The impact of Business Continuity Management (BCM) on Supply Chain Resilience constituents: a quantitative analysis

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Abstract

Purpose. To date, scholars have not devolved significant attention to the effectiveness of BCM or to its role in building supply chain resilience, whereas an increasing number of practitioners regard it as the gold standard. The aim of the paper is to investigate the influence of BCM on the focal company's performance in face of supply chain disruptions.

Design/methodology/approach. The theoretical framework was developed using Supply Chain Resilience (SCRES) constituents. Hypotheses relied on the contribution of BCM to reduce supply chain vulnerability and performance loss. The data set of the 2017 BCI Supply Chain Resilience Report was used for testing the hypotheses. Preliminary statistical analysis was implemented via SPSS software package. Partial least square-based structural equation modelling, with reflective constructs for both exogenous and endogenous variables, was adopted through SmartPLS3.

Findings. Results demonstrate that BCM implementation reduces vulnerability and mitigates operational performance loss against supply chain disruptions. The study unveils BCM's holistic contribution to SCRES: visibility, collaboration and agility are the most influenced SCRES constituents. Insurance coverage has a significant positive moderation effect.

Originality. The majority of extant SCRES literature considered BCM only as a practice and mainly focused on BC plans. In this paper BCM is conceptualised as a management system which influences different organisational dimensions, establishing multiple connections with SCRES. Overall, this is the first study that quantitatively investigate the role of BCM on SCRES.

Keywords: *supply chain disruption, supply chain resilience, business continuity management, SEM.*

1. Introduction

Today organizations deal with high levels of uncertainty, due to a wider and increasingly complex threat landscape. A 2018 study from the Business Continuity Institute (BCI) shows how most organizations experienced at least one incident to their supply chains in the previous twelve months[1], revealing the need for higher levels of supply chain resilience.

To be able to mitigate the impact of such disruptions, organizations should develop a business continuity management system, which can help increase supply chain resilience[2]. Over the past decade, BCM adoption has risen significantly and expanded across supply chains, as many organizations started requiring their suppliers to implement BCM processes and procedures. Similarly, third-party vendors certifications against BCM standards, such as ISO 22301, have increased from 12% in 2010 to 51% in 2018[3]. However, despite its rapid diffusion and establishment as a gold standard among practitioners, scholars have not yet devolved significant attention to the effectiveness of BCM in the supply chain.

Conversely, supply chain resilience (SCRES) as a field of study has been growing through the years, especially as a response to large-scale, low-probability and highly disruptive events[4][5][6][7].This was the case of the MIT Centre for Transportation and Logistics that developed a new stream of research on how to counter terror attacks to the supply chain after September 11[8]. SCRES can be conceptualised as the adaptive capability to prepare for unexpected events and respond and recover from disruptions while sustaining operations[9]. In terms of operationalization, SCRES can be articulated over different resilience constituents that are often recurring in the literature[10].

Given this definition of SCRES, it is possible to appreciate how BCM could influence levels of resilience, given that its primary goal is to build mitigation measures and establish a preparedness culture within the focal company and its suppliers. Nonetheless, scholarly research on SCRES has not yet investigated thoroughly the potential impact of BCM as a resilience capability building process.

Starting from these premises, the aim of the paper is to investigate the influence of BCM on the focal company's performance and ability to prevent losses when facing supply chain disruptions. SCRES constituents will constitute the metrics to quantify BCM's impact. To this end, the following research question is set forth:

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[2] ISO 22301 (2019). ISO 22301:2019 - SOCIETAL SECURITY BUSINESS CONTINUITY MANAGEMENT SYSTEMS - REQUIREMENTS

[3] Muhammad, K., Elliot, R., Thomas, C. (2019). *BCI Supply Chain Resilience Report 2019*. The BCI. https://insider.zurich.co.uk/app/uploads/2019/11/BCISupplyChainResilienceReportOctober2019SingleLow1.pdf

[4] Caniato, F. and Rice, J. (2003). Building a Secure and Resilient Supply Network. *Supply Chain Management Review*. [online] Available at: http://web.mit.edu/scresponse/repository/Rice_SCResp_Article_SCMR.pdf [Accessed 8 May 2019].

[5] Christopher, M. and Peck, H. (2004). Building the Resilient Supply Chain. *The International Journal of Logistics Management*, 15(2), pp.1-14.

[6] Sheffi, Y. and Rice, J. (2005). A Supply Chain View of the Resilient Enterprise. *MIT Sloan Management Review*. Available on line at: https://pdfs.semanticscholar.org/d811/8bf7c3623cd00f6f73f274d741b804419f6c.pdf [Accessed 8 May 2019].

