

Examining Global Supply Chain Risks: Development of Belt & Road Initiative (BRI) Supply Chain Disruption Model

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Résumé de l'article

Les risques liés à la chaîne d'approvisionnement mondiale (GSC) augmentent, encore plus avec le dévoilement de l'initiative « *Belt and Road* » (BRI). Cependant, peu de connaissances existent sur le sujet. En utilisant une double approche, cette étude a systématiquement passé en revue 178 articles de la littérature et a utilisé un cadre de risques de la GSC pour identifier les risques opérationnels, d'offre, de demande et autres risques environnementaux. Ensuite, sur la base de fondements théoriques, des propositions ont été élaborées avant de modéliser les effets de six facteurs de risque sur les perturbations du GSC de BRI. Ce modèle fournit un cadre théorique pour développer une compréhension commune des risques du GSC BRI et facilitera l'application cohérente des connaissances dans la pratique.

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ABSTRACT

Global supply chain (GSC) risks are increasing, even more so with the unveiling of the Belt and Road Initiative (BRI). However, little knowledge exists on the subject. Using a twofold approach, this study systematically reviewed 178 articles in the literature and used a GSC risk framework to identify operational, supply, demand, and other environmental risks. Next, grounded in theoretical underpinning, propositions were developed before modelling the effects of six risk factors on BRI GSC disruption. This model provides a theoretical framework for developing a common understanding of BRI GSC risks and will facilitate the consistent application of knowledge in practice.

Keywords: global supply chains (GSCs); supply chain risk management; Belt and Road Initiative (BRI); international management; global operations

Résumé

Les risques liés à la chaîne d'approvisionnement mondiale (GSC) augmentent, encore plus avec le dévoilement de l'initiative "Belt and Road" (BRI). Cependant, peu de connaissances existent sur le sujet. En utilisant une double approche, cette étude a systématiquement passé en revue 178 articles de la littérature et a utilisé un cadre de risques de la GSC pour identifier les risques opérationnels, d'offre, de demande et autres risques environnementaux. Ensuite, sur la base de fondements théoriques, des propositions ont été élaborées avant de modéliser les effets de six facteurs de risque sur les perturbations du GSC de BRI. Ce modèle fournit un cadre théorique pour développer une compréhension commune des risques du GSC BRI et facilitera l'application cohérente des connaissances dans la pratique.

Mots-Clés : chaînes d'approvisionnement mondiales (GSC); gestion des risques de la chaîne d'approvisionnement; Belt and Road Initiative (BRI); gestion internationale; opérations mondiales

Resumen

Los riesgos de la cadena de suministro mundial (GSC) están aumentando, y más aún con la presentación de la Iniciativa de Cinturón y Carretera (BRI). Sin embargo, hay pocos conocimientos sobre el tema. Utilizando un doble enfoque, en este estudio se examinaron sistemáticamente 178 artículos de la bibliografía y se utilizó un marco de riesgos de la GSC para identificar los riesgos operacionales, de la oferta, la demanda y otros riesgos ambientales. A continuación, sobre la base de fundamentos teóricos, se elaboraron propuestas antes de modelar los efectos de seis factores de riesgo en la perturbación de la GSC del BRI. Este modelo proporciona un marco teórico para desarrollar una comprensión común de los riesgos del BRI GSC y facilitará la aplicación coherente de los conocimientos en la práctica.

Palabras Clave: cadenas mundiales de suministro (GSC); gestión del riesgo de la cadena de suministro; Iniciativa del Cinturón y la Carretera (BRI); gestión internacional; operaciones mundiales

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The internationalization of business has redefined the need for and utility of global supply chains (GSCs). GSCs provide businesses with the means of gaining worldwide access to suppliers and markets, cheap labor, and a wider range of financing options (Qazi *et al.*, 2018). Becoming part of the GSC helps businesses to benefit from internationally available opportunities (on both the demand and supply sides), increasing their profitability and efficiency and becoming sustainable in a competitive marketplace (Manuj and Mentzer, 2008a).

Despite these benefits, GSCs entail a variety of risks related to value chains and financial, security, cultural, jurisdictional, contractual, and legal aspects (Huang, 2016; Sodhi, Son, and Tang, 2012; Wiengarten *et al.*, 2016). GSC risks are defined as “the distribution of performance outcomes of interest expressed in terms of losses, probability, speed of event, speed of losses, time for detection of events, and frequency” (Manuj and Mentzer, 2008a, p. 197).

