when expertise from production, delivery, and sourcing activities are embedded early in the recovery process, the poor or incomplete scope of the disruption is avoided. In line with how interactive controls are defined (Simons, 1994), SCiBCM helps broaden the scope of understanding, which helps with faster recognition, diagnosis, and resolution of issues caused by the disruption (Pavlov and Bourne, 2011).

SCDs are distinct from operational disruptions in that they lead to measurable loss by more than one party (Azadegan et al., 2019). When expertise from supply chain departments is embedded in BIA (Business Impact Analysis), identifying the extent of the potential impact of the disruptions is broadened to consider the damage to suppliers, to customers, and the company's relationship with these external constituents (Kildow, 2011). LOCF highlights how interactive controls help focus on managerial attention (Simons, 1994). Interactive controls encourage dialogue across departments, providing a framework for conference, and enhancing the accumulation of knowledge of expertise across the organization. Through frequent and regular interactions, departmental units can learn quickly that inadequately addressing the disruption can have important consequences. Such observations can lead to shared commitment and improved motivation in being involved in addressing the disruption. The richer and more informative knowledge offered by SCiBCM helps address deviations and correct the recovery path. In line with explanations about interactive controls, the coordinative role of supply chain management (Mentzer et al., 2001) suggests that SCiBCM can help guide and intensify risk management efforts in containing the operational damage caused by major SCDs (Pavlov and Bourne, 2011, Henri, 2006). Hypothesis 2 captures the above arguments:

> **Hypothesis 2.** *Supply chain involvement in BCM is positively related to operational damage containment of major SCDs.*

3.3 The moderating effects of supply chain vulnerability

Earlier, we defined supply chain vulnerability as the susceptibility and exposure of the company's supply system to disturbances that can lead to the obstruction of flows and to the breakdown of its operations (Jüttner and Maklan, 2011). Vulnerability is associated with uncertainty, which makes it difficult to identify risks or to prepare for the impact of disruptions (Svensson, 2000). As Flynn et al. (2016) note, firms can be surrounded by vague cues, and by a lack of understanding of the situation at hand. It follows that with a rise in vulnerability, the best approach to containing the damage from disruptions in the face of vulnerability is to somehow counterbalance the firm's susceptibility and weakened ability to prepare and respond through better identification of risks and through the strengthening of the firm's preparation and response capabilities (Svensson, 2004, Pettit et al., 2013).

Two particular tools in BCM help in counterbalancing the effects of vulnerability and thereby help contain the reputational damage of disruption. First, BCM includes a thorough assessment of organizational vulnerabilities. Business impact analysis (BIA) allows for better identification and awareness of the potentials of risks. BIA identifies what resources are needed to protect from damages and how quickly the firm can re-establish its critical activities (Kildow, 2011, Zsidisin et al., 2005). In turn, these allow for developing well-thought-out communication procedures a priori that clearly differentiate between decisions that are constructive and those that are potentially damaging to company reputation (Simons, 1994).

Second, as we noted earlier, detailed documentation, prioritization of activities, and consensus on a company's critical departments help focus organizational efforts and thereby strengthen the preparation and response efforts. Such understanding can help provide a more accurate and timely assessment of the progress in response and recovery efforts. In turn, the available information can help provide better communication with stakeholders.

In line with Simons' explanations on the effectiveness of diagnostic controls under uncertainty (Simons, 1994), with rising supply chain vulnerability, the need for accurate information rises. The tools noted above allow BCM to offer more accurate information about the situation at hand, which helps with effective communication with stakeholders. In short, whereas vulnerability makes it harder to prepare for and respond to potential disruptions, BCM can help lift the ambiguity associated with facing them (Wagner and Bode, 2006). Therefore:

> **Hypothesis 3a**. Supply chain vulnerability amplifies the effects of BCM on containing the reputational damage of major SCDs.

With rising vulnerability, it becomes more difficult to know what information is necessary, where to collect accurate information from or how to correctly interpret the observations (Schrader et al., 1993). These effects can be reduced through SCiBCM in several ways. First, SCiBCM can help with sharing knowledge and expertise, which can lead to better information transparency, and exchange of information across organizational departments that are involved in the response and recovery efforts. For instance, SCiBCM includes supply chain risk planning activities that include supplier monitoring and information exchange with suppliers (Wagner and Neshat, 2012).

Second, the boundary-spanning (i.e., inter-organizational) information insights offered by SCiBCM helps provide more clarity to develop a better analytical baseline and thus a better diagnosis of the issues caused by major SCDs. In other words, SCiBCM provides a clearer view of the challenges that supply chain vulnerability may cause, thereby limiting the effects of major SCDs.

These arguments fall in line with the depictions made by LOCF on the use of controls in uncertain settings. When used interactively by multiple departments in the organization, controls can serve as a catalyst for information about disruptions to become more widely used by a broad array of participants. Therefore:

> **Hypothesis 3b**. Supply chain vulnerability amplifies the effects of supply chain involvement in BCM on containing the operational damage of major SCDs.

4. Data collection and data analysis

This research focuses on questions that required collecting data about organizational capabilities (i.e., BCM and supply chain involvement) and performance (i.e., operational and reputational damage containment) when facing SCDs. We developed a questionnaire to help collect and analyze data from qualified managers about their companies. The questionnaire was developed with insight from academics and professionals in supply chain management and business continuity.

It was pilot tested in two steps. First, three highly experienced management professors in academic research were presented with the questionnaire to pretest the suitability and appropriateness of the survey questionnaire, which ensured that the survey content and measurement scales were clear, valid, and appropriate. Following this stage, a second pretest was carried out with 20 Swedish and Swiss managers, with debriefing sessions to elicit respondents' views. The managers were requested to detect any repetitive, unclear, ambiguous, or irrelevant items. This approach assured the face and construct validity of our questionnaire. Based on the results, some minor changes were made, mainly to the instructions to respondents in completing the questionnaire, and further information was included to ensure anonymity to respondents and encourage participation. At the end of the second phase of pretesting, the practitioners reported no concerns regarding the instructional content and wording, and the questionnaire was, therefore, ready for final administration.

4.1. Measures

Independent variables. To the extent possible, we used existing measures from prior studies. Given the novelty of empirical research in business continuity in general and as related to supply chain management in particular, some new measures were necessary. We measured BCM using five items in line with previous measurements proposed and used in business continuity literature (Kildow, 2011, Revilla and Saenz, 2014, Zsidisin et al., 2005). Our questions asked about the extent of consideration given to hazard assessment, the extent of consideration given to business impact analysis, how thoroughly the company's recovery plans are developed, how often plans are tested, and the extent of involvement by personnel and executives in BCM.

We measured SCiBCM using a four-item scale proposed by Kildow (2011; Appendix A). The questions asked about the extent of inclusion of supply chain management in BCM activities. Supply chain vulnerability is defined as the firm's susceptibility and exposure to potentially damaging events (Gualandris and Kalchschmidt, 2015, Cardona, 2004, Wagner and Bode, 2006). In line with this depiction, we measured supply chain vulnerability using a four-item construct that considers the factors and how they make the company susceptible to major man-made or natural SCDs.

Dependent variables. Our interest was in how well response and recovery efforts helped contain (i.e., limit) the damaging effects of a major disruption on operational and reputational performance. We label these as *operational containment* and *reputational containment*. As noted earlier, SCDs are different from operational ones because they cross-organizational boundaries by affecting multiple entities (Azadegan et al., 2019, Lukina et al., 2018). To make sure that respondents are attuned to our definition of major SCD, we offered a number of examples that explained the type of major SCDs experienced by a typical manufacturer. We measured *reputational containment*, by asking how the response and recovery efforts influenced the reputation, stature, popularity and public image damage of the disruption (Gatzert, 2015, Pallas and Svensson, 2016, Rose, 2004). To measure *operational containment,* we combined commonly applied dimensions used in measuring operational performance regarding on-time delivery, product quality, manufacturing cost, order fulfillment, and cash-to-cash cycle (e.g., Bode et al., 2011, Klassen and Whybark, 1999). Respondents were asked to evaluate the effect of response and recovery activities in reducing the effects of a major SCD. We focused on operational containment versus operational performance because it offers specificity versus generality and because performance can be affected by many factors.

We asked for operational containment as opposed to operational performance for several reasons. First, from a conceptual perspective, even large-scale disruptions may not affect the entire operations of a firm. Asking respondents to rate operational performance on aggregate would include how well other unaffected aspects of the business performed. This would not truly capture the essence of what we aimed for: how well the firm is able to manage/minimize the damage from the disruption. Second, the approach in measuring containment (i.e., limiting the effect of the disruption) has been applied to several recent studies in SCD management, arguably because of its ability to decipher the firm's efforts in addressing the disruption better (Bode et al., 2011, Azadegan et al., 2019, Lukina et al., 2017).

Specific to reputational damage containment, a similar line of argument can be offered. For instance, conglomerates with several brands may be affected by product contamination of a particular line of product, but not others. Asking for the reputational performance of the organization fails to capture the nuance associated with the particular disruption and the firm's effort to minimize the reputational damage. Firm size, firm age, frequency of small disruptions, and environmental dynamism, industry, and country were used as control variables. The comprehensive details and justification of our control variables are provided in Appendix section A-2.

4.2 Methodological checks on validation and bias

Table A-2 (Appendix) provides the descriptive statistics of constructs in the structural model. An array of methodological tests was conducted prior to running our analysis. These are detailed in sections A-3 and section A-4 of the Appendix. These include measurement invariance test (Section A-3), late and non-response bias (Section A-4.1) measure validation checks (Section A-4.2), Common Method bias check (Section A-4.3), and tests for normal distribution and multicollinearity (Section A-4.4).

Structural model fit. We assessed the model fit of our structural model through confirmatory factor analysis (CFA) before running a regression analysis. We used a chi-squared statistic (χ^2), comparative fit index (CFI), the goodness of fit index (GFI), Bentler-Bonett normed fit index (NFI), Tucker-Lewis index (TLI), root mean squared error approximation (RMSEA) and standardized root mean square residual (SRMR) to assess the measurement model fit. The CFA revealed χ^2 (629) = 1846.5; RMSEA = 0.042; SRMR = 0.03; CFI = 0.963; GFI = 0.977; TLI = 0.959. The model fit indices were above the recommended thresholds (Hu and Bentler, 1999), indicating the measures of our model variables were acceptable. Table 2 presents the descriptive statistics of our key variables.

--- Insert Table 2 About Here ---

4.3 Results

We tested our hypotheses in using stepwise hierarchical regression models shown in Table 3. Our main hypotheses were analyzed using StataIC 13.0, while robustness checks were performed in SPSS 22.0 and AMOS 22.0. Model 2 in Table 3a shows that BCM is positively and significantly related to *reputational containment* ($p < 0.01$, $\beta = 0.150$), supporting H1. Model 6 in Table 3a shows that *SCiBCM* is positively and significantly related to *operational containment* ($p < 0.01$, $\beta = 0.270$), supporting H2. Regarding the moderating effects of *supply chain vulnerability,* Model 4 in Table 3a shows that *supply chain vulnerability* significantly moderates the effects of *BCM* on r*eputational containment* ($p < 0.01$, $\beta = 0.170$). Figure 1 offers an overall depiction of the results. Figure 2a shows that the positive effect of BCM on *reputational containment* is amplified with higher levels of *supply chain vulnerability*. The statistical results and graphical depiction support H3a. Model 8 in Table 3a shows that *supply chain vulnerability* significantly moderates the effects of *SCiBCM* on *operational containment* ($p < 0.01$, $\beta = 0.135$). Graphical representation of this result in Figure 2b indicates that the positive effect of *SCiBCM* on *operational containment* is amplified with higher levels of *supply chain vulnerability*. The statistical results and graphical depiction support H3b. We performed additional tests to check for the endogeneity concerns in our key variables [1].

--- Insert Table 2 and Figures 1, 2(a-d) About Here ---

4.4 Post hoc analysis

[1] Details on the endogeneity tests using Durbin–Wu–Hausman can be found in the Appendix section A-5.

Our four hypotheses (H1, H2, H3a, H3b) were all supported. The fact that all three factors had significant effects on at least one dimension of damage containment led us to contemplate on whether BCM and SCiBCM, would have complementary effects on one another under high supply chain vulnerability settings. Theoretically, Simons suggests that diagnostic and interactive controls can be complementary because they can work simultaneously but in different ways to enhance performance (Simons, 1994). When combined, diagnostic controls can provide the structure for interactive controls to intensify attention and guide the organization's resources (Tuomela, 2005). To test the interaction effects of BCM and SCiBCM in high supply chain vulnerability settings, we conducted step-wise regression analysis on the 25 percentile of the sample with high supply chain vulnerability scores (112 out of a total of 448). The results are summarized in Table 3b. Results show that *SCiBCM* significantly moderates the effects of *BCM* on r*eputational containment* ($p < 0.05$, $\beta = 0.102$) as well as on *operational containment* ($p < 0.05$, $\beta = 0.112$) in Model 4 and Model 8 respectively. Graphical representation of these results in Figure 2c and Figure 2d provides further credence to these statistical findings. Thus, both statistical results and graphical interpretations support our post-hoc conjecture.