[7]Datta, P. (2017), "Supply network resilience: a systematic literature review and future research", The International Journal of Logistics Management, Vol. 28 No. 4, pp. 1387-1424.

[8] Ibid.

[9] Ponomarov, S.Y. and Holcomb, M.C. (2009), "Understanding the concept of supply chain resilience", *The International Journal of Logistics Management*, Vol. 20 No. 1, pp. 124-143. https://doi.org/10.1108/09574090910954873

[10] Christopher and Peck, 2004

RQ: "*Which Business Continuity Management practices boost SCRES constituents, thus mitigating performance losses and vulnerability in the face of disruptive events?*"

The study adopts a quantitative research approach, where supply chain resilience is taken as the conceptual lens for formulating the hypotheses to be tested.

The rest of the paper is organised as follows. Section 2 includes a critical review of the relevant scientific and professional literature on BCM and SCRES. Following, section 3 introduces the theoretical framework and the hypotheses to be tested. Then, Section 4 and 5 present the study methodology and results. Finally, Section 6 is devoted to the conclusions and directions for future research.

2. Background knowledge

According to Ponomarov and Holcomb (2009)[11] "resilience is the adaptive capability of the organisation to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function".

In line with such definition, most authors frame SCRES according to some formative elements that stem from seminal papers in the field, such as the following:

- Agility: "the ability to respond rapidly to unpredictable changes in demand or supply"[12][13];
- Velocity: "the total time it takes to move product and materials from one end of the supply chain to the other"[14];
- Visibility: "a clear view of upstream and downstream inventories, demand and supply conditions, and production and purchasing schedules"[15];
- Flexibility: is emphasized by Sheffi (2005)[16] and Ponis and Koronis (2012)[17] as one of the three main ways to build SCR;
- Collaboration: "a high level of collaborative working across supply chains can significantly help mitigate risk"[18].

[11] Ponomarov and Holcomb, 2009
[12] Christopher and Peck, 2004
[13] Datta, 2017
[14] Ibid.
[15] Ibid.
[16] Sheffi, 2015
[17] Ponis, S. and Koronis, E. (2012). Supply Chain Resilience: Definition Of Concept And Its Formative Elements. *Journal of Applied Business Research*, 28(5), p.921.
[18] Datta, 2017

Building on these ideas, Caniato and Rice[19] identify Business Continuity Planning as an optimal resilience measure and recommend assessing vulnerabilities, reporting threats and embedding the plans. On a similar note, Ponis and Koronis (2012)[20] stress the importance of contingency plans and recovery strategies as building blocks of SCRES. In their paper discussing the integration of SCRES theory and practitioners' knowledge, Scholten et al. (2014)[21] identify different phases of SCRES, such as: risk prevention, crisis management and recovery. Dabhilkar et al. (2016)[22] group bundles of resilience practices into four main categories: reactive, proactive, internal, and external. Their findings state that proactive practices, including planning for disruptions, have a positive impact on SCRES.

The literature discussing the implications of BCM implementation has so far fallen short of investigating its implementation across the supply chain; however, SCRES literature frequently refers to some BCM practices as helpful resilience practices but fails in addressing the role of BCM as a holistic managerial approach to mitigate supply chain disruptions.

Most of the advancement in the BCM discipline comes from practitioners, through international technical standards and guidelines, which envision the BCM lifecycle as follows[23]:

1) Embedding: getting approval from top management, so that the necessary resources and commitment will be devoted to the BCM lifecycle;
2) Business Impact Analysis (BIA): Determining what the critical processes are within an organization;
3) Design: Building the Business Continuity Plan;
4) Implementation: Making the plan operative;
5) Validation: Testing and exercising the plan to make improvements if needed.

3. Theoretical Framework

The paper identifies two main metrics to understand the overall impact of BCM implementation. These consist in the two principal goals of business continuity, namely reducing the company's vulnerability (VUL) and its performance loss (PLR) in the case of a disruption. Specifically, in this case, the analysis focuses on supply chains. It is worth stressing that the choice of these two specific variables is also deeply rooted in the international technical guidelines and the literature mentioned in this paper. The main goal of BCM is indeed to reduce vulnerability and performance losses to ensure the focal company stays operational, including in the case of a disruption to its vendors and suppliers (ISO 22301: 2019).

Following this line of reasoning, the authors propose the first two hypotheses as follows:

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[22] Dabhilkar et al., 2016
[23] Higgins, D. (2018). *Good practice guidelines*. 2nd ed. Reading: The Business Continuity Institute.

HP1: BCM implementation positively contributes to reduce the focal company's vulnerability to supply chain disruption (VUL) by enhancing SCRES constituents.