In line with this definition, GSC risks often lead to significant monetary and reputational losses to companies. Examples of GSC risks and failures include Adidas’s sales and productivity issues arising from problems with its majority Asian suppliers and Tesla failing to meet its targeted car production (Cosgrove, 2019; Fabbri, 2019; Raza, 2019). The situation is also reflected in recent reports on rising trends in supply chain (SC) disruptions, causing loss of productivity (55% of incidents) and failures costing the global economy upwards of €600 billion a year (Bowes, 2018; Zurich Insider, 2018).

The launch of global economic endeavors such as the Belt and Road Initiative (BRI) adds a new dimension to GSC risks. The unique geopolitical context, extent of trade activities, and myriad cultural, economic, and security issues associated with BRI have amplified GSC risks because BRI-related trade is susceptible to defaults and bankruptcies, the intricacies of sensitive relationships, and governance, security, and SC instability risks (Haley, 2003; Zabakhidze and Beradze, 2017). Indeed, since the launch of BRI in 2013, the Hong Kong International Arbitration Centre has handled “362 cases involving BRI jurisdictions with one third of cases involving a party from the [People’s Republic of China] and another party from another BRI country” (Chan, Cheung, and Fung, 2018, p. 1), highlighting the increasing risks in BRI-related global trade and associated activities.

Despite these growing challenges, the knowledge about GSC risks lacks coherence. Some studies have examined sources of risk (e.g. Enyinda and Mbah,

2017; Ma and Wong, 2018; Vilko, Ritala, and Hallikas, 2019), while others have developed risk frameworks (e.g. Soni and Kodali, 2013) or proposed GSC risk mitigation strategies (e.g. Christopher *et al.*, 2011; Giannakis and Papadopoulos, 2016; Qazi *et al.*, 2018). Further, there are currently no formal studies that have specifically investigated GSC risk in the BRI context. Apart from some consulting reports (e.g. Wong and Jia, 2017), there is a significant dearth of knowledge on BRI GSC risks.

In addition, the research that exists has failed to take a theoretically informed approach to systematically build knowledge about GSC risks, contributing to a further fragmentation of knowledge. This has not helped in addressing the increasing GSC risks from either a theoretical or a practical perspective.

Research Need and Theoretical Basis

The discussion in the preceding section points to a twofold gap in the knowledge. First, there has been a lack of systematic knowledge development for GSC risks, particularly in the BRI context. This has impeded the utility of existing knowledge and its beneficial application to industry, potentially increasing the vulnerability of businesses to GSC risks (Wijeratne, Rathbone, and Wong, 2018).

Second, a recent World Bank (2019) report highlights that the BRI will have a significant effect on trade and SCs across Europe, Asia, and Africa. With its ongoing expansion (comprising over 70 countries, most recently Italy), the BRI will profoundly influence global trade, underlining the need to build knowledge of BRI GSCs and associated risks. The geopolitical, economic, social, and security complexities related to BRI poses unique GSC risks that must be examined to enable the development of solutions (Huang, 2016). There have already been calls (e.g., Cullinane *et al.*, 2018) for further research on issues related to BRI GSC risks.

In addressing the aforementioned gaps in the knowledge, this study draws upon Manuj and Mentzer’s (2008a) theoretical framework of GSC risk classification and management to achieve the following two objectives: (1) to systematically examine the current body of knowledge on GSC risks, including BRI-related risks, and present a review (informed by the theoretical framework) to help understand GSC risks; (2) to identify risk factors to develop a BRI GSC risk model, which will help improve the understanding of BRI GSC risks to develop



strategies for better risk management. The model will also contribute toward building a theory of SC risk management (particularly in the BRI context).

GSC risks have typically been classified in terms of internal (e.g., operational) and external (e.g., supply/demand) risks to enable the consideration of as many risks as possible (Sofyalioğlu and Kartal, 2012). For instance, Cucchiella and Gastaldi (2006) identified both internal (e.g., internal organizational and information delays) and external (e.g., supplier quality and competitor action) sources of SC risk. Manuj and Mentzer (2008a) broadly categorized GSC risks as operational, supply, demand, and other (e.g., security risks) and identified relationships between risk factors and risk management outcomes. Sofyalioğlu and Kartal (2012) and Christopher *et al.* (2011) proposed a similar four-category classification of GSC risks.