5. Discussion and conclusions

Research and practice need to know whether investing in risk management programs such as BCM offers any value. Whether companies should spend resources and managerial attention on developing and integrating their BCMs into enterprise-wide risk management programs has been the subject of much debate (e.g., Bailey, 2015, Duncan et al., 2011, Selden and Perks, 2007). The empirical results and theoretical arguments offered in this paper help in recognizing the potential value offered by BCM and by SCiBCM. These results and theoretical expectations also help in understanding the nuances associated with the benefits of BCM in facing SCDs. In other words, the results offer insights as to why implementing BCMs may prove to be more or less advantageous for some companies and in some situations.

Results support the argument that BCM helps limit the reputational damage from major SCDs (Hypothesis 1). This is our first interesting finding. Firms that emphasize the fundamental aspects of BCM (e.g., BIA, hazard assessment, and crisis response plan) can lower the damage on the stature and public image of their company. These results are in line with how the conceptual depictions in the literature explain the effects of BCM (e.g., Herbane et al., 2004, Hiles, 2010). The structured and rehearsed policies established through BCM ensure that the company is prepared in a way that can readily engage in protecting its reputation. Indeed, the volume of published books and guidelines on the matter would suggest that reputational containment is well embedded in how BCM is developed (c.f., Sellnow and Seeger, 2013, Fink, 2013).

Our second interesting finding is on the relationship between SCiBCM and operational damage containment (Hypothesis 2). Commonly reported benefits of internal integration are enhanced information sharing and improved use of company resources (Chen et al., 2009, Adams et al., 2014). By integrating the expertise and insights that activities in the supply chain business unit and departments engaged in the supply chain bring to the table, SCiBCM helps in preserving the operational capabilities of companies. Field reports from industry-based associations suggest that firms are recognizing the value provided by supply chain integration in risk management efforts (Burson and Mersteller, 2009). From 2009 through 2016, many have continually raised the emphasis on firm-wide engagement in their BCM activities (Business Continuity Institute, 2016).

A third interesting finding is on supporting results about the effects of BCM on reputational damage with rising supply chain vulnerability (H3a) and the effects of SCiBCM on operational damage with rising supply chain vulnerability settings (H3b). Companies operating in high supply chain vulnerability settings benefit more from both BCM and SCiBCM. More interestingly, when H1, H2, and H3a/b are considered in tandem, they offer a more clear picture of the effects of BCM and its integration with the supply chain activities of the firm. Combined, the two mechanisms (BCM and SCiBCM) help improve diverse dimensions of firm capabilities and therefore lead to a better outcome in terms of damage containment through response and recovery efforts. Moreover, the fact that rising supply chain vulnerability augments the effectiveness of both mechanisms highlights the significance of the presence of both firms to effectively address the ramifications of SCDs.

A fourth and final interesting finding is the complementary role played between BCM, and SCiBCM, for companies exposed to high supply chain vulnerability. Based on post-hoc analyses, SCiBCM positively moderates the effects of BCM on reputational containment. Theoretically, one shortcoming for diagnostic controls is that they can act as filters that homogenize information (Simons, 1994). Sole reliance on BCM procedures may hinder managerial attention on the particularities of the situation at hand. On the other hand, one shortcoming of interactive controls is the increased time and effort in decision-making. Debate and dialogue may surface unnecessary tensions and may require more time for decisions to be made. The diagnostic use of BCM enables managers to benchmark against targets and better determine how to leverage the involvement of the supply chain in limiting operational and reputational damage. This makes it easier to define the underlying concerns and helps groups define their boundaries and roles. BCM positively moderates the effects of SCiBCM on operational containment. These results offer confirmation of the suggested complementarity between controls, as suggested by Simons (Simons, 2000), which makes them an interesting finding. The combined use of diagnostic and integrative control systems is associated with improved decision making because their potential complementarities help compensate for the other's shortcomings (Bisbe and Otley, 2004). In other words, whereas feedback from BCM assures that decisions and actions are within company expectations, the feedforward from integrating the supply chain in BCM provides guidance and motivation to fine-tune actions, and adjust the recovery strategy (Pavlov and Bourne, 2011).

5.1 Implications: A summary

There are multiple interesting and important contributions from this work to the literature and to the field of practice. In terms of research implications, the study offers empirical and theoretical explanations on a concept less emphasized, but arguably valuable in risk and disruption management. Second, the study contributes to the literature in internal integration by diving deeper into explaining the particular effects of involvement. Third, it extends our understanding of the applicability and use of management controls by applying and testing a well-established management control theory (LOCF) in the supply chain and risk management fields. Finally, in terms of practical implications, the study offers evidence and explanations that can be of particular benefit to mangers. We explain these in more detail below.

5.2 Implications for the literature

The empirical and theoretical explanations offered in this study contribute to the scant empirical evidence about BCM, its integration, and its effect on disruption management (Zsidisin et al., 2005, Ojha et al., 2013, Prud'homme, 2008). Specifically, this study offers empirical evidence on how BCM helps minimize the reputational damage of SCDs. Whereas calls for (internal) integration of BCM have been prominently made, evidence of the usefulness of an integrated BCM is missing. Our study not only confirms the claims regarding the benefits of integrating BCM by studying the effects of SCiBCM, but it also offers supporting evidence on how BCM integration broadens the effects of BCM on different dimensions of damage containment.

Many believe that BCM is already integrative because information about different aspects of the business is to be shared (i.e., integrated) with the developers of BCM programs. However, what may be missing from this approach to integration is the involvement of such departments. This is one contribution of our study – to help differentiate that information sharing alone (albeit a form of integration) may not be enough to offer the full benefits that BCM can offer. Rather by involving other departments (the supply chain department in this study), the firm can tap into the richer and more valuable aspects of integration.

This paper offers an important contribution to the literature on internal integration, a generally neglected the topic (Flynn et al., 2010, Wieland et al., 2016). While ample studies have shown the benefits of internal integration in the new product development, others suggest that the relationship between internal integration and performance can be complicated (Zhao et al., 2015). By focusing on involvement as a particular form of integration, this paper shows that not only can SCiBCM be an effective means to limit operational damage, but that the effect is amplified for firms that are faced with high supply chain vulnerability.

A small stream of literature relates control systems to supply management activities (Gunasekaran and Kobu, 2007, Pernot and Roodhooft, 2014). For instance, Cantor et al. (2014) highlight risk mitigation activities as one type of management control that can enable the firm to become more responsive to customer demand. Svensson labels this broader consideration of risks as a "holistic vulnerability approach" or the ability to consider a system-wide view of the disruption (Svensson, 2000). The fourth contribution of the paper is in extending the use of Simons' LOCF to risk management by exploring the effects of BCM.

5.3 Implications for the field of practice

From a practical standpoint, we offer evidence and explanation on when pursuing an integrated BCM is a valuable undertaking. Business continuity is receiving increased "board-level" attention because of increased geopolitical, socio-political, and socio-economic risks across the globe. However, many are reluctant to invest time and resources on initiatives that are not only complex but also unproven. Our findings suggest that all things considered, a narrow view of risk and response in BCM may not be enough to ensure readiness against SCDs. Rather, investing in internal integration in risk management can offer companies the ability to recover from SCDs with less damage. Moreover, such investments should be made on activities aimed at mitigation and response to disruptions. Businesses that are competing in the complex (e.g., automotive), rapidly changing (e.g., electronics), and knowledge-intensive (e.g., pharmaceutical) contexts are likely to be exposed to supply chain vulnerability. For them, BCM is a more justified investment.

6. Limitations and future research

The results shared here should be viewed alongside their potential limitations. First, we focused on reputational and operational damage caused by major SCDs. SCDs can affect other dimensions of firm performance, such as profitability, market share, innovation, and staff loyalty. Expanding the dimensions of performance affected by disruptions can be of value in better understanding their effect and the mitigation role played by an integrated BCM that involves other activities such as supply chain business unit.

We focused on SCiBCM as a unique form of internal integration. Another organizational activity that is often integrated with the supply chain is information technology. Future studies may consider researching the effects of internal integration between the supply chain management business unit and information technology activities of the organization in addressing SCDs. How these two integrate with BCM may also be potential for future research. Second, internal integration literature suggests that integration is less effective at the organizational rather than at the team level. A multi-level examination of how internal integration affects the firm’s ability to respond could provide significant insights into how integration can most positively affect damage containment.

References

Adams, F. G., Richey, R. G., Autry, C. W., Morgan, T. R. & Gabler, C. B. (2014), "Supply chain collaboration, integration, and relational technology: How complex operant resources increase performance outcomes". *Journal of Business Logistics,* Vol. 35 No. 4, pp. 299-317.

Asbjørnslett, B. E. (2009). "Assessing the vulnerability of supply chains", *Supply chain risk.* Springer.

Azadegan, A., Mellat Parast, M., Lucianetti, L., Nishant, R. & Blackhurst, J. (2019), "Supply Chain Disruptions and Business Continuity: An Empirical Assessment". *Decision Sciences,* Vol. 51 No. 1, pp. 38-73.

Bailey, D. (2015), "Business continuity management into operational risk management: Assimilation is imminent... resistance is futile!". *Journal of Business Continuity & Emergency Planning,* Vol. 8 No. 4, pp. 290-294.
Beldad, A. D., Van Laar, E. & Hegner, S. M. (2018), "Should the shady steal thunder? The effects of crisis communication timing, pre-crisis reputation valence, and crisis type on post-crisis organizational trust and purchase intention". *Journal of Contingencies and Crisis Management,* Vol. 26 No. 1, pp. 150-163.
Benoit, W. L. (1995). *Accounts, Excuses, and Apologies: A Theory of Image Restoration Strategies, Suny Series in Speech Communication,* Albany, NY, State University of New York Press.
Bisbe, J. & Otley, D. (2004), "The effects of the interactive use of management control systems on product innovation". *Accounting, Organizations and Society,* Vol. 29 No. 8, pp. 709-737.
Blades, A. (2017), "Organisational resilience: What does it mean?". *Governance Directions,* Vol. 69 No. 11, pp. 669-671.
Blos, M. F., Quaddus, M., Wee, H. M. & Watanabe, K. (2009), "Supply chain risk management (SCRM): A case study on the automotive and electronic industries in Brazil". *Supply Chain Management: An International Journal,* Vol. 14 No. 4, pp. 247-252.
Blos, M. F., Wee, H. M. & Yang, W. H. (2012). "Supply chain risk management: Resilience and business continuity", in*:* Lu, J., Jain, L. C. & Zhang:, G. (eds.) *Handbook on Decision Making.* Berlin Heidelberg: Springer-Verlag
Bode, C., Wagner, S. M., Petersen, K. J. & Ellram, L. M. (2011), "Understanding responses to supply chain disruptions: Insights from information processing and resource dependence perspectives". *Academy of Management Journal,* Vol. 54 No. 4, pp. 833-856.
Brandon-Jones, E., Squire, B., Autry, C. W. & Petersen, K. J. (2014), "A contingent resource-based perspective of supply chain resilience and robustness". *Journal of Supply Chain Management,* Vol. 50 No. 3, pp. 55-73.
Bühler, A., Wallenburg, C. M. & Wieland, A. (2016), "Accounting for external turbulence of logistics organizations via performance measurement systems". *Supply Chain Management: An International Journal,* Vol. 21 No. 6, pp. 694-708.
Burson, H. & Mersteller, W. (2009). *Crisis Preparedness and ROI,* New York, NY, Penn Schoen and Berland Associates.
Burtles, J. (2015). *Principles and Practice of Business Continuity: Tools and Techniques,* Brookfield, CT, Rothstein Publishing.
Business Continuity Institute (2016). *Supply Chain Resilience Report,* Caversham, UK.
Butler, C. (2018), "Five steps to organisational resilience: Being adaptive and flexible during both normal operations and times of disruption". *Journal of Business Continuity & Emergency Planning,* Vol. 12 No. 2, pp. 103-112.
Cantor, D. E., Blackhurst, J., Pan, M. & Crum, M. (2014), "Examining the role of stakeholder pressure and knowledge management on supply chain risk and demand responsiveness". *The International Journal of Logistics Management,* Vol. 25 No. 1, pp. 202-223.
Cardona, O. D. (2004). "The need for rethinking the concepts of vulnerability and risk from a holistic perspective: A necessary review and criticism for effective risk management", in*:* Bankoff, G., Frerks, G. & Hilhorst, D. (eds.) *Mapping Vulnerability Disasters, Development and People.* London: Earthscan.
Chang, C.-T., Chou, Y.-Y. & Zhuang, Z.-Y. (2015), "A practical expected-value-approach model to assess the relevant procurement costs". *Journal of the Operational Research Society,* Vol. 66 No. 4, pp. 539-553.
Chen, H., Daugherty, P. J. & Landry, T. D. (2009), "Supply chain process integration: A theoretical framework". *Journal of Business Logistics,* Vol. 30 No. 2, pp. 27-46.
Daft, R. L., Sormunen, J. & Parks, D. (1988), "Chief executive scanning, environmental characteristics, and company performance: An empirical study". *Strategic management journal,* Vol. 9 No. 2, pp. 123-139.
Duncan, W. J., Yeager, V. A., Rucks, A. C. & Ginter, P. M. (2011), "Surviving organizational disasters". *Business Horizons,* Vol. 54 No. 2, pp. 135-142.