HP2: BCM implementation positively contributes to reduce the focal company's performance loss under supply chain disruption (PLR) by enhancing SCRES constituents.

As for the relationship between BCM implementation and SCRES, BCM contributes to better visibility by urging BC managers to perform a continuity requirements analysis (CRA), where critical suppliers are identified to ensure there are no single points of failure or high-risk concentrations (Higgins, 2018; ISO 22301:2019). This kind of analysis is also supported by the Business Impact Analysis (BIA) and Risk Assessment phases (Higgins, 2018; ISO 22301:2019). Additionally, previous studies pointed out how a BIA can help have better visibility over possible disruptive scenarios, such as a data centre failure or a damaged product, as well as a better understanding of recovery time and expected financial losses (Lee, T., Chee, A., 2014). A 2010 survey from the Massachusets Institute of Technology (MIT) stresses this point, as the majority of the practitioners in the study report that BCPs are effective in countering disruptions in the supply chain (Arntzen, 2010). Similarly, a study from the Business Continuity Institute directly highlights how organizations with a BCP tend to have a better resilience culture and visibility over both risks and disruptive events (Muhammad *et al*., 2019). The influence of collaboration and visibility on the supplier's and buyer's recovery capabilities was analysed by Namdar *et al*. (2018) with direct reference to the improvement of BCM implementation.

However, it was not possible to identify any prior research which provides theoretical arguments or empirical evidence to establish an explicit relationship between the implementation of core BCM practices and observed improvements on supply chain velocity or flexibility. Hence, the analysis comprises only those constructs that meet two basic requirements: i) they are recurrent in SCRES literature and are widely adopted; ii) they could be analysed based on the data sample.

Based on the reported background, BCM implementation factors and requirements can be translated into formative elements of a sub-set of SCRES constituents:

- Collaboration (COL);
- Agility (AGI);
- Visibility over disruptive events (VoE),
- Visibility over risks (VoR)
- Visibility over suppliers' activities and performance (VoS).

Accordingly, HP1 and HP2 can be turned into more specific and testable sub-hypotheses:

HP1a: BCM implementation positively contributes to reduce the focal company's vulnerability to supply chain disruption (VUL) by enhancing supply chain collaboration (COL).

HP1b: BCM implementation positively contributes to reduce the focal company's vulnerability to supply chain disruption (VUL) by enhancing visibility over supply chain risks (VoR).

HP1c: BCM implementation positively contributes to reduce the focal company's vulnerability to supply chain disruption (VUL) by enhancing visibility over suppliers' activities and performance (VoS).

HP1d: BCM implementation positively contributes to reduce the focal company's vulnerability to supply chain disruption (VUL) by enhancing visibility over disruptive events (VoE).

HP1e: BCM implementation positively contributes to reduce the focal company's vulnerability to supply chain disruption (VUL) by enhancing agility (AGI).

HP2a: BCM implementation positively contributes to reduce the focal company's performance loss under supply chain disruption (PLR) by enhancing supply chain collaboration (COL).

HP2b: BCM implementation positively contributes to reduce the focal company's performance loss under supply chain disruption (PLR) by enhancing visibility over supply chain risks (VoR).

HP2c: BCM implementation positively contributes to reduce the focal company's performance loss under supply chain disruption (PLR) by enhancing visibility over suppliers' activities and performance (VoS).

HP2d: BCM implementation positively contributes to reduce the focal company's performance loss under supply chain disruption (PLR) by enhancing visibility over disruptive events (VoE).

HP2e: BCM implementation positively contributes to reduce focal company's performance loss under supply chain disruption (PLR) by enhancing agility (AGI).

Finally, the commitment and involvement of senior management are increasingly recognised as pre-conditions for any successful business continuity management (BCM) initiative. An effective BCM programme starts at the top of the organization, with senior management conveying the importance of BCM through the entire organization. In turn, this might have a positive effect on SCRES components, as SCRES is one of the goals of BCM (Germain *et al.*, 2012; ISO 22301, 2019; Kato and Charoenrat, 2018a). Gartner Research (2010) considers Executive Management Commitment for the BCM programme as the number one best practice for creating and maintaining effective business continuity management plans. Coherently, we posit a third hypothesis:

HP2: Top Management leadership and commitment to BCM (TMC) has a positive effect on supply chain resilience (SCRES).

According to the conceptualisation of resilience through its constituents and similarly to HP1 and HP2, also HP3 can be turned into more specific and testable sub-hypotheses:

HP3a: Top Management leadership and commitment to BCM (TMC) has a positive effect on supply chain collaboration (COL).

HP3b: Top Management leadership and commitment to BCM (TMC) has a positive effect on the visibility over supply chain risks (VoR).