Given its inclusiveness and similarity with other classification schemes, Manuj and Mentzer's (2008a) model was adopted by this study as the theoretical framework through which to examine and present a review of GSC risks and develop a model of BRI GSC risks. Such an approach is not only useful for the systematic development of knowledge but will also enable future studies to scaffold knowledge based on the results of this study.

BRI-Related GSC Risk Model: Rationale and Choice of Risk Factors

The rationale for choosing BRI to build a GSC risk model is multidimensional. First, there is virtually no existing research in the BRI GSC context; thus, choosing BRI as a case will help to develop new knowledge (Wang, Jie, and Abareshi, 2018). Second, the extent of the BRI endeavor, which involves over 70 countries, generates enormous business opportunities, and SCs will play a critical role in its success. Therefore, building knowledge on BRI-related GSC risks will help improve the performance of GSCs and the resulting economic developments. Third, the unique geopolitical, economic, social, and security characteristics of the BRI necessitates the development of a new research stream specifically related to BRI GSC risk in the overall body of knowledge of GSC risk. Finally, the continued expansion of the BRI (e.g., new entrants such as Italy) makes it worthwhile to begin building knowledge about BRI GSC risk.

In light of this rationale, this study identified six risk factors from an analysis of the literature for modelling purposes (see Table 2 for mapping of identified

factors to the literature). Then, following earlier research studies (Liu, 2013; Manuj and Mentzer, 2008a; Wang, Jie, and Abareshi, 2018) and the theoretical underpinning used in this study, we conceptualized and proposed relationships between identified factors and BRI GSC risk disruption to build a model. This model includes *operational* (e.g., developing managerial synergies and cross-border payment management systems), *supply/demand* (e.g., SC visibility, vendor risk profiling, and immaturity of logistics networks), and *environmental/other* (e.g., cargo movement and warehousing security) risk factors. A detailed discussion on proposed relationships involving these six risk factors is presented in the model development section.

For the purpose of this study, GSC risk factors are defined as any events, conditions, or experiences that increase the likelihood that negative SC outcomes will be created, maintained, or exacerbated (Fraser and Terzian, 2005). GSC disruption is defined as the likelihood of a disruption caused by an event, condition or experience (risk antecedent/factor) that would impact the ability of supply chain partner(s) to continuously supply products or services (Chase, Shankar, and Jacobs, 2013; p.31).

The rest of the paper is structured as follows. Next, we discuss methodology, followed by the literature findings. We then present the development of a GSC risk model using BRI GSC as a case in point. Theoretical and managerial implications, limitations of the study and possible directions for future research are provided in the next section, followed by the conclusions.

Methodology

This study drew upon an extensive body of literature to identify risks and related issues in the GSC or BRI GSC context. Consistent with guidelines for literature reviews by Durach, Kembro, and Wieland (2017), we used the following steps.

Steps 1 and 2

We clearly framed our research objectives presented in the preceding section and determined the required characteristics of studies (i.e., those focusing on GSC and BRI GSC risks), which led to the creation of keyword combinations to gather relevant literature data (see Figure 1).



Step 3

We searched the relevant literature using multiple keyword combinations. The search centered on four major databases, ScienceDirect, Emerald, EBSCOhost, and ProQuest, which were expected to yield the most relevant literature output. Given the large number of articles generated, these databases were found to be appropriate, which is consistent with prior studies (e.g., Yeboah-Assiamah, Asamoah, and Kyeremeh, 2017).

Step 4

Initially, 178 articles were downloaded based on their titles and keywords. This sample was filtered and refined using a two-step scrutiny process to arrive at a subset of the most relevant articles (see Figure 1 for an overview of the process). The first step involved identifying which of the 178 articles specifically related to GSC or BRI GSC risks. To maintain objectivity, we specified inclusion and exclusion criteria (see Table 1). Thirty-four articles did not meet inclusion criterion 1 and were excluded. The remaining 144 articles (Figure 1) were further analyzed.

TABLE 1 Inclusion/Exclusion Criteria	
Inclusion Criteria	Exclusion Criteria
1 Articles focusing on: <ul style="list-style-type: none"> • global supply chain (GSC) risks • Belt and Road Initiative (BRI) supply chain (SC) risks 	1 Articles focusing on: <ul style="list-style-type: none"> • non-GSC risk management • non-SC BRI risks • global or BRI SCs but not SC risks
2 Academic publications (e.g., journal articles, books or book chapters)	2 Non-academic publications (e.g., magazine articles)
3 Articles published between 2008 and 2018 (this 10-year publication cycle covers new GSCs such as the BRI established in 2013)	3 Articles published outside 2008-2019
4 Publication language: English	4 Non-English articles

The second scrutiny step involved reviewing the remaining 144 articles by reading their abstracts and reviewing the literature focus and results to further refine and identify the most relevant articles. This resulted in the classification of the 144 articles into two categories: those most relevant (59 articles) and those partially relevant (85 articles) to the topic. Of the 85 articles, 64 were excluded under exclusion criterion 1 and 21 were excluded under exclusion criterion 2 (see Table 1).