Elliott, D., Swartz, E. & Herbane, B. (2010). *Business Continuity Management: A Crisis Management Approach,* New York, NY, Routledge.
Engemann, K. J. & Henderson, D. M. (2011). *Business Continuity and Risk Management: Essentials of Organizational Resilience,* Brookefield, CT, Rothstein Associates, Inc.
Estall, H. (2012). *Business continuity management systems: Implementation and certification to ISO 22301*, BCS, The Chartered Institute.
Feng, T. W. & Wang, D. (2013), "Supply chain involvement for better product development performance". *Industrial Management & Data Systems,* Vol. 113 No. 1-2, pp. 190-206.
Ferguson, C. S. (2019), "Assessing the KING IV Corporate Governance Report in relation to business continuity and resilience". *Journal of Business Continuity & Emergency Planning,* Vol. 13 No. 2, pp. 174-185.
Fink, S. (2013). *Crisis communications: The definitive guide to managing the message,* New York, McGraw Hill Professional.
Flynn, B. B., Huo, B. & Zhao, X. (2010), "The impact of supply chain integration on performance: A contingency and configuration approach". *Journal of Operations Management,* Vol. 28 No. 1, pp. 58-71.
Flynn, B. B., Koufteros, X. & Lu, G. (2016), "On theory in supply chain uncertainty and its implications for supply chain integration". *Journal of Supply Chain Management,* Vol. 52 No. 3, pp. 3-27.
Gatzert, N. (2015), "The impact of corporate reputation and reputation damaging events on financial performance: Empirical evidence from the literature". *European Management Journal,* Vol. 33 No. 6, pp. 485-499.
Gjerdrum, D. & Peter, M. (2011), "The new international standard on the practice of risk management–A comparison of ISO 31000: 2009 and the COSO ERM framework". *Risk management,* Vol. 31 No. 21, pp. 8-12.
Gosling, M. & Hiles, A. 2009. *Business continuity statistics: Where myth meets fact* [Online]. Continuity Central. Available: http://www.continuitycentral.com/feature0660.html [Accessed August 19, 2018].
Greyser, S. A. (2009), "Corporate brand reputation and brand crisis management". *Management Decision,* Vol. 47 No. 4, pp. 590-602.
Gualandris, J. & Kalchschmidt, M. (2014), "A model to evaluate upstream vulnerability". *International Journal of Logistics-Research and Applications,* Vol. 17 No. 3, pp. 249-268.
Gualandris, J. & Kalchschmidt, M. (2015), "Supply risk management and competitive advantage: A misfit model". *International Journal of Logistics Management,* Vol. 26 No. 3, pp. 459-478.
Gunasekaran, A. & Kobu, B. (2007), "Performance measures and metrics in logistics and supply chain management: A review of recent literature (1995–2004) for research and applications". *International Journal of Production Research,* Vol. 45 No. 12, pp. 2819-2840.
Gupta, A. K., Raj, S. & Wilemon, D. (1985a), "The R&D-marketing interface in high-technology firms". *Journal of Product Innovation Management,* Vol. 2 No. 1, pp. 12-24.
Gupta, A. K., Raj, S. & Wilemon, D. L. (1985b), "R & D and marketing dialogue in high-tech firms". *Industrial Marketing Management,* Vol. 14 No. 4, pp. 289-300.
Henri, J.-F. (2006), "Management control systems and strategy: A resource-based perspective". *Accounting, Organizations and Society,* Vol. 31 No. 6, pp. 529-558.
Herbane, B. (2010), "The evolution of business continuity management: A historical review of practices and drivers". *Business History,* Vol. 52 No. 6, pp. 978-1002.
Herbane, B., Elliott, D. & Swartz, E. M. (2004), "Business continuity management: Time for a strategic role?". *Long Range Planning,* Vol. 37 No. 5, pp. 435-457.
Hiles, A. (2010). *The Definitive Handbook of Business Continuity Management,* New York, John Wiley & Sons.
Ho, W., Zheng, T., Yildiz, H. & Talluri, S. (2015), "Supply chain risk management: a literature review". *International Journal of Production Research,* Vol. 53 No. 16, pp. 5031-5069.
Homburg, C. & Kuehnl, C. (2014), "Is the more always better? A comparative study of internal and external integration practices in new product and new service development". *Journal of Business Research,* Vol. 67 No. 7, pp. 1360-1367.

Hu, L. T. & Bentler, P. M. (1999), "Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives". *Structural Equation Modeling: A Multidisciplinary Journal,* Vol. 6 No. 1, pp. 1-55.
Huo, B. (2012), "The impact of supply chain integration on company performance: an organizational capability perspective". *Supply Chain Management: An International Journal,* Vol. 17 No. 6, pp. 596-610.
Jüttner, U. & Maklan, S. (2011), "Supply chain resilience in the global financial crisis: an empirical study". *Supply Chain Management-An International Journal,* Vol. 16 No. 4, pp. 246-259.
Kildow, B. A. (2011). *A Supply Chain Management Guide to Business Continuity,* New York, NY, AMACOM.
Kim, H. J. & Cameron, G. T. (2011), "Emotions matter in crisis: The role of anger and sadness in the publics' response to crisis news framing and corporate crisis response". *Communication Research,* Vol. 38 No. 6, pp. 826-855.
Klassen, R. D. & Whybark, D. C. (1999), "The impact of environmental technologies on manufacturing performance". *Academy of Management Journal,* Vol. 42 No. 6, pp. 599-615.
Lindgreen, A., Swaen, V., Maon, F., Eltantawy, R. A., Fox, G. L. & Giunipero, L. (2009), "Supply management ethical responsibility: reputation and performance impacts". *Supply Chain Management: An International Journal,* Vol. No., pp.
Lindstedt, D. (2007), "Grounding the discipline of business continuity planning: What needs to be done to take it forward?". *Journal of Business Continuity & Emergency Planning,* Vol. 2 No. 2, pp. 197-205.
Lukina, I., Azadegan, A. & Davis, D. After the Triggering Event: A Phasic Perspective on Leadership during Supply Chain Disruptions. Academy of Management Proceedings, 2018. Academy of Management Briarcliff Manor, NY 10510, pp. 18140.
Lukina, I., Azadegan, A. & Hooker, R. Leadership in the face of major supply chain disruptions: baseline and contextual traits. Academy of Management Proceedings, 2017. Academy of Management Briarcliff Manor, NY 10510, pp. 15644.
Manuj, I. & Mentzer, J. T. (2008), "Global supply chain risk management". *Journal of Business Logistics,* Vol. 29 No. 1, pp. 133-155.
Marconi, J. (1997). *Crisis marketing: When bad things happen to good companies*, NTC Business Books.
Mentzer, J. T., Dewitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D. & Zacharia, Z. G. (2001), "Defining supply chain management". *Journal of Business Logistics,* Vol. 22 No. 2, pp. 1-25.
Najmi, A. & Khan, A. A. (2017), "Does supply chain involvement improve the new product development performance? A partial least square-structural equation modelling approach". *International Journal of Advanced Operations Management,* Vol. 9 No. 2, pp. 122-141.
Norrman, A. & Jansson, U. (2004), "Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident". *International Journal of Physical Distribution & Logistics Management,* Vol. 34 No. 5, pp. 434-456.
Ojha, D., Gianiodis, P. T. & Manuj, I. (2013), "Impact of logistical business continuity planning on operational capabilities and financial performance". *International Journal of Logistics Management,* Vol. 24 No. 2, pp. 180-209.
Pallas, J. & Svensson, E. (2016), "Typical tools for assessment of communicative performance". *Corporate Reputation Review,* Vol. 19 No. 1, pp. 47-58.
Pavlov, A. & Bourne, M. (2011), "Explaining the effects of performance measurement on performance: An organizational routines perspective". *International Journal of Operations & Production Management,* Vol. 31 No. 1, pp. 101-122.
Pernot, E. & Roodhooft, F. (2014), "The impact of inter-organizational management control systems on performance: A retrospective case study of an automotive supplier relationship". *International Journal of Production Economics,* Vol. 158 No., pp. 156-170.
Petersen, H. L. & Lemke, F. (2015), "Mitigating reputational risks in supply chains". *Supply Chain Management: An International Journal,* Vol. 20 No. 5, pp. 495-510.
Pettit, T. J., Croxton, K. L. & Fiksel, J. (2013), "Ensuring supply chain resilience: Development and implementation of an assessment tool". *Journal of Business Logistics,* Vol. 34 No. 1, pp. 46-76.

Pich, M. T., Loch, C. H. & Meyer, A. D. (2002), "On uncertainty, ambiguity, and complexity in project management". *Management Science,* Vol. 48 No. 8, pp. 1008-1023.
Ponomarov, S. Y. & Holcomb, M. C. (2009), "Understanding the concept of supply chain resilience". *International Journal of Logistics Management,* Vol. 20 No. 1, pp. 124-143.
Prud'homme, A. M. 2008. *Business continuity in the supply chain: Planning for disruptive events.* Michigan State University.
Purdy, G. (2010), "ISO 31000: 2009—setting a new standard for risk management". *Risk Analysis: An International Journal,* Vol. 30 No. 6, pp. 881-886.
Revilla, E. & Saenz, M. J. (2014), "Supply chain disruption management: Global convergence vs national specificity". *Journal of Business Research,* Vol. 67 No. 6, pp. 1123-1135.
Riley, J. M., Klein, R., Miller, J. & Sridharan, V. (2016), "How internal integration, information sharing, and training affect supply chain risk management capabilities". *International Journal of Physical Distribution & Logistics Management,* Vol. 46 No. 10, pp. 953-980.
Rose, A. (2004), "Defining and measuring economic resilience to disasters". *Disaster Prevention and Management,* Vol. 13 No. 4, pp. 307-314.
Schoenherr, T. & Swink, M. (2015), "The roles of supply chain intelligence and adaptability in new product launch success". *Decision Sciences,* Vol. 46 No. 5, pp. 901-936.
Schrader, S., Riggs, W. M. & Smith, R. P. (1993), "Choice over uncertainty and ambiguity in technical problem solving". *Journal of Engineering and Technology Management,* Vol. 10 No. 1-2, pp. 73-99.
Selden, S. & Perks, S. (2007), "How a structured BIA aligned business continuity management with Gallaher's strategic objectives". *Journal of Business Continuity & Emergency Planning,* Vol. 1 No. 4, pp. 348-355.
Sellnow, T. L. & Seeger, M. W. (2013). *Theorizing crisis communication,* New York, John Wiley & Sons.
Simons, R. (1987), "Planning, control, and uncertainty: a process view". Vol. No., pp.
Simons, R. (1994). *Levers of Control: How Managers Use Innovative Control Systems To Drive Strategic Renewal,* Cambridge, MA, Harvard Business Press.
Simons, R. (1995), "Control in an age of empowerment". *Harvard Business Review,* Vol. 73 No. 2, pp. 80-88.
Simons, R. (2000). *Performance Measurement and Control Systems for Implementing Strategy,* Upper Saddle River, NJ, Pearson Higher Ed.
Sodhi, M. S., Son, B. G. & Tang, C. S. (2012), "Researchers' perspectives on supply chain risk management". *Production and Operations Management Journal,* Vol. 21 No. 1, pp. 1-13.
Song, X. M. & Parry, M. E. (1992), "The R&D–marketing interface in Japanese high-technology firms". *Journal of Product Innovation Management,* Vol. 9 No. 2, pp. 91-112.
Song, X. M. & Parry, M. E. (1993), "R&D-marketing integration in Japanese high-technology firms: Hypotheses and empirical evidence". *Journal of the academy of Marketing Science,* Vol. 21 No. 2, pp. 125-133.
Svata, V. (2013), "System view of business continuity management". *Journal of Systems Integration,* Vol. 4 No. 2, pp. 19-35.
Svensson, G. (2000), "A conceptual framework for the analysis of vulnerability in supply chains". *International Journal of Physical Distribution & Logistics Management,* Vol. 30 No. 9, pp. 731-750.
Svensson, G. (2004), "Key areas, causes and contingency planning of corporate vulnerability in supply chains: A qualitative approach". *International Journal of Physical Distribution & Logistics Management,* Vol. 34 No. 9, pp. 728-748.
Swink, M. & Schoenherr, T. (2015), "The effects of cross-functional integration on profitability, process efficiency, and asset productivity". *Journal of Business Logistics,* Vol. 36 No. 1, pp. 69-87.
Tang, C. (2006), "Robust strategies for mitigating supply chain disruptions". *International Journal of Logistics,* Vol. 9 No. 1, pp. 33-45.
Tukamuhabwa, B. R., Stevenson, M., Busby, J. & Zorzini, M. (2015), "Supply chain resilience: definition, review and theoretical foundations for further study". *International Journal of Production Research,* Vol. 53 No. 18, pp. 5592-5623.