HP3c: Top Management leadership and commitment to BCM (TMC) has a positive effect on the visibility over suppliers' activities and performance (VoS).

HP3d: Top Management leadership and commitment to BCM (TMC) has a positive effect on the visibility over disruptive events (VoE).

HP3e: Top Management leadership and commitment to BCM (TMC) has a positive effect on agility (AGI).

Contingency theory suggests that measures and actions for optimal results must consider internal and external business environment[24]. The theory applies to turbulent and uncertain environments, since it explains how organizations can implement proactive measures in such contexts[25][26]. Furthermore, this study examines the moderating effect of three contextual variables: industry sector (SEC), company size (SIZE), and insurance coverage (INS). The first two consider variations across the sample, while the third one examines the mitigating impact of insurance, which is often present in industry research[27].

The complete theoretical framework is reported in Figure 1.

[24] Powell, T.C. (1992). Organizational alignment as competitive advantage. *Strategic Management Journal*, 13 (2), pp. 119-134.
[25] Søgaard, B., Skipworth, H.D., Bourlakis, M., Mena, C., Wilding, R. (2019). Facing disruptive technologies: aligning purchasing maturity to contingencies. *Supply Chain Management: An International Journal*, 24 (1), pp. 147-169.
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[27] Alcantara et al., 2018

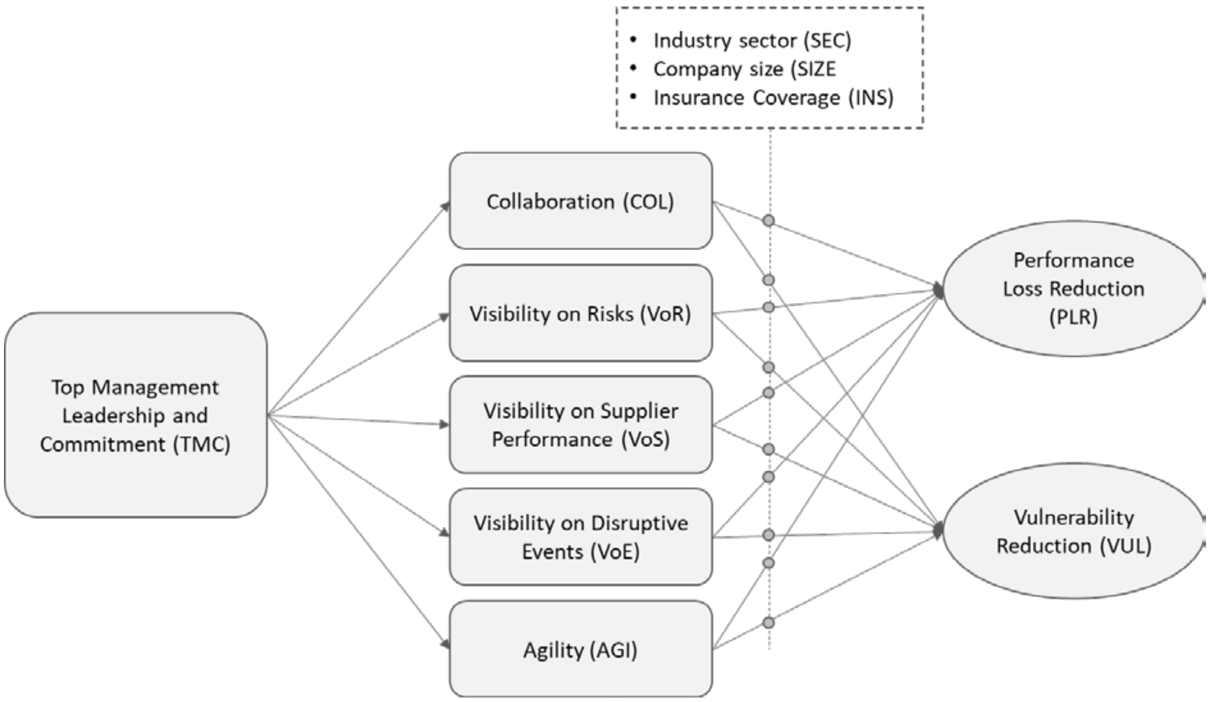

Figure 1. Theoretical framework.

4. Study methodology

4.1 Dataset

The dataset used in this study was created by the Business Continuity Institute (BCI) by administering a questionnaire to SCM and BCM managers to publish the "BCI Supply Chain Resilience report 2017" which is one of the earliest and most comprehensive studies focusing on origins, causes and consequences of supply chain disruptions worldwide. The BCI survey captures different aspects of supply chain management and BCM, ranging from threats to business continuity to preparedness activities and arrangements. The original questionnaire is made of 28 questions put in different forms, e.g. "Yes, No", multiple choices or Likert scale degree of agreement. The survey had an international scope, since the 408 respondents came from 64 different countries, and covered a wide spectrum of economic sectors. Company size was captured through the number of employees and the annual revenue figures.