The remaining 59 most relevant articles identified were further checked. Twelve were either non-academic publications or were outside the 2008–2018 publication cycle and were excluded. Consequently, 47 relevant articles (see Appendix 1) were selected as the research data set for presenting literature findings and development of propositions (see Figure 1).

Step 5

In Step 5, we reviewed the 47 remaining articles by reading their introduction, methods, results, and discussion sections, to identify the key issues and findings related to GSC and BRI GSC risks.

Step 6

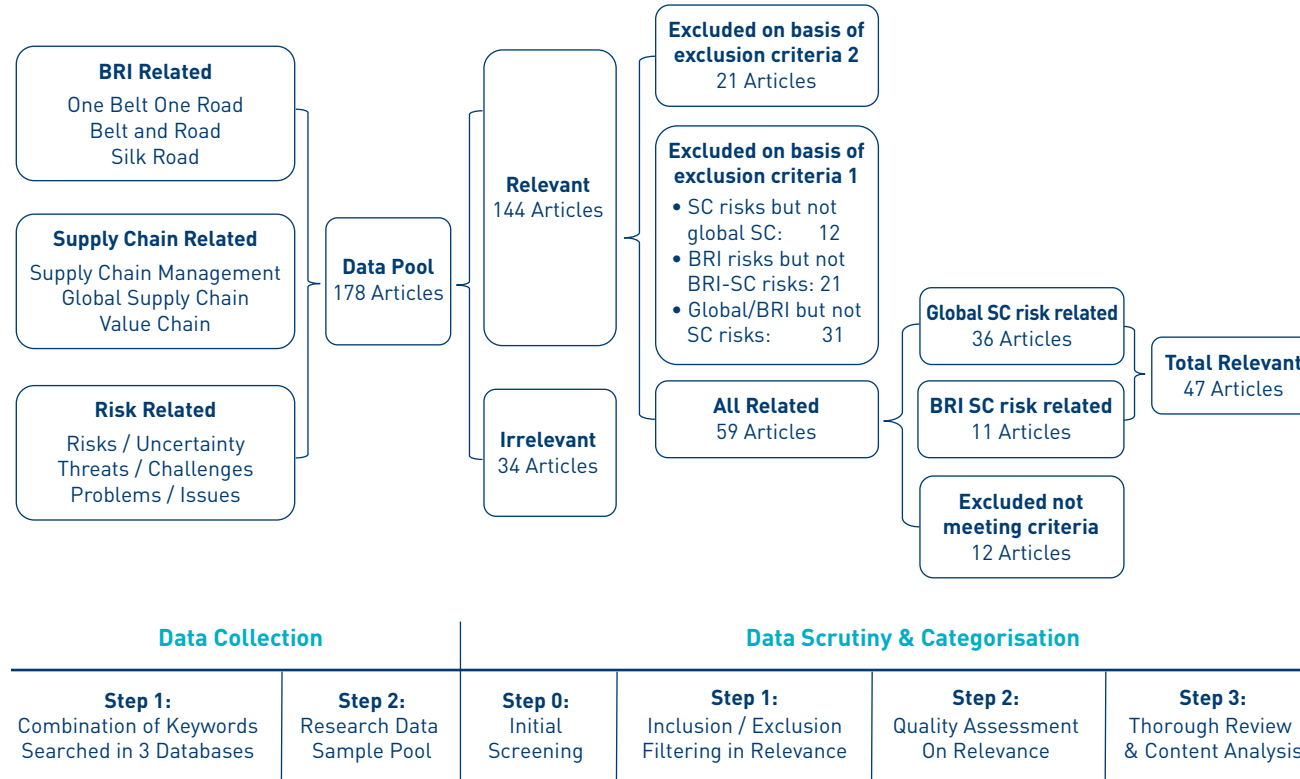
Key issues and findings identified in Step 5 are synthesized in Appendix1 according to a GSC risk theoretical framework comprising three broad risk categories (i.e., operational, supply/demand and environmental/other). The following section on the BRI also provides an overview of the key literature findings.