Tummala, R. & Schoenherr, T. (2011), "Assessing and managing risks using the supply chain risk management process (SCRMP)". *Supply Chain Management: An International Journal,* Vol. 16 No. 6, pp. 474-483.
Tuomela, T.-S. (2005), "The interplay of different levers of control: A case study of introducing a new performance measurement system". *Management Accounting Research,* Vol. 16 No. 3, pp. 293-320.
Turkulainen, V. & Ketokivi, M. (2012), "Cross-functional integration and performance: What are the real benefits?". *International Journal of Operations & Production Management,* Vol. 32 No. 4, pp. 447-467.
Ulmer, R. R., Sellnow, T. L. & Seeger, M. W. (2017). *Effective Crisis Communication: Moving From Crisis To Opportunity,* Thousand Oaks, Sage Publications.
Wagner, S. M. & Bode, C. (2006), "An empirical investigation into supply chain vulnerability". *Journal of Purchasing and Supply Management,* Vol. 12 No. 6, pp. 301-312.
Wagner, S. M. & Bode, C. (2009). "Dominant risks and risk management practices in supply chains", in*:* Zsidisin, G. A. & Ritchie, B. (eds.) *Supply Chain Risk: A Handbook of Assessment, Management, and Performance.* New York: Springer Link.
Wagner, S. M. & Neshat, N. (2012), "A comparison of supply chain vulnerability indices for different categories of firms". *International Journal of Production Research,* Vol. 50 No. 11, pp. 2877-2891.
Watters, J. & Watters, J. (2014). *Disaster Recovery, Crisis Response, and Business Continuity: A Management Desk Reference*, Apress.
Wieland, A., Handfield, R. B. & Durach, C. F. (2016), "Mapping the landscape of future research themes in supply chain management". *Journal of Business Logistics,* Vol. 37 No. 3, pp. 205-212.
Wieland, A. & Wallenburg, C. M. (2013), "The influence of relational competencies on supply chain resilience: A relational view". *International Journal of Physical Distribution & Logistics Management,* Vol. 43 No. 4, pp. 300-320.
Wong, C. Y., Boon-Itt, S. & Wong, C. W. (2011), "The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance". *Journal of Operations management,* Vol. 29 No. 6, pp. 604-615.
Wong, W. N. Z. & Shi, J. (2014). *Business Continuity Management System: A Complete Guide to Implementing ISO 22301*, Kogan Page Publishers.
Ye, Y., Huo, B., Zhang, M., Wang, B. & Zhao, X. (2018), "The impact of modular designs on new product development outcomes: the moderating effect of supply chain involvement". *Supply Chain Management: An International Journal,* Vol. No., pp.
Zawada, B. (2014), "The practical application of ISO 22301". *Journal of Business Continuity & Emergency Planning,* Vol. 8 No. 1, pp. 83-90.
Zhao, G., Feng, T. & Wang, D. (2015), "Is more supply chain integration always beneficial to financial performance?". *Industrial Marketing Management,* Vol. 45 No. Feb, pp. 162-172.
Zsidisin, G. A., Hartley, J. L., Bernardes, E. S. & Saunders, L. W. (2015), "Examining supply market scanning and internal communication climate as facilitators of supply chain integration". *Supply Chain Management: An International Journal,* Vol. 20 No. 5, pp. 549-560.
Zsidisin, G. A., Melnyk, S. A. & Ragatz, G. L. (2005), "An institutional theory perspective of business continuity planning for purchasing and supply management". *International Journal of Production Research,* Vol. 43 No. 16, pp. 3401-3420.

Table 1. Definitions

Construct	Definition	Sources
Supply Chain Business Unit	The combination of functions directly involved in sourcing, making, storing, and delivery processes of company products.	Comelli et al. (2008) Fenies et al. (2012) Mustafee et al. (2012)
Supply Chain Management	The systemic, strategic coordination of traditional business functions and tactics across these business functions within a particular company and across businesses within the supply chain to improve the long-term performance of individual companies and the supply chain as a whole.	Mentzer et al. (2001)
Business Continuity Management (BCM)	A holistic management program for identifying risks that could impact continued operations, and providing a structure for developing capabilities in effective mitigation and response to disruptions	Engemann et al. (2011) Waters (2011) Norrman et al. (2004)
Supply chain involvement in BCM	The extent of inclusion and representation of business functions engaged in supply chain management, such as the supply chain business unit and traditional business functions, in BCM	Kildow (2011) Mentzer et al. (2001)
Supply Chain Vulnerability	Susceptibility and exposure of the supply chain business unit to potentially damaging events.	Cardona (2004) Wagner et al. (2006) Gualandris et al. (2015)
Major Supply Chain Disruption (SCD)	Disruptions that, despite their relatively low probability, create ambiguous and unfamiliar situations that exert high damage on the company.	Talluri et al. (2013) Tomlin (2006)
Operational Performance	The company's ability to accomplish its objectives in terms of cost, quality, speed, and flexibility of operations.	Klassen et al. (1999) Narasimhan et al. (2001)
Corporate Reputation	Perceived image, status, and popularity of the organization among its internal and external stakeholders.	Gray et al. (1998) Rindova et al. (2005) Bitektine (2011)
Operational Containment of SCD	The ability of the company's response and recovery efforts to reduce the diminishing effects of major supply chain disruptions on its operational performance.	Bode et al. (2011)
Reputational Containment of SCD	The ability of the company's response and recovery efforts to reduce diminishing effects of major supply chain disruption on its corporate reputation.	Gray et al. (1998) Rindova et al. (2005) Bitektine (2011)

Table 2. Results - Effect of Business Continuity and related factors on reputational containment and operational damage containment

	Reputational containment				Operational containment			
Variables/Models	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Business Continuity Management (BCM)		0.150**	0.147**	0.234**				
Supply chain involvement in BCM (SCiBCM)						0.270**	0.272**	0.246**
Supply chain vulnerability (SCV)			0.145**	0.145**			-0.016	0.009
BCM x SCV				0.170**				
SCiBCM x SCV								0.135**
Controls								
Small disruption frequency	-0.041	-0.105	-0.084	-0.013	0.027	0.042	0.042	0.024
Environmental dynamism	0.181	0.180	0.179	0.178	0.069	0.068	0.068	0.077
Firm age	0.111*	0.129*	0.125*	0.119*	0.273**	0.211**	0.211**	0.229**
Firm size	0.052	0.052	0.051	0.051	-0.033	-0.029	-0.029	-0.028
Industry 1	0.003	0.004	0.001	0.003	0.279	0.208	0.207	0.165
Industry 2	0.023	0.022	0.022	0.022	0.057	0.029	0.029	0.056
Industry 3	0.097	0.100	0.077	0.082	-0.101	-0.076	-0.076	-0.086
Country 1	0.071	0.070	0.070	0.069	0.064	0.082	0.082	0.076
Country 2	0.022	-0.010	-0.094	-0.143	-0.174	-0.091	-0.091	-0.106
Constant	-0.675	-0.611	-0.551	-0.554	-1.196**	-1.061**	-1.060**	-1.107**
Observations	448	448	448	448	448	448	448	448
R-squared	0.020	0.039	0.057	0.085	0.056	0.113	0.114	0.131
Adjusted R-square	0.011	0.031	0.049	0.074	0.043	0.107	0.108	0.124

** $p<0.01$, * $p<0.05$

Table 2 (Continued) - Results Post-hoc Analysis

Interaction effects of Business Continuity Management and Supply chain involvement in BCM under high supply chain vulnerability settings

	Reputational containment				Operational containment			
Variables/Models	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Business Continuity Management (BCM)		0.453**		0.577**			0.073	0.001
Supply chain involvement in BCM (SCiBCM)			0.047	0.019		0.315**		0.444**
BCM x SCiBCM				0.102*				0.112*
Controls								
Small disruption frequency	-0.089	-0.198*	-0.096	-0.154	-0.102	-0.144	-0.119	-0.0533
Environmental Dynamism	0.244*	0.283*	0.243*	0.271*	0.390**	0.384**	0.396**	0.347**
Firm age	-0.065	-0.044	-0.063	-0.045	-0.024	-0.013	-0.020	-0.019
Firm sales	-0.031	-0.063	-0.055	-0.033	0.386*	0.226	0.381*	0.200
Industry 1	-0.320	-0.415	-0.366	-0.404	0.979*	0.668*	0.963*	0.560
Industry 2	-0.215	-0.282	-0.232	-0.258	0.395	0.279	0.384	0.284
Industry 3	-0.344	-0.177	-0.371	-0.131	0.259	0.081	0.286	-0.011
Country 1	0.544*	0.400	0.56**	0.378	-0.143	-0.005	-0.166	0.093
Country 2	0.669*	0.533*	0.688*	0.536*	-0.131	-0.001	-0.153	0.129
Constant	-0.418	0.032	-0.308	-0.221	-2.332*	-1.598	-2.259*	-1.783
R-squared	0.180	0.323	0.183	0.343	0.125	0.238	0.128	0.264
Adjusted R-square	0.169	0.316	0.177	0.338	0.113	0.231	0.119	0.257
Observations	112	112	112	112	112	112	112	112

Note: ** $p<0.01$, * $p<0.05$

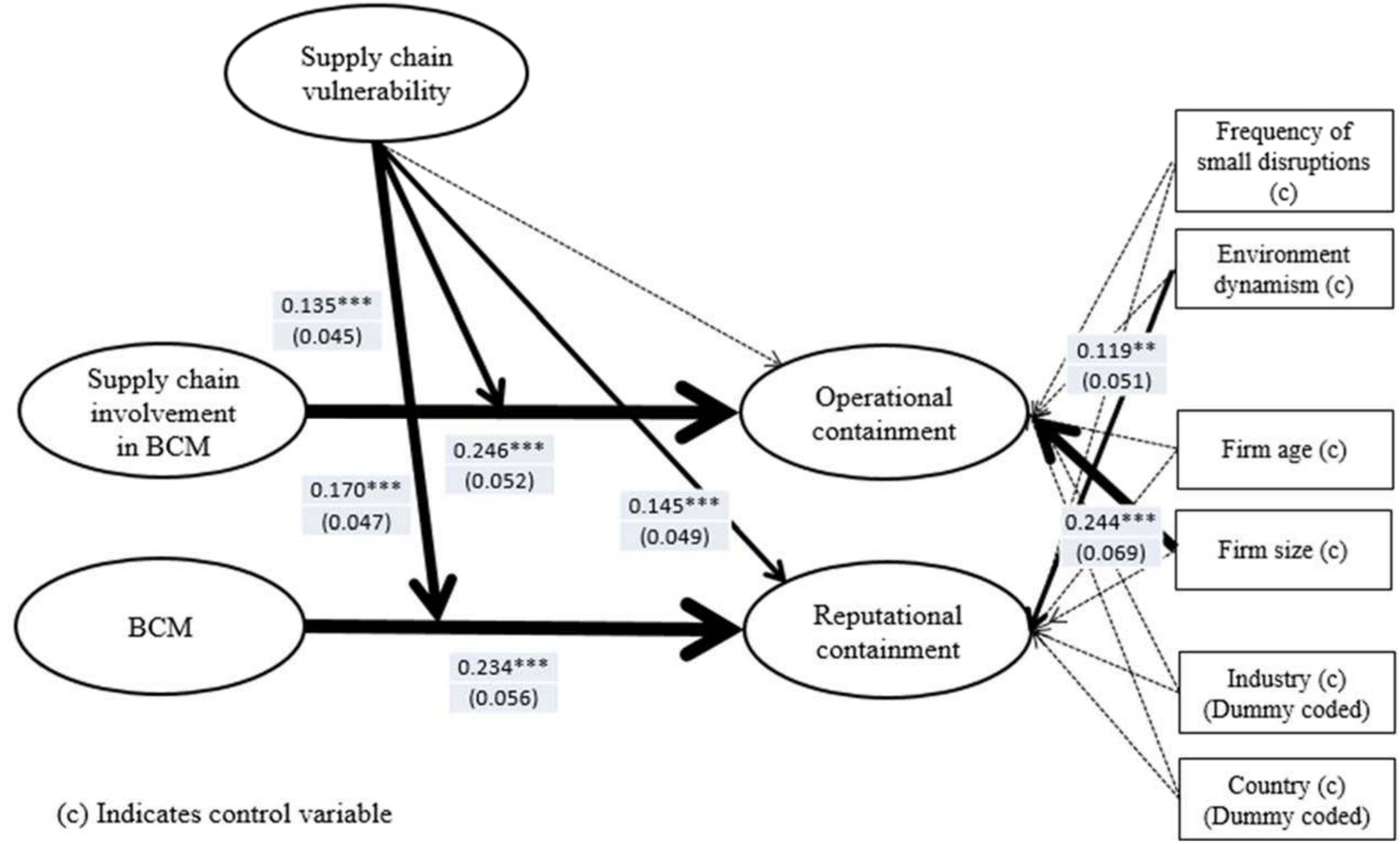
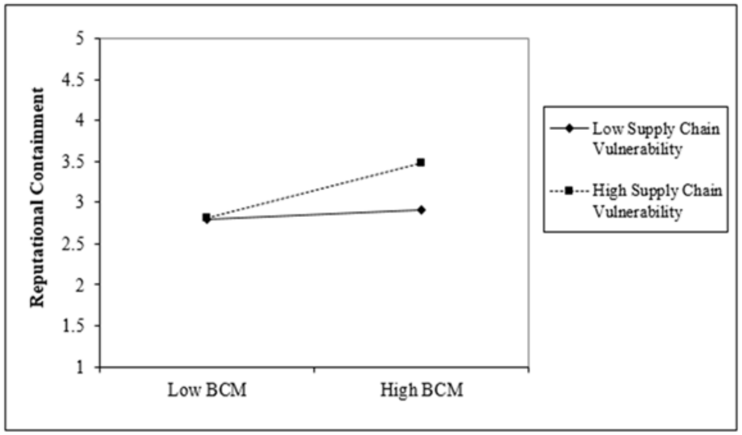