Seventeen (17) questions out of the 28 present in the original questionnaire were selected and used for this study and the final sample underwent a process of data-cleaning before being analysed, to make sure any possible unreliable entries were excluded at the beginning of the process.

4.2 Modelling and analysis method

Partial Least Square Structural Equation Modelling (PLS-SEM model) was used to test the hypotheses and the moderation effect of contextual variables. Specifically, the paper adopts a

PLS over covariance-based SEM as it is suitable for this type of samples[28] and with formative multilevel constructs[29].

The analysis employed Smart PLS software package version 3, with a data set that includes coded questions as input. A path model was used to test the impact of BCM on target variables. The model is twofold, as it includes a structural model, to test the paths between the constructs, and a measurement model to show the relationships between each construct and its indicators. Each SCRES constituent is constructed as a reflective model for both exogenous (TMC, SIZE, INS and SEC) and endogenous (COL, VoR, VoS, VoE and AGI) variables.

One of the main advantages of the PLS-SEM method is creating, analysing and evaluating the effect of moderation and mediation variables[30]. The moderation effect tests the impact of a third variable on a direct relationship among two other variables. It also captures the strength and direction of a relationship between two constructs in the model. This paper looks at the moderation effect of contextual (SIZE, INS and SEC) variables on the target variables (PLR and VUR).

The analysis includes the bootstrapping technique to estimate the significance of path coefficients and item weights, relying on random sampling.

5. Results

Results are organised in two parts. The first one focuses on the relationships between BCM and PLR (Model 1), while the second one on the relationship between BCM and VUR (Model 2). Both models take into consideration the possible effect of moderating variables. For the purposes of this paper, a p-value of 0.05 is the threshold for statistical significance.

The average variance extracted (AVE) measures the validity of the reflective measurement model across all items associated with a particular construct[31]. An acceptable threshold for the AVE is 0.50 or higher. This level or higher indicates that, on average, the construct explains 50% or more of the variance of its items[32]. Another measure of internal consistency reliability is Cronbach's alpha, which assumes the same thresholds but yields lower values than the composite reliability. A Cronbach's alpha higher than 0.5 is in the acceptable range. The third criterion for acceptability considered in this study is the composite reliability; a value between 0.60 and 0.70 is considered as "acceptable in exploratory research," whereas results between 0.70 and 0.95 represent "satisfactory to good" reliability levels (Sarstedt *et al.*, 2017).

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[32] Ibid.

5.1 Model 1 – BCM contribution to Performance Loss Reduction (PLR)

The evaluation of the PLS-SEM results begins with an assessment of Model 1. Path coefficients are positive and reveal a positive relationship between TMC, BCM, SCRES constituents (COL, AGI, VoE, VoR and VoS) and PLR. Furthermore, all the outer loadings of both endogenous and exogenous variables resulted positive and above 0.70, with only one endogenous with an outer loading factor of 0.5489, indicating that all the variables exhibit a good or sufficient level of reliability (i.e., >0.50).

All the variables show values of AVE higher than 0.5, ranging from 0.6213 to 1, meaning that all the constructs can capture much more than the 50% of the variance of its items. Also, Composite Reliability and R^2 values are within an acceptable range, except for VoE, which returned the lowest R^2 value (0.0005), which means that the component is not capable to capture the variability of VoE. The assessment of the internal consistency of the model, assessed through Cronbach's alpha, yields satisfactory (between 0.7 and 0.95) and acceptable (between 0.6 and 0.7) values. Table II provides t-Student values to test the statistical significance of the relationships among variables. Values higher than 1.6 confirm statistically significant relationships and their effect (coefficient) must be taken into consideration in the interpretation of the model.

A separate model was used to assess the mediation effect of resilience constituents on the relationship between TMC and PLR. For this purpose, the new model includes both the direct relationship between TMC and PLR and the indirect effect through AGI, VoR, VoS. VoE, and COL. The path coefficient for the direct relationship equals 0.123, showing a somewhat positive influence that is however not statistically significant (t-Student is 0.472, lower than 1.6).

The analysis on contextual variables (SEC, SIZE, and INS) shows a positive moderating effect of SIZE and INS on PLR, while the bootstrapping confirms that only INS has a statistically significant relationship (path coefficient is 0.276 with a t-Student of 2.78).

A synthesis of results of Model 1 is reported in Figure 2.