Figure 1 – Visual representation of conceptual model with analysis results



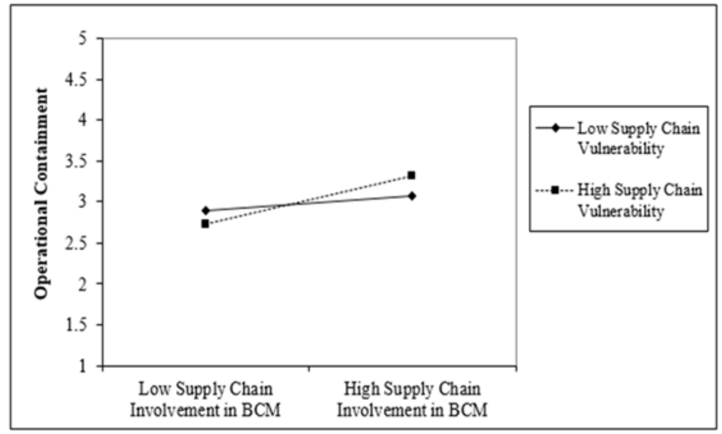
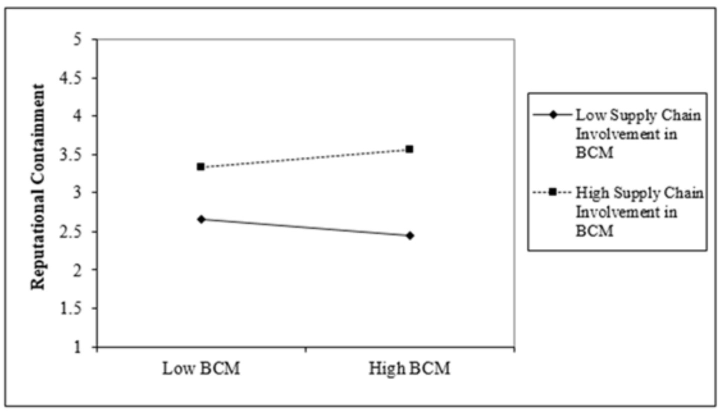


Figure 2a – Moderating effects of supply chain vulnerability on the association between BCM and reputational containment [H3a]

Figure 2b – Moderating effects of supply chain vulnerability on the association between supply chain involvement in BCM and operational containment [H3a]



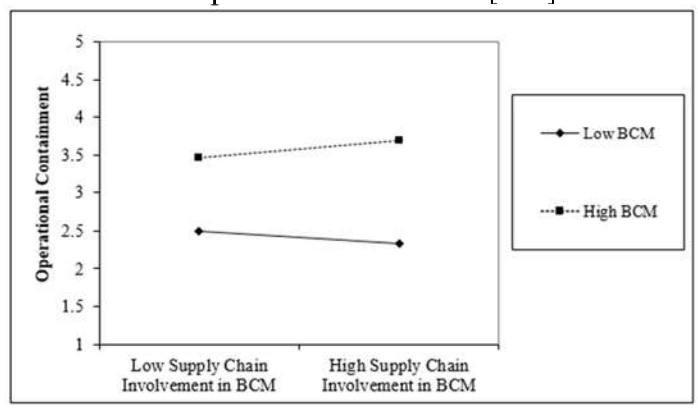


Figure 2c – Interaction effects of BCM and supply chain involvement in BCM on reputational containment in high supply chain vulnerability settings [Post-Hoc]

Figure 2d – Interaction effects of supply chain involvement in BCM and BCM on operational containment in high supply chain vulnerability settings [Post-Hoc]

Supply Chain Involvement in Business Continuity Management: Effects on Reputational and Operational Damage Containment from Supply Chain Disruptions

Appendix

A-1. Survey development, pilot testing and sampling frame

The questionnaire was developed with insight from academics and professionals in supply chain management and business continuity. It was pilot tested in two steps. First, three highly experienced management professors in academic research were presented with the questionnaire to pretest the suitability and appropriateness of the survey questionnaire, which ensured that the survey content and measurement scales were clear, valid, and appropriate. Following this stage, a second pretest was carried out with 20 Swedish and Swiss managers, with debriefing sessions to elicit respondents' views. The managers were requested to detect any repetitive, unclear, ambiguous, or irrelevant items. This approach assured the face and construct validity of our questionnaire. Based on the results, some minor changes were made, mainly to the instructions to respondents in completing the questionnaire, and further information was included to ensure anonymity to respondents and encourage participation. At the end of the second phase of pretesting, the practitioners reported no concerns regarding the instructional content and wording, and the questionnaire was, therefore, ready for final administration.

This research study focused on questions that required collecting information about organizational capabilities (i.e., BCM) and performance (i.e., operational and reputational damage containment) in facing supply chain disruptions. Our sample population was limited to manufacturing firms (NAICS 32 and 33) from three European countries with established industrial bases (Germany, Sweden, and Switzerland). To our knowledge, there are no publicly available data sets that collect such information. The same procedure was employed in each country. These countries were selected because all of them enjoy high GDP through high net exports (exports-imports) wherein they have a good performance in trade, high FDI (foreign direct investment) from private firms outside the country, high consumption (their citizens are able to spend and acquire goods), and high government spending either for technological advancement, labor development, and infrastructure (OECD, 2012) during the last decade. We developed a questionnaire to help collect and analyze data from qualified managers in manufacturing firms.

The questionnaire was developed with insight from academic experts and professionals in supply chain management and BCM. To ensure the validity of the translation process and to minimize any impact of language on the results, a back-translation method was employed for the German survey by independent professional translators. A comparison between the two English versions and the back-translated version of the instrument was performed. The versions contained non-significant differences, which suggested that the translation process was acceptable. The final version was adopted for Swiss and German target firms. However, the original English version was used for Swedish firms because of their fluency with the English language. Then, the questionnaire was pretested using four Swedish and German academics with significant experience in academic research, to ensure that the survey content and measurement scales were clear, valid, and appropriate. Following this stage, a second pretest was carried out with 20 Swedish and Swiss managers, with debriefing sessions to elicit respondents' views. Again, the respondents were asked to identify any item that was ambiguous or difficult to answer. By the end of the second phase of pretesting, the practitioners reported no concerns regarding the instructional content and wording, and the questionnaire was, therefore, ready for final administration.

Target respondents were senior managers and executives whose responsibilities placed them in the proximity of how supply chain disruptions were managed at their companies. Details of the Swedish firms were obtained from Sweden's register of Swedish firms—Economic Statistics Department (www.scb.se) and Affärsdata (www.ad.se), a Swedish national business directory and were designed to be representative of firms consisting of 14,338 manufacturing firms. Details of the Swiss firms were taken from all firms listed in the European databases EPO, and some private sources (arvato az direct, swissfirms, teledata, Handelszeitung) consisting of 8,392 manufacturing firms. In Germany, the sampling frame was used from the available dataset of about 6,200 firms from the German Institute for Economic Research (DIW) Berlin (www.diw.de) and the Chamber for Industry and Commerce, in which membership is mandatory for all firms in Germany.

Due to budgetary constraints, we randomly selected 1,000 firms operating in supply chain management in each country using a procedure adapted from the total design method to administer the survey (Dillman et al., 2016). Because it was likely that some of the firms are listed in different directories, we screened them to ensure that the final samples were not duplicated. Multiple methods were used for data collection. To achieve our goal, the data collection was carried out over a period of five months. Following the procedure recommended by Dillman et al. (2016), the direct mail questionnaire was sent to the sample of companies in four waves. Each wave contained a copy of the questionnaire and a modified cover letter. In the first wave, each senior executive was mailed a letter explaining the general purpose of the study, a copy of the questionnaire with pre-addressed postage-paid envelopes, and a cover letter explaining the purpose of the study and the confidentiality of responses. Due to the low response rate in the first wave, three weeks after the first mailing, a follow-up letter was sent with a duplicate copy of the questionnaire and another return envelope to non-respondents (a total of three reminders were used). The third and fourth mailings were sent only to firms who had not yet responded. To ensure a high response rate and the provision of reliable and accurate responses, the key informants were promised that information about the respondents and the company would be kept entirely confidential. Moreover, some native graduate students were recruited and trained from each country to contact the managers of target firms by telephone to explain the purpose of the study, to persuade the respondents to participate, and also to get permission to send the printed questionnaire. Despite our greatest efforts, at the end of the fourth wave and extensive telephone outreach, we received 135 responses from Switzerland, 195 responses from Sweden, and 118 responses from Germany. A total of 460 surveys were returned. Twelve of these questionnaires were excluded from the final analyses due to missing responses, due to missing responses and perceived lack of participation or interest. In this process, 448 surveys were useable resulting in a response rate of 14.9%.

Section A-2. Control variables

We selected control variables that could minimize issues related to spurious effects. Firm size may affect our results because larger firms tend to have more resources, which can facilitate implementing BCM and containing the damage from disruptions. At the same time, larger firms are more often involved in complex supply chains more susceptible to disruption. We controlled for size based on sales (Revilla and Saenz, 2017). Firm age may affect our results because older firms tend to have more established processes, which can enable implementing BCM and containing the damage of disruptions (Ambulkar et al., 2015). The frequency of small disruptions was included by taking a logarithmic value of the number of disruptions per month because firms facing more frequent small disruptions might be pushed towards more vulnerable supply chain performances (Bode and Wagner, 2015). We controlled for environmental dynamism because, in greater the environmental uncertainty, the greater amount of information must be processed among decision-makers in order to achieve a given level of operational and reputational performances (Bode and Macdonald, 2017). Beyond firm-level controls, we controlled for the industry, given the diverse nature to which firms in different industries may experience supply chain disruptions (Jüttner, 2005a). We clustered firms into six industry groups based on their NAICS codes: (1) fast-moving consumer goods, (2) textile and apparel, (3) wood, paper, chemical, and petrochemical, (4) computer and electronic, (5) metals and machinery, and (6) transport industries. Six dummy variables were created, constituting each industry as 1 and 0 for rest. However, we had to truncate our dummy variables of industry 2, 3, and 6 in our analyses due to multicollinearity issues. Therefore, dummy variables of industry 1, industry 2, and industry 3 in our analysis represent industries of fast-moving consumer goods, computers and electronics, and metals and machinery, respectively. Finally, we controlled for the country, since our data were from three European countries and disruptions may vary geographically (Stecke and Kumar, 2009). We created three dummy variables, constituting each country 1 and rest 0 (i.e., 1 for Swiss firms and 0 for other firms, dummy variable country 2 constituting 1 for Swedish firms and 0 for rest, and dummy variable country 3 constituting 1 for German firms and 0 for other firms). However, we had to truncate our dummy variable country 3 in our analyses due to multicollinearity issues.

A-3. Measurement invariance

Following the methods recommended by Steenkamp and Baumgartner (1998), we tested for measurement invariance among the data collected in Switzerland, Sweden, and Germany. First, we tested for configural invariance by comparing the configuration of salient and non-salient factor loadings across different countries. The chi-square difference results revealed no significant difference between salient and non-salient loadings across the three countries *($\Delta\chi^2$ = 1.613; Δdf = 2; $p > 0.1$)* and model fit was fairly achieved *(χ^2 (590) = 1808.374; CFI = 0.812; NNFI = 0.871; RMSEA = 0.051; SRMR = 0.062)*. Thus, our model variables exhibited configural invariance. Next, we tested for metric invariance by constraining the entire factor loadings for each construct simultaneously and comparing it to the unconstrained model. The chi-square difference test between metric invariance model and unconstrained model were statistically significant *($\Delta\chi^2$ = 243.929; Δdf = 44; $p < 0.05$)*. This revealed that the three samples did not exhibit metric invariance. We ran metric invariance tests for each construct separately to identify the variant constructs. To detect the factors that exhibited variance, all the factor loadings of each variant construct were tested individually. We relaxed the factor loadings of eight items and retested the metric invariance among the three samples. The results revealed that the sample groups were not statistically different *($\Delta\chi^2$ = 19.841; Δdf = 14; $p > 0.1$)*. Next, we tested the systematic upward or downward bias in means of the constructs and items by testing for scalar invariance. We took a number of steps to set up the model for the scalar invariance test. First, we fixed one loading for each construct to invariant value in all three groups. Second, we constrained the intercepts for the corresponding loading to be equal across groups. Third, in the reference group, only the latent mean and latent variance were fixed to zero and one respectively. We ran the scalar invariance test by constraining the intercepts to be equal in addition to factor loadings across the three samples. The Chi-square difference between scalar invariance and unconstrained models was statistically significantly different *($\Delta\chi^2$ = 109.823; Δdf = 36; $p < 0.01$)*, revealing that the samples did not exhibit scalar invariance. Further analysis revealed that five items were variant between samples of Switzerland and Sweden, three items between Germany and Sweden, and eight items between Germany and Switzerland. The identified items were relaxed, and we repeated the scalar invariance test for the remaining items. The results showed that the sample groups were significantly similar *($\Delta\chi^2 = 32.592; \Delta df = 24; p > 0.1$)*. Next, we tested for factor covariance invariance by constraining the covariance among construct factors for the sample of three countries. The chi-square difference between the covariance invariance model and the scalar invariance model revealed that the models were not statistically different *($\Delta\chi^2 = 22.957; \Delta df = 16; p > 0.1$)*. Next, we tested for factor variance invariance by constraining the variances of the factor across the sample of three countries. The Chi-square difference between the factor variance invariance model and the factor covariance invariance model revealed that the models were not statistically different *($\Delta\chi^2 = 14.051; \Delta df = 9; p > 0.1$)*. The above results showed that both factor invariance and factor covariance were invariant, indicating that the correlation among the latent constructs is invariant across the sample of three countries (Steenkamp and Baumgartner, 1998). Finally, we conducted a test for error variance invariance by constraining the measurement residuals of all the items across sample groups. The comparison between factor variance invariance model and error variance invariance model indicated the sample to be statistically different *($\Delta\chi^2 =53.245; \Delta df = 38; p < 0.1$)*. Further testing each factor separately revealed five items with variant measurement residual. After relaxing these items, the Chi-square difference test between factor variance invariance and error variance invariance models revealed the samples to be statistically similar *($\Delta\chi^2 =46.018; \Delta df = 35; p > 0.1$)*. The series of invariance tests conducted above might not frequently hold (Steenkamp and Baumgartner, 1998). Instead, Steenkamp and Baumgartner argue that partial measurement invariance is sufficient to test differences across samples. While the results of these analyses do not preclude the possibility of variance completely, they do suggest that measurement variance is not of great concern in our data. Thus, it is unlikely to confound the interpretations of our results in combining the three samples to test our hypotheses.

A-4. Methodological Checks on Late response, Measure validation, Common Method bias, Normal distribution, and multicollinearity

A-4.1 Late-response and Non-response bias. To check for late-response bias, we compared the demographics of the first wave of respondents (early respondents) with the fourth wave of respondents (late respondents). T-tests showed no statistical difference between two groups based on number of employees ($p > 0.05$), sales ($p > 0.05$) and industry ($p > 0.05$). These results give us confidence that there were no issues with regards to late-response bias. To check our data for non-response bias, we compared the demographics of our respondent sample with the population demographics (Wagner and Kemmerling, 2010). T-tests revealed no pattern of statistical significant differences between the sample data and industry population on the basis of sales ($p > 0.05$) and firm age ($p > 0.10$). Li et al. (2007) suggests examining non-response bias due to poor business unit performance. One hundred and twenty units (approximately one third of our sample) that participated in the study performed poorly on our reputational containment scale which minimizes concerns of a biased sample of high performing units. Thus re-assuring that non-response bias was not a problem in this study.

A-4.2 Measure validation. We followed the methodology recommendation made by (Fawcett et al., 2014) to ensure that our measures are reliable and valid. Congeneric reliability (rho_C) scores of all constructs were found to be higher than 0.70 providing evidence of reliability (Table A-3). All of the items loaded on the intended constructs with standardized loadings greater than 0.50 and the average variance extracted for the constructs exceeded 0.50 (Table A-3), evidencing convergent validity (Fornell and Larcker, 1981). We confirmed convergent validity using item loadings. All items presented higher loadings on their assigned construct than on any other construct as evidenced in Table A-2.

We followed the methodological recommendations made by Voorhees et al. (2016) to check for discriminant validity using HTMT and AVE-SE methods. HTMT method measures the ratio of the average correlations between constructs to the geometric mean of the average correlations within items of the same constructs (Voorhees et al., 2016). Table A-4 provides the results of HTMT test with all values below the 0.85 threshold, suggesting no discriminant validity among the constructs (Voorhees et al., 2016). AVE-SE method compares the average variance extracted (AVE) estimate for each construct to the shared variance (i.e., squared correlation) between the construct and all other constructs in the model. If a construct's AVE is greater than the shared variance between it and all other constructs, then discriminant validity is said to be achieved (Fornell and Larcker, 1981; Voorhees et al., 2016). Table A-5 provides the results of our AVE-SE test that reinforces HTMT finding of no discriminant validity among our constructs.

A-4.3 Common method bias. To control for potential common method bias, we performed common method bias ex-ante procedural methods in our survey design following Podsakoff et al. (2003). First, the chosen respondents were senior managers, the most reliable assessors of organizational information (Simsek et al., 2007). Second, the survey provided an exceptional level of anonymity and confidentiality to respondents, thereby reducing the potential for common-rater effects. Third, we assured respondents that there is no right or wrong answer to the survey and that they should answer questions as honestly as possible. This reduced the potential for socially desirable responses. Finally, we mixed the order of predictor and criterion variables to control for priming effect and item-context induced mood state.

In addition, we performed three tests to detect the presence of common method bias in our collected data. First, we performed the Harman one-factor test that is commonly used to test for the presence of common method bias. The appearance of the single factor to explain for more than half of the total variance indicates a higher probability of common method bias in the data. The analysis generated eight distinct factors, with the largest factor accounting for 14.97 percent of the total variance (68.15 percent).

Second, we employed the CFA marker technique specifically designed for observing the shared variance between a marker variable and hypothesized variables (Jarvis et al., 2003; Williams et al., 2010). The foremost step for this method is that the marker variable should be theoretically unrelated to any other variables used in this study and can be operationalized as single-item scales, multi-item scales, or objective items (Lindell and Whitney, 2001; Williams et al., 2010). The shared variance between the marker variable and the research variables is believed to represent the method bias (Richardson et al., 2009; Williams et al., 2010). In other words, common method variance would not be a major concern if there is no significant correlation between the marker variable and the hypothesized variables. We used a single-item scale for the marker variable that was developed to capture the level of product maturity. Respondents were asked to answer the following scaled question: "our products can be described as a commodity rather than as distinctively novel." We evaluated the presence of common method bias based on the statistical significance in chi-squares within CFA setting (Craighead et al., 2011; Richardson et al., 2009). Following Malhotra et al. (2006), we performed the χ^2 difference test via CFA and checked statistical differences between a basic measurement model that included only hypothesized variables and an extended measurement model that included the hypothesized variables and the theoretically irrelevant marker. The analysis indicated that there was no significant improvement in the series of fit indices (the basic model vs. the extended model): χ^2/df = 1846.5/629 vs. 2737.8/627, CFI = 0.963 vs. 0.941, GFI = 0.977 vs. 0.955, and TLI = 0.939 vs. 0.911. Moreover, there was no significant difference in the chi-squares ($\Delta\chi^2 = 1.431$; $p > 0.1$) between the measurement models, suggesting that common method bias can be rule out (Williams et al., 2010). Finally, studies have revealed that the presence of common method bias in data can undermine the significance level of interaction coefficients (Siemsen et al., 2010). The presence of significant interactions in our study further increases our confidence that the threat due to common method bias is minimal.

A-4.4 Normal distribution and multicollinearity. The multivariate normality test was performed for each item to check if the data were normally distributed. The results showed that all *z*-values of the skewness and kurtosis for constructs items ranged from −1.483 to 1.197, indicating that the data were normally distributed and that there was no evidence of skewness or kurtosis. We checked for possible multicollinearity between our construct variables by (1) checking the correlation coefficient between the constructs and (2) analyzing the Variance Inflation Factor (VIF). For the former, the highest correlation coefficient between our hypothesized constructs is 0.525 (Table 5), and the VIF scores ranged from 1.01 to 2.96, sufficiently below recommended thresholds (Hair et al., 2013). Table 5 presents the descriptive statistics of all constructs in our structural model.

--- Insert Table 5 About Here ---

A-5. Endogeneity test

We performed the endogeneity tests for our independent variables (i.e., BCM and SCiBCM). BCM is defined as the systemic process of identifying risks that could impact continued operations and providing a framework for developing capabilities in effective mitigation and response. Senior managers use information about the organizational established policies and practices when evaluating risks or developing mitigation plans. We use instrument variable, namely policies, that measures the tendency of senior managers' use of organizational established procedures and rules when responding to disruptions. Policies (Cronbach alpha = 0.860) is measured using a three-item scale that correlated with BCM ($r = 0.183$; $p < 0.05$) and was not correlated with reputational containment ($r = 0.091$; $p > 0.30$), providing support to its use as instrument (Wooldridge, 2003).

We ran an instrumental variable regression in STATA 13. In the first stage, we used policies along with the control variables to predict BCM. In the second stage, we use the predicted scores from the first stage analysis to predict reputational containment. Wooldridge (2003) recommends running an additional test for endogeneity and providing a report on the first stage regression statistics. The Durbin–Wu–Hausman test for endogeneity rejected the endogenous structure of BCM for reputational containment ($F = 4.01$, $p > 0.20$) (Davidson and MacKinnon, 1993). The first stage goodness of fit statistic offers support to the quality of the instrument (policies) used in our model. That is, the F-statistic significance of the policies as instruments for BCM is 5.17 ($p < 0.001$). In addition, the F-statistic for the first stage regression for the excluded instrument is 8.13 (greater than 5.17), providing an alternative test for the quality of the instrument (Stock et al., 2002).

Supply chain involvement in BCM (SCiBCM) refers to the extent of the inclusion of supply chain business units in BCM activities. SCiBCM requires firms to exchange and share knowledge with their supply chain units. Beckett (2008) suggests that knowledge sticks within the organization only if formalization and repeated interactions with internal as well as external partners happen over time. For example, quality improvement programs such as kaizen events are successful when supplier involvement is deeper and occurs over a longer period allowing for iterative knowledge development (Shah and Ward, 2007). The repeated and iterative knowledge interactions develop a deeper knowledge enrichment between collaborative network partners to assimilate information for commercial gains (Jayaram and Pathak, 2013). Thus, we used knowledge integration as an instrumental variable that measures the extent of proficiency in reactivating and developing existing knowledge for new users. Knowledge integration (Cronbach alpha = 0.748) is measured using a two-item scale that correlated with SCiBCM ($r = 0.275$; $p < 0.01$) and was not correlated with operational containment ($r = 0.005$; $p > 0.90$), providing support to its use as instrument (Wooldridge, 2003).

A two-stage least square regression procedure (described earlier) corrects for endogeneity. However, the Durbin–Wu–Hausman test for endogeneity rejected the endogenous structure of SCiBCM for the operational containment ($F = 6.12$, $p > 0.20$) (Davidson and MacKinnon, 1993). The first stage goodness of fit statistic ($F = 7.23$, $p < 0.01$) offers support to the quality of the instrument (knowledge integration) used in our model. In addition, the F-statistic for the first stage regression that excluded instrument is relevant is 9.04 (greater than 7.23), providing an alternative test for the quality of the instrument (Stock et al., 2002).

Table A-1. Literature on Business Continuity in supply chain settings

Authors (Year)	Contribution as related to business continuity in supply chain risk and disruption	BCM	Supply Chain & BCM	Methodology	Exogenous Factors Considered?
Iyer et al. (1998)	Offers early stage conceptual argument on the significance of BCM in manufacturing.	√		Conceptual	
Christopher et al. (2004)	Introduces the concept of "supply chain continuity management" as a cultural extension to risk management.	√	√	Conceptual	
Finch (2004)	The need for BCM is increases when companies are exposed to inter-organizational networks.	√		Case Studies	√
Norrman et al. (2004)	Provides a detailed overview of BCM and a supply chain fosued approach adopted at Ericsson.	√	√	Single Case Study	
Juttner (2005)	Highlights joint BCM and supplier BCM awareness in supply chain risk management.	√	√	Survey (137 responses)	
Kleindorfer et al. (2005)	New risks and potential exposure has led to BCM to become a strategic priority in corporate risk management	√		Survey+Framework	
Peck (2005)	Offers a historical perspective on the evolution of BCM and focus on information technology.	√		Theory using case study	
Sheffi et al. (2005)	Shares anecdotal evidence and suggests for rise in emphasis in BCM among companies.	√		Anecdotal	
Zsidisin et al. (2005)	Offers and institutional theory persepctive as to why firms implement BCM and supplier-enhanced BCM.	√	√	Case Studies (3 firms)	√
Peck (2006)	Suggests for regulations to be a driver of renewed interest in BCM.	√		Conceptual	
Waters (2007)	Outlines steps in BCM programs as related to supply chain risk.	√		Conceptual	
Prud'homme (2008)	Companies engaged in BCM show higher level performance, more dependency leads to risk management.	√		Survey (303 responses)	√
Blos et al. (2009)	BCM related training programs are explained as implemented in automotive and electronics industries.	√		Surveys (49)	√
Ojha et al. (2009)	Extends BCM to consider risks associated with logistics operations - offers new scale on Logistics BCP.		√	Survey (106 responses)	
Pettit et al. (2010)	Considers BCM as a factor in enhancing anticipation capability in facing disruptions.	√		Survey (7 firms)	
Zsidisin et al. (2010)	Considers business continuity as a redundnacy practice alongside excess inventory and multiple suppliers.	√		Survey (296 responses)	
Juttner et al. (2011)	Jointly developed business continuity plans with supplier help with risk management.	√	√	Case Studies	
Kildow (2011)	Highlights the role of purchasing in BCM planning and supplier risk assessment in supplier selection.	√	√	Conceptual	
Blos et al. (2012)	Offers the SC continuity framework, which augments BCM across its lifecycle, to better manage SC risks.	√	√	Conceptual	
Clark (2012)	Explains supply chain related business continuity at DHL using a 10 step process		√	Anecdotal	
Wildgoose et al. (2012)	Suggests the use of Kraljic (Supplier) matrix to improve BCM by focusing on critical suppliers.	√	√	Conceptual	
Ojha et al. (2013)	Logistics BCP improves financial performance via competitive capability and enhanced disaster immunity.		√	Survey (201 responses)	
Nuttall (2013)	Offers anecdotal lessons and frustrations experienced in managing supply chains for BCM.		√	Anecdotal	
Schlegel et al. (2014)	Highlights the importance of impact analysis and recovery objectives in supply chain risk management.	√		Conceptual	
Torabi et al. (2014)	Offers a framework for enhanced use of impact analaysis (BIA) as applied to auto parts supplier.	√		Modeling	
Fiksel et al. (2015)	Considers BCM as proecss that incorporates disaster recovery and crisis management.	√		Conceptual with examples	
Montshiwa et al. (2016)	Business impact analysis offers better awareness to supply chain risks and enhances collaboration.	√		Survey	
Sheffi (2015)	Offers examples on how leading edge companies have expanded their BCM to integrate suppliers'.	√	√	Anecdotal	
Brindley (2017)	Highlights Inter- and Intra-organizational awareness as a important steps in BCM	√	√	Conceptual	
Torabi et al. (2016)	Offers analytical techniques that facilitate implementing BCM in addressing supply chain risk		√	Case Studies	
Revilla et al. (2017)	Buyer - supplier collaboration ensures the efficacy of business continuity plans.		√	Survey (908 responses)	
Azadegan et al. (2018)	Highlights BCM as an anticipatory resilience - designed and implemented to protect against risks		√	Conceptual	√
Sahebjamnia et al. (2018)	Offers a multi-objective mixed-integer possibilistic programming model that enhances BCM.	√		Modeling	