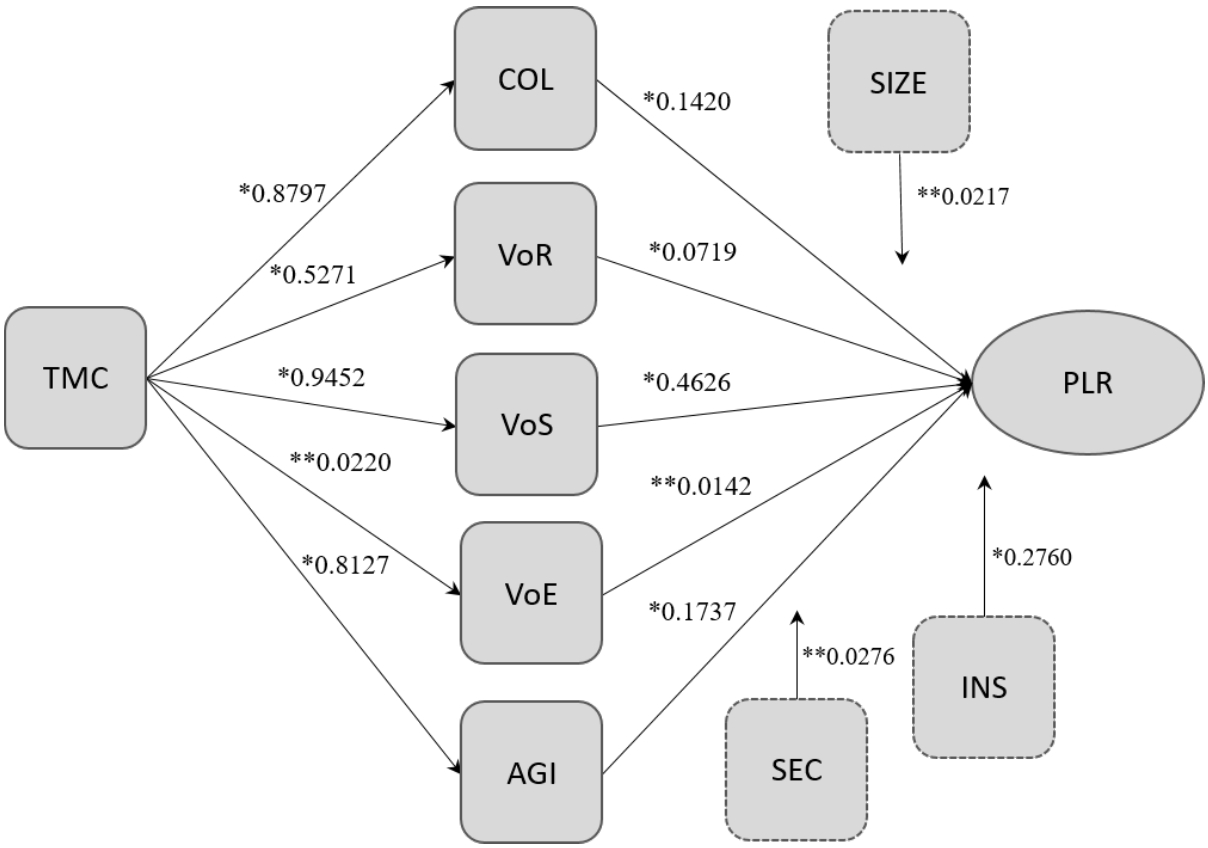

Figure 2. Outcome of Model 1 (* = statistically significant at p<0.05; ** = not statistically significant).

5.2 Model 2 – BCM contribution to Vulnerability reduction (VUL)

The primary aim of Model 2 is to estimate the weights of the dependent variable (VUL) on the independent variables (TMC, COL, VoR, VoS, VoE and AGI), as well as to investigate the effect of contextual variables (SIZE and INS). The first step of the evaluation includes the basic model, without any moderation and mediation effects.

The path coefficient is positive and shows a positive relationship of TMC with SCRES constituents (COL, AGI, VoE, VoR and VoS), as well as the positive influence of SCRES constituents on VUR. All the outer loadings of both exogenous and endogenous variables are evaluated. Furthermore, all the outer loadings are positive and above 0.70, indicating that all indicators exhibit a sufficient level of reliability (>0.50) and have a suitable level of relevance.

Based on the AVE for Model 2, all the variables have values higher than 0.5, which means on average the construct can capture more than 50% of the variance of its items. Further, the composite reliability levels for each variable can be considered as acceptable, as well as the R^2 values, with the exception of VoE, which is considerably low (0.0005). This means this component is unable to capture the variability of VoE. The last criterion for the assessment of Model 2 is Cronbach's alpha. Noticeably, in three criteria, namely AVE, composite reliability and Cronbach's alpha, both AGI and VoE have values equal to one. These variables share the feature of including only one component, such as AGI1 and VoE1.