Table A-2. Descriptive statistics

	Construct	Min	Max	Mean (SD)	1	2	3	4	5
1	Business Continuity Management (BCM)	1.00	7.00	4.63(0.75)	1.000				
2	Supply chain involvement in BCM	1.00	7.00	4.28(0.93)	**0.180**	1.000			
3	Supply chain vulnerability	1.00	5.00	3.54(0.88)	-0.057	**0.181**	1.000		
4	Reputational containment	1.00	5.00	3.04(0.90)	0.112	**0.096**	**0.148**	1.000	
5	Operational containment	1.00	5.00	3.66(0.83)	-0.002	**0.253**	0.072	0.009	1.000
6	Small disruption frequency	1.61	3.33	2.65(0.29)	**0.176**	**-0.239**	**-0.138**	-0.032	-0.003
7	Environmental dynamism	1.00	5.00	3.66(0.83)	**-0.153**	0.000	0.027	**0.097**	0.053
8	Firm age (years)	1.00	3.00	3.52(2.39)	**-0.144**	**0.107**	**0.192**	0.041	0.009
9	Firm size (Sales)	1.00	5.00	3.61(0.72)	-0.059	**0.236**	**0.187**	0.072	**0.180**
10	Industry	0.00	1.00	0.04(0.21)	0.051	0.076	**0.147**	-0.006	0.052
11	Industry 2	0.00	1.00	0.15(0.36)	0.042	0.011	-0.079	0.024	0.002
12	Industry 3	0.00	1.00	0.10(0.30)	0.004	-0.054	0.014	-0.060	-0.028
13	Country Code 1	0.00	1.00	0.44(0.49)	-0.054	0.069	**0.195**	0.043	0.079
14	Country Code 2	0.00	1.00	0.26(0.44)	**0.184**	**-0.199**	**-0.283**	-0.038	**-0.103**

	Construct	6	7	8	9	10	11	12	13	14
6	Small disruption frequency	1.000								
7	Environmental dynamism	0.023	1.000							
8	Firm age (years)	**-0.326**	0.069	1.000						
9	Firm size (Sales)	**-0.225**	-0.030	**0.268**	1.000					
10	Industry	0..010	**-0.142**	**0.102**	-0.011	1.000				
11	Industry 2	-0.014	0.003	-0.056	-0.031	-0.091	1.000			
12	Industry 3	0.072	0.003	**-0.098**	0.068	-0.072	**-0.140**	1.000		
13	Country Code 1	**-0.107**	0.043	**0.103**	0.039	**0.094**	-0.053	**-0.129**	1.000	
14	Country Code 2	**0.311**	-0.085	**-0.313**	**-0.184**	**-0.129**	**0.190**	**0.137**	**-0.525**	1.000

Bold values indicate significant correlation scores at p<0.01.

Table A-3. Items level correlations

Items	BCM	SCiBCM	Scv	RC	OC	Ed
Bcp1	0.862	0.125	0.102	0.045	-0.042	0.030
Bcp2	0.773	-0.003	0.002	0.017	-0.065	-0.092
Bcp3	0.774	0.011	-0.046	-0.032	-0.009	-0.067
Bcp4	0.796	0.076	0.001	-0.006	0.008	0.078
Bcp5	0.803	-0.141	-0.035	-0.024	0.055	0.042
Bsc1	-0.081	0.857	0.049	-0.012	0.004	0.025
Bsc2	0.115	0.677	-0.136	-0.013	0.072	-0.041
Bsc3	-0.069	0.875	0.056	-0.015	0.002	0.014
Bsc4	0.082	0.776	-0.056	0.017	0.012	-0.013
Scv1	0.019	-0.036	0.858	-0.021	0.030	-0.036
Scv2	0.103	-0.011	0.839	0.006	-0.071	0.118
Scv3	0.001	-0.041	0.922	0.014	0.082	-0.072
Scv4	-0.107	0.023	0.667	-0.012	0.064	-0.068
RC1	-0.037	-0.063	-0.050	0.767	-0.079	0.006
RC2	-0.015	0.129	0.033	0.743	-0.107	0.104
RC3	0.043	-0.011	-0.215	0.794	0.192	-0.174
RC4	0.020	-0.071	0.171	0.762	0.043	0.055
OC1	-0.110	0.071	0.099	0.047	0.664	0.026
OC2	-0.049	-0.016	-0.011	0.005	0.797	-0.008
OC3	0.037	0.068	0.032	-0.032	0.704	0.138
OC4	0.035	0.040	-0.010	-0.033	0.889	-0.034
OC5	0.061	-0.065	0.021	-0.009	0.879	-0.051
Ed1	0.044	0.061	-0.006	0.082	-0.023	0.659
Ed2	0.001	0.062	0.071	-0.005	-0.021	0.721
Ed3	-0.011	-0.133	-0.125	0.003	0.143	0.677
Ed4	-0.004	-0.021	-0.050	-0.033	-0.020	0.697

BCM= Business Continuity Management,
SCiBCM=Supply chain involvement in business continuity management,
Scv=Supply chain vulnerability, RC=Reputational Containment, OC=Operational Containment,
Ed=environmental Dynamism

Table A-4. Reliability Measures

Construct/Item	Mean (SD)	Standardized loadings	AVE	(rho_C)	Mean shared variance
Business Continuity Program (BCM) *(α)*	4.63 (0.75)		0.52	0.84	0.09
Source: Norrman and Jansson (2004), Engemann and Henderson (2011), Waters (2011)					
BCM is developed based on a hazard assessment	4.50 (0.91)	0.68			
BCM is developed based on a business impact analysis	4.51 (1.08)	0.72			
BCM disaster recovery plan is developed thoroughly	4.75 (1.01)	0.7			
BCMs are regularly tested	4.57 (1.20)	0.82			
Employees are regularly trained about their role and responsibilities in the BCM.	4.65 (0.98)	0.72			
Supply chain involvement in Business Continuity Management (SCiBCM) *(Ω)*	4.28 (0.93)		0.63	0.87	0.07
Source: Kildow (2011)					
All supply chain management business units are fully included in the business continuity planning process.	4.19 (1.18)	0.87			
At least one representative of the supply chain business units is a member of the business continuity planning group	4.39 (0.91)	0.71			
Existing plans include business continuity procedures and strategies for supply chain business units	4.15 (1.19)	0.89			
A list of key people and qualified alternates for each key person needed for critical business functions is maintained	4.38 (0.94)	0.92			
Supply chain vulnerability (Scv) (∂)	3.54 (0.88)		0.66	0.88	0.05
Source: Cardona (2004), Wagner and Bode (2006), Gualandris and Kalchschmidt (2015)					
Our physical location exposes us to the effects of naturally-caused SC disruptions	3.51 (1.00)	0.86			
Our physical location exposes us to the effects of man-made SC disruptions	3.37 (1.11)	0.85			
What we make (products) and how we make them (operations and supply) us susceptible to the effects of man-made SC disruptions	3.72 (0.95)	0.88			
The industry that we operate in susceptible to naturally-caused SC disruptions.	3.67 (0.97)	0.65			

Table A-4. Reliability Measures (Continued)

Construct/Item	Mean (SD)	Standardized loadings	AVE	(rho_C)	Mean shared variance
Reputational containment (RC) (∂)	2.75 (0.90)		0.51	0.8	0.03
Source: Rindova et al. (2005), Bitektine (2011), Gray and Balmer (1998)					
Question Stem: We are interested in how response and recovery efforts reduced the impact of this large disruption. **Effect of response/recovery efforts on reducing reputational impact of large disruption.** With reference to the recent large supply chain disruption:					
Without the response/recovery activities the popularity of the organization among its suppliers and customers would have hurt more.	2.87 (1.05)	0.74			
Without the response/recovery activities the public image of the organization would have been damaged more.	3.13 (1.04)	0.61			
Without the response/recovery activities the organization's status with its customers and suppliers would have been damaged more.	2.89 (1.05)	0.79			
Without the response/recovery activities the reputational effect of the disruption to our company would have been significantly higher	2.51 (1.06)	0.73			
Operational containment (OC) *(α)*	3.66 (0.83)		0.63	0.89	0.07
Source: Klassen and Whybark (1999), Narasimhan and Das (2001), Bode et al. (2011)					
Question Stem: We are interested in how response and recovery efforts reduced the impact of this large disruption. **Effect of response/recovery efforts on reducing operational effects** With reference to the recent large supply chain disruption:					
Without the response/recovery activities the damage to our on-time delivery performance would have been significantly higher.	3.62 (0.98)	0.66			
Without the response/recovery activities the damage to our product quality performance would have been significantly higher	3.74 (0.89)	0.78			
Without the response/recovery activities the damage to our manufacturing costs would have been significantly higher.	3.62 (0.97)	0.75			
Without the response/recovery activities the damage to our order fulfilment would have been significantly higher.	3.66 (0.98)	0.89			
Without the response/recovery activities the damage to our cash-to-cash cycle would have been significantly higher.	3.65 (1.04)	0.87			

Table A-4. Reliability Measures (Continued)

Construct/Item	Mean (SD)	Standardized loadings	AVE	(rho_C)	Mean shared variance
Environmental dynamism (Ed) *(Ω)* Source: Zhao et al. (2013) Zhang et al. (2012)	3.35 (0.94)		0.54	0.78	0.07
Our customers' needs and wants are difficult to ascertain.	3.42 (1.10)	0.67			
All of our customers desire essentially the same products.	3.67 (1.17)	0.71			
The needs and wants of our customers are changing very fast.	2.95 (1.37)	0.64			
The demand for our plant's products is unstable and unpredictable.	3.38 (1.15)	0.72			

AVE= Average Variance Extracted, rho_C is a measurement of Congeneric reliability.
$\Delta\chi^2$ (Δdf = 1846.5 (629); CFI = .93; IFI = .91; RSMEA (90% CI) = .042 (.038–.045); NCP (90% CI) = 879.999 (764.552–952.940). All loadings are significant at $p < .001$
α = scale is adapted, Ω = scale is adopted, ∂ = scale is self-developed.

Table A-5a. Discriminant validity results using heterotrait-monotrait ratio of correlations (HTMT)

Construct	1	2	3	4	5	6	7
1. BCM							
2. SCiBCM	0.180						
3. Scv	0.057	0.181					
4. RC	0.113	0.096	0.148				
5. OC	0.002	0.253	0.072	0.009			
6. Sdf	0.264	0.160	0.202	0.048	0.019		
7. Ed	0.153	0.000	0.027	0.097	0.053	0.001	
8. Firm age (Ln)	0.144	0.107	0.192	0.041	0.009	0.339	0.069
9. Firm size	0.059	0.236	0.187	0.072	0.180	0.228	0.030
10. Industry 1	0.051	0.076	0.147	0.006	0.052	0.009	0.142
11. Industry 2	0.043	0.011	0.079	0.024	0.002	0.014	0.003
12. Industry 3	0.004	0.054	0.014	0.060	0.028	0.085	0.003
13. Country 1	0.054	0.069	0.195	0.043	0.079	0.113	0.043
14. Country 2	0.184	0.199	0.283	0.038	0.104	0.328	0.086

Construct	8	9	10	11	12	13	14
9. Firm size	0.268						
10. Industry 1	0.102	0.011					
11. Industry 2	0.056	0.031	0.091				
12. Industry 3	0.098	0.068	0.072	0.140			
13. Country 1	0.104	0.039	0.094	0.053	0.129		
14. Country 2	0.380	0.185	0.129	0.190	0.137	0.525	

Squared correlations; AVE in the diagonal.
BCM= Business Continuity Management,
SCiBCM=Supply chain involvement in business continuity management,
SCV=Supply chain vulnerability, Escp =External supply chain pressure, Govp =government pressure,
RC=Reputational Containment, OC=Operational Containment,
Sdf =Small Disruption frequency, Ed=environmental Dynamism.