Again, a separate model was used to assess the mediation effect of TMC on VUR. The new model considers both the direct relationship of TMC on VUR and the mediation effect of TMC on VUR through the SCRES constituents. The direct relationship path coefficient is 0.033, which illustrates the positive influence and the t-statistics amounts to 0.127, hence lower than 1.6. Therefore, this direct moderation effect of TMC on VUR is not statistically significant, thus revealing that there is a full mediating effect of TMC on VUR through SCRES constituents. The investigation of the moderating effect of contextual variables (INS, SEC and SIZE) on VUR returned a positive moderation of SIZE on VUR; however, the bootstrapping did not confirm a statistically significant relationship (t-statistics=1.039). Also, the moderating effect of SEC on VUR is not statistically significant. Finally, INS registers a positive path coefficient of 0.142 and a partial significance (t-statistics=1.53). Overall, the analysis of the moderation effect shows that INS is the only statistically important variable and has partial influence on reducing VUR.

A synthesis of results on Model 2 is shown in Figure 3.

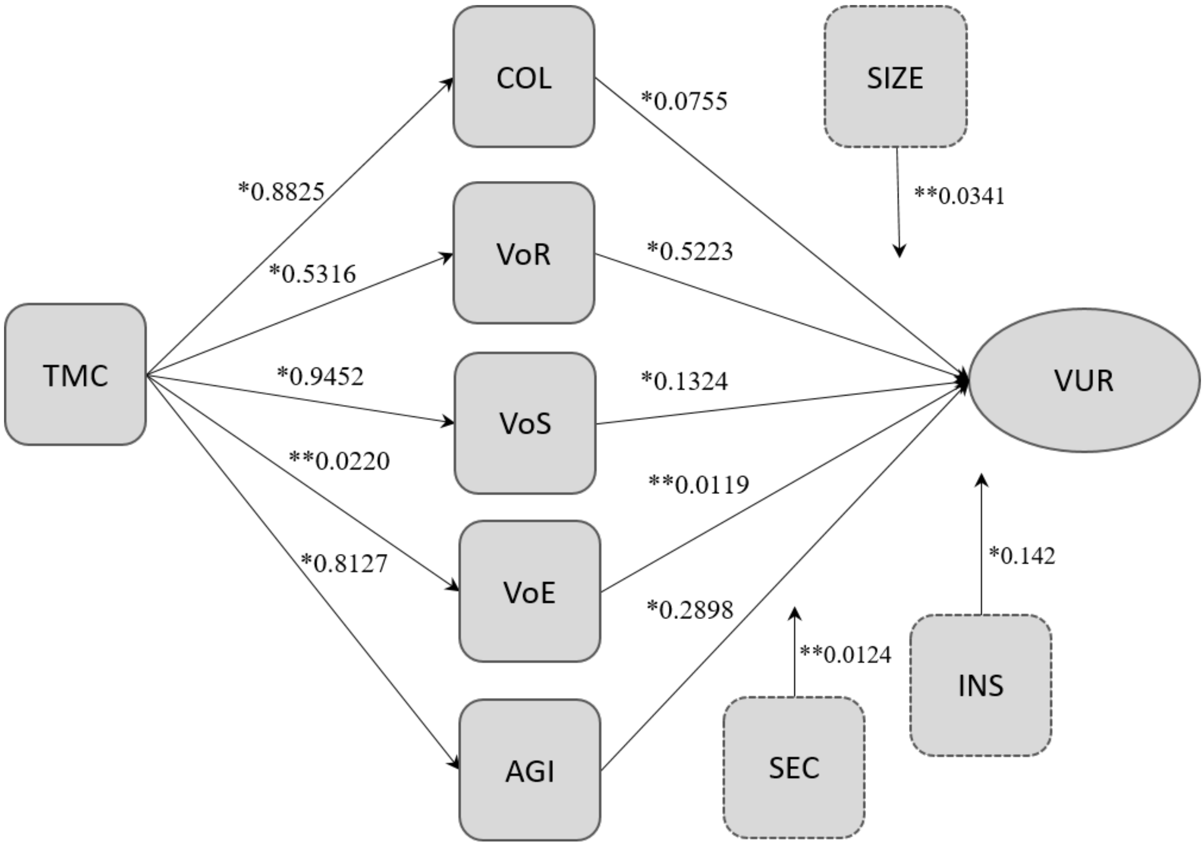

Figure 3. Outcome of Model 2 (* = statistically significant at p<0.05; ** = not statistically significant).

5.3 – Discussion

According to the findings, BCM implementation positively contributes to both vulnerability and performance loss reduction through four resilience constituents, namely: agility, visibility on risks, visibility on suppliers' performance, and collaboration. BCM positively influences the reduction of performance loss through its contribution to a better visibility on suppliers, higher agility in the response and improved collaboration with suppliers. Besides, BCM also contributes to reduce focal company's vulnerability to supply chain disruptions, mainly thanks to higher visibility on risks and suppliers' arrangements, as well as higher agility, supported by effective BC plans.

Similarly, BCM boosts performance loss by enhancing the visibility on disruptive events. This is consistent with the focus of BCM on preparedness and business continuity planning, which is achieved by collecting related information from suppliers, developing impact and risk assessments that incorporate suppliers' BCM arrangements and performance. This eventually turns into a quick and effective response in the face of a disruptive supply chain event. As highlighted in the literature review, the value of conducting risk assessments and implementing contingency plans has been largely discussed in supply chain management literature, but no previous studies addressed the specific role and contribution of BCM.

Furthermore, results reveal that all the BCM components directly linked to SCRES constituents receive a positive influence from Top Management leadership and commitment (TMC).

The findings emphasise the role and value of BCM implementation not just as an effective way of building BC plans – as previous works state – but as a comprehensive management approach to building SCRES.

Results are not affected by industrial sector and size (the moderating effect of SIZE and SEC resulted not significant), indicating a key feature of BCM, its adaptability. BCM standards and international guidelines clearly indicate that plans should be adjusted according to sectors, size and particular needs of an organization, making them highly flexible to different contexts (ISO, 2019). This could be a feasible interpretation of the lack of impact of SIZE and SEC on the results. Finally, the degree of insurance coverage resulted to have a positive moderating effect on reducing the extent of financial losses.

6. Conclusions

The literature on SCRES has increased dramatically in recent years; however, scholars have not devolved significant attention to the evolution and diffusion of BCM as a core resilience practice. On the contrary, BCM has received increasing attention by companies and professionals, so today BCM implementation is key to organizations in mitigating disruptive events.

This study employed a quantitative research approach to investigate the role and contribution of BCM to the focal company's vulnerability and performance loss reduction during supply chain disruptions. To this end, SCRES constituents formed the bases of the theoretical framework. The authors tested the hypotheses using the data set of the BCI Supply Chain

Resilience survey 2017.

Results confirm that BCM implementation grants the focal company lower vulnerability and reduced performance loss in the face of supply chain disruptions. In particular, the positive contribution mainly comes from the improvement of specific resilience capabilities: visibility on suppliers, visibility on risks, velocity, and collaboration. In addition, top management leadership and commitment proved to be a critical success factor as pre-condition.

To the best of authors' knowledge, this is the first study which implements a quantitative research approach for a better and more detailed understanding of the relationship between BCM and SCRES. The study originally contributes to research in the SCRES area by proving that BCM should not be limited to the development of well-designed BC plans, since it should work as an effective resilience capability building process. Moreover, according to the results, future research on SCRES should take into proper consideration BCM arrangements, within each single organisation and in the buyer-supplier relationships across the supply chain. The BCM role could be conceptualised either as a set of formative elements of multiple resilience constituents or as bundles of practices.

The present study also has relevant practical implications. It offers BC and SC managers clear and convincing insights on how and why BCM contributes to higher SCRES, so the scope of its implementation should be extended to supply chain relationships. On the other hand, it also makes clear that some resilience constituents, such as visibility on events, are not well supported by BCM implementation. It implies that building SCRES requires a broader and harmonised set of approaches, practices and solutions at both strategic and tactical level. The results also confirm that the insurance coverage (e.g. Contingent Business Interruption insurance) should be regarded as a complementary risk treatment option and not a substitute of proactive and more holistic risk mitigation approaches, such as BCM.

However, the role and contribution of BCM to SCRES has only been partly proven in the present study. Working on a pre-existing questionnaire and dataset offered a world-scale view and a large sample; yet, it limited the possibility of achieving a perfect coverage of all the plausible relationships between BCM components and SCRES constituents. It was not possible to investigate any possible relationship between BCM implementation and flexibility or redundancy.

Future research is then needed to fully unfold the BCM - SCRES relationship. Both quantitative research, grounded on more tailored surveys and data collection processes, and qualitative research, to better capture managerial and other soft characteristics of BCM and SCRES, are called for. Furthermore, another direction for future studies could be to investigate whether size and industry affect top management commitment to BCM. In this paper this type of analysis was considered out of scope since the main goal was to verify the impact of SCRES constituents. Finally, further scientific research is sought for building a comprehensive and fully validated BCM Maturity Model covering both intra- and interorganisational practices.

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