Table A-5b. Discriminant validity results using AVE-SE (Fornell-Larker criterion)

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. BCM														
2. SCiBCM	0.032													
3. Scv	0.003	0.033												
4. RC	0.013	0.009	0.022											
5. OC	0.000	0.064	0.005	0.000										
6. Sdf	0.069	0.026	0.041	0.002	0.000									
7. Ed	0.024	0.000	0.001	0.010	0.003	0.000								
8. Firm age (Ln)	0.021	0.012	0.037	0.002	0.000	0.115	0.005							
9. Firm size	0.004	0.056	0.035	0.005	0.032	0.052	0.001	0.072						
10. Industry 1	0.003	0.006	0.022	0.000	0.003	0.000	0.020	0.010	0.000					
11. Industry 2	0.002	0.000	0.006	0.001	0.000	0.000	0.000	0.003	0.001	0.008				
12. Industry 3	0.000	0.003	0.000	0.004	0.001	0.007	0.000	0.010	0.005	0.005	0.020			
13. Country 1	0.003	0.005	0.038	0.002	0.006	0.013	0.002	0.011	0.002	0.009	0.003	0.017		
14. Country 2	0.034	0.040	0.080	0.001	0.011	0.108	0.007	0.144	0.034	0.017	0.036	0.019	0.276	

Squared correlations; AVE in the diagonal.
BCM= Business Continuity Management
SCiBCM=Supply chain involvement in business continuity management
Scv=Supply chain vulnerability, RC=Reputational Containment, OC=Operational Containment
Sdf=Small Disruption frequency, Ed=environmental Dynamism.

Table A-6. Instrument variables for tests of endogeneity

Instrument variable constructs/items	Mean (SD)	Standardized loadings	Cronbach's Alpha
Policies	**4.04 (1.18)**		**0.860**
When responding to disruptions the use of established policies and procedures play a major role.	4.42 (1.37)	0.68	
When responding to disruptions how past disruptions have been managed is referred to.	3.83 (1.26)	0.72	
When responding to disruptions role, responsibilities and ownership of problems are rigidly followed.	4.07 (1.38)	0.70	
Knowledge integration	**4.04 (0.68)**		**0.748**
We are proficient in reactivating existing knowledge for new uses.	3.89 (0.82)	0.67	
We thoroughly maintain relevant knowledge over time.	4.20 (0.72)	0.72	

References

Ambulkar, S., Blackhurst, J., Grawe, S., 2015. Firm's resilience to supply chain disruptions: Scale development and empirical examination. Journal of Operations Management 33-34 (1), 111-122.
Beckett, R.C., 2008. Utilizing and adaptation of the absorptive capacity concept in a virtual enterprise context. International Journal of Production Research 46 (5), 1243–1252.
Bitektine, A., 2011. Toward a theory of social judgments of organizations: The case of legitimacy, reputation, and status. Academy of Management Review 36 (1), 151-179.
Blos, M.F., Quaddus, M., Wee, H.M., Watanabe, K., 2009. Supply chain risk management (SCRM): A case study on the automotive and electronic industries in Brazil. Supply Chain Management: An International Journal 14 (4), 247-252.
Bode, C., Macdonald, J.R., 2017. Stages of supply chain disruption response: Direct, constraining, and mediating factors for impact mitigation. Decision Sciences 48 (5), 836-874.
Bode, C., Wagner, S.M., 2015. Structural drivers of upstream supply chain complexity and the frequency of supply chain disruptions. Journal of Operations Management 36 (1), 215-228.
Bode, C., Wagner, S.M., Petersen, K.J., Ellram, L.M., 2011. Understanding responses to supply chain disruptions: Insights from information processing and resource dependence perspectives. Academy of Management Journal 54 (4), 833-856.
Brindley, C., 2017. Supply chain risk. Taylor & Francis
Cardona, O.D., 2004. The need for rethinking the concepts of vulnerability and risk from a holistic perspective: A necessary review and criticism for effective risk management, In: Bankoff, G., Frerks, G., Hilhorst, D. (Eds), Mapping Vulnerability Disasters, Development and People. Earthscan, London, pp. 37-51.
Christopher, M., Peck, H., 2004. Building the resilient supply chain. The international journal of logistics management 15 (2), 1-14.
Clark, G., 2012. Understanding and reducing the risk of supply chain disruptions. Journal of business continuity & emergency planning 6 (1), 6-12.
Craighead, C.W., Ketchen, D.J., Dunn, K.S., Hult, G.T.M., 2011. Addressing common method variance: guidelines for survey research on information technology, operations, and supply chain management. IEEE Transactions on Engineering Management 58 (3), 578-588.
Davidson, R., MacKinnon, J.G., 1993. Estimation and inference in econometrics. OUP Catalogue
Dillman, D.A., Smyth, J.D., Christian, L.M., 2016. Internet, Phone, Mail and Mixed-Mode Surveys: The Tailored Design Method, 4th ed. John Wiley & Sons, Inc., New York.
Engemann, K.J., Henderson, D.M., 2011. Business Continuity and Risk Management: Essentials of Organizational Resilience. Rothstein Associates, Inc., Brookefield, CT.
Fawcett, S.E., Waller, M.A., Miller, J.W., Schwieterman, M.A., Hazen, B.T., Overstreet, R.E., 2014. A trail guide to publishing success: tips on writing influential conceptual, qualitative, and survey research. Journal of Business Logistics 35 (1), 1-16.
Fiksel, J., Polyviou, M., Croxton, K.L., Pettit, T.J., 2015. From risk to resilience: Learning to deal with disruption. MIT Sloan Management Review 56 (2), 79-86.
Finch, P., 2004. Supply chain risk management. Supply Chain Management: An International Journal 9 (2), 183-196.
Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research 18 (1), 39-50.
Gray, E.R., Balmer, J.M., 1998. Managing corporate image and corporate reputation. Long Range Planning 31 (5), 695-702.
Gualandris, J., Kalchschmidt, M., 2015. Supply risk management and competitive advantage: A misfit model. International Journal of Logistics Management 26 (3), 459-478.
Hair, J.F., Black, W.C., Babin, B.J., 2013. Multivariate data analysis: A global perspective: International version, 7th ed. Pearson Education, United Kingdom.

Iyer, R.K., Sarkis, J., 1998. Disaster recovery planning in an automated manufacturing environment. IEEE Transactions on Engineering Management 45 (2), 163-175.
Jarvis, C.B., MacKenzie, S.B., Podsakoff, P.M., 2003. A critical review of construct indicators and measurement model misspecification in marketing and consumer research. Journal of Consumer Research 30 (2), 199-218.
Jayaram, J., Pathak, S., 2013. A holistic view of knowledge integration in collaborative supply chains. International Journal of Production Research 51 (7), 1958–1972.
Jüttner, U., 2005a. Supply chain risk management. The international journal of logistics management 16 (1), 120-141.
Jüttner, U., 2005b. Supply chain risk management: Understanding the business requirements from a practitioner perspective. The international journal of logistics management 16 (1), 120–141.
Jüttner, U., Maklan, S., 2011. Supply chain resilience in the global financial crisis: an empirical study. Supply Chain Management-an International Journal 16 (4), 246-259.
Kildow, B.A., 2011. A Supply Chain Management Guide to Business Continuity. AMACOM, New York, NY.
Klassen, R.D., Whybark, D.C., 1999. The impact of environmental technologies on manufacturing performance. Academy of Management Journal 42 (6), 599-615.
Kleindorfer, P., Saad, G., 2005. Managing disruption risks in supply chains. Production and operations management 14 (1), 53-68.
Li, H., Bingham, J.B., Umphress, E.E., 2007. Fairness from the top: Perceived procedural justice and collaborative problem solving in new product development. Organization Science 18 (2), 200–216.
Lindell, M.K., Whitney, D.J., 2001. Accounting for common method variance in cross-sectional research designs. Journal of Applied Psychology 86 (1), 114-121.
Malhotra, N.K., Kim, S.S., Patil, A., 2006. Common method variance in IS research: A comparison of alternative approaches and a reanalysis of past research. Management Science 52 (12), 1865-1883.
Montshiwa, A.L., Nagahira, A., Ishida, S., 2016. Modifying business continuity plan (BCP) towards an effective auto-mobile business continuity management (BCM): A quantitative approach. Journal of Disaster Research 11 (4), 691-698.
Narasimhan, R., Das, A., 2001. The impact of purchasing integration and practices on manufacturing performance. Journal of Operations Management 19 (5), 593-609.
Norrman, A., Jansson, U., 2004. Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident. International Journal of Physical Distribution & Logistics Management 34 (5), 434-456.
Ojha, D., Gokhale, R.A., 2009. Logistical business continuity planning-scale development and validation. International Journal of Logistics Management 20 (3), 342-359.
Peck, H., 2005. Drivers of supply chain vulnerability: An integrated framework. International Journal of Physical Distribution & Logistics Management 35 (4), 210-232.
Peck, H., 2006. Reconciling supply chain vulnerability, risk and supply chain management. International Journal of Logistics: Research and Applications 9 (2), 127–142.
Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. Journal of Applied Psychology 88 (5), 879.
Prud'homme, A.M., 2008. Business continuity in the supply chain: Planning for disruptive events, Department of Marketing and Supply Chain Management. Michigan State University, East Lansing, MI
Revilla, E., Saenz, M.J., 2017. The impact of risk management on the frequency of supply chain disruptions. A configurational approach. International Journal of Operations & Production Management 37 (5), 557-576.
Richardson, H.A., Simmering, M.J., Sturman, M.C., 2009. A tale of three perspectives: Examining post hoc statistical techniques for detection and correction of common method variance. Organizational Research Methods 12 (4), 762-800.

Rindova, V.P., Williamson, I.O., Petkova, A.P., Sever, J.M., 2005. Being good or being known: An empirical examination of the dimensions, antecedents, and consequences of organizational reputation. Academy of Management Journal 48 (6), 1033-1049.
Schlegel, G.L., Trent, R.J., 2014. Supply Chain Risk Management: An Emerging Discipline. CRC Press, United Kingdom.
Shah, R., Ward, P.T., 2007. Defining and developing measures of lean production. Journal of Operations Management 25 (4), 785–805.
Sheffi, Y., 2015. The Power of Resilience: How the Best Companies Manage the Unexpected. The MIT Press, Cambridge, MA.
Sheffi, Y., Rice, J.B., 2005. A supply chain view of the resilient enterprise. MIT Sloan Management Review 47 (1), 41-48.
Siemsen, E., Roth, A., Oliveira, P., 2010. Common method bias in regression models with linear, quadratic, and interaction effects. Organizational Research Methods 13 (3), 456–476.
Simsek, Z., Veiga, J.F., Lubatkin, M.H., 2007. The impact of managerial environmental perceptions on corporate entrepreneurship: Towards understanding discretionary slack's pivotal role. Journal of Management Studies 44 (8), 1398-1424.
Stecke, K.E., Kumar, S., 2009. Sources of supply chain disruptions, factors that breed vulnerability, and mitigating strategies. Journal of Marketing Channels 16 (3), 193-226.
Steenkamp, J.-B., Baumgartner, H., 1998. Assessing Measurement Invariance in Cross - National Consumer Research. Journal of Consumer Research 25 (1), 78-107.
Stock, J.H., Wright, J.H., Yogo, M., 2002. A survey of weak instruments and weak identification in generalized method of moments. Journal of Business & Economic Statistics 20 (4), 518–529.
Torabi, S.A., Baghersad, M., Mansouri, S.A., 2015. Resilient supplier selection and order allocation under operational and disruption risks. Transportation Research Part E-Logistics and Transportation Review 79 22-48.
Voorhees, C.M., Brady, M.K., Calantone, R., Ramirez, E., 2016. Discriminant validity testing in marketing: an analysis, causes for concern, and proposed remedies. Journal of the academy of Marketing Science 44 (1), 119-134.
Wagner, S.M., Bode, C., 2006. An empirical investigation into supply chain vulnerability. Journal of Purchasing and Supply Management 12 (6), 301-312.
Wagner, S.M., Kemmerling, R., 2010. Handling nonresponse in logistics research. Journal of Business Logistics 31 (2), 357-381.
Waters, D., 2011. Supply Chain Risk Management: Vulnerability and Resilience in Logistics, 2nd ed. Kogan Page, London.
Wildgoose, N., Brennan, P., Thompson, S., 2012. Understanding your supply chain to reduce the risk of supply chain disruption. Journal of business continuity & emergency planning 6 (1), 55-67.
Williams, L.J., Hartman, N., Cavazotte, F., 2010. Method variance and marker variables: A review and comprehensive CFA marker technique. Organizational Research Methods 13 (3), 477-514.
Wooldridge, J.M., 2003. Econometric analysis of cross section and panel data. MIT Press, Boston, MA.
Zhang, D., Linderman, K., Schroeder, R.G., 2012. The moderating role of contextual factors on quality management practices. Journal of Operations Management 30 (1-2), 12-23.
Zhao, L., Huo, B.F., Sun, L.Y., Zhao, X.D., 2013. The impact of supply chain risk on supply chain integration and company performance: A global investigation. Supply Chain Management: An International Journal 18 (2), 115-131.
Zsidisin, G.A., Melnyk, S.A., Ragatz, G.L., 2005. An institutional theory perspective of business continuity planning for purchasing and supply management. International Journal of Production Research 43 (16), 3401-3420.
Zsidisin, G.A., Wagner, S.M., 2010. Do perceptions become reality? The moderating role of supply chain resiliency on disruption occurrence. Journal of Business Logistics 31 (2), 1-20.