Literature Findings

The BRI

China has grown at an astounding pace over the last three decades (Huo, Gu, and Jiang, 2018). However, the global economic slowdown from 2007 to 2015 had a corresponding slowing effect on Chinese gross domestic product growth rate (Huang, 2016). To address this situation, the Chinese government launched the BRI in 2013. The BRI, which involves China and countries across Asia, Africa, and Europe, aims to bolster regional integration and stimulate economies and trade between participating countries (Chan, 2017; Wong and Jia, 2017).

FIGURE 1
Data Collection and Analysis Flow



The BRI comprises six economic corridors: the China–Indochina Peninsula Economic Corridor, New Eurasian Land Bridge, China–Central Asia–West Asia Economic Corridor, Bangladesh–China–India–Myanmar Economic Corridor, China–Mongolia–Russia Economic Corridor, and China–Pakistan Economic Corridor. These six corridors promise various trade and economic gains to the parties involved in the initiative. For instance, the China–Indochina Peninsula Economic Corridor alone is expected to yield an estimated USD372 billion in economic benefits to participating countries (Hahm and Raihan, 2018).

Given its scale and scope of benefits, the BRI has attracted great interest from Eurasia and Africa, with the Chinese government promising to make an investment of at least \$1 trillion in the BRI through the Silk Road Fund, Chinese policy banks, the New Development Bank, and the Asian Infrastructure Investment Bank, among others (Wong and Jia, 2017).

Countries participating in the initiative perceive it as an avenue for progress by enhancing trade, SC benefits and infrastructure development (Shaikh, Ji, and Fan, 2016). Reporting on the current status of the BRI, Stephens (2019, para. 4) writes that “trade generated by the BRI reached \$117 billion last year... The World Bank estimates that the BRI could reduce transportation times on many corridors by 12 percent, increase trade between 2.7 percent and 9.7 percent, increase income by up to 3.4 percent, and lift 7.6 million people from extreme poverty.”

Despite its promised benefits, the BRI is unique from many perspectives and entails multiple risks in terms of trade and SC activities. First, as Das (2017) argues, the BRI is planted on the historical Silk Route, making it different from other regional initiatives such as Brazil, Russia, India, China, and South Africa (BRICS) because of the unique geo-economic dimensions of countries along the Silk Route. Second, the cultural diversity, security sensitivities, and economic



contexts of the more than 70 participating countries make the BRI a unique endeavor that is exposed to significant risks from financial, operational, social, and security aspects, affecting GSCs (Shaikh, Ji, and Fan, 2016). Third, the vast involvement of over 70 countries adds complexity to trade and SC management because of differing interests, objectives, and preferences of participating nations. For instance, Sheu and Kundu (2018, p. 3) have highlighted the difficulties in managing the BRI GSC because of risks associated with international logistics, political instability, cross-border entry–exit regulations, transfer prices, taxation, and network security issues. Similarly, Sarker *et al.* (2018) have discussed the risks and challenges related to energy logistics and transportation involving the BRI GSC. Fourth, given that no precedent exists for an initiative similar to the scale and size of the BRI, parties involved in the BRI must face various uncertainties in establishing SCs that can facilitate trade and economic activities under the BRI. Finally, the multidimensional nature of projects (e.g., infrastructure and social) executed under the BRI gives rise to a variety of challenges (e.g., communications and managerial and personal interactions), making BRI GSCs vulnerable to various risks. Therefore, we argue that BRI GSCs are unique, warranting research to address potential risks and reap the benefits of the BRI. This study aims to achieve such objectives.

GSC and BRI GSC Risks

Operational risks

Operational risks are defined as “the distribution of outcomes related to adverse events within the firm that affect a firm’s internal ability to produce goods and services, quality and timeliness of production, and/or profitability” (Manuj and Mentzer, 2008a; p.198). Operational risks are driven by factors such as a lack of established/mature practices, processes, and guidelines, problems with internal controls and systems, and inappropriate actions by stakeholders (Christopher *et al.*, 2011; Li *et al.*, 2016). Other drivers of operational risks include inadequate manufacturing process capability, malfunctions in production processes, process variations, operational breakdowns, technological changes, and changes in operating exposure (Manuj and Mentzer, 2008b), as well as reputational, partnership, and collaboration factors and quality and sustainability awareness (see Appendix 1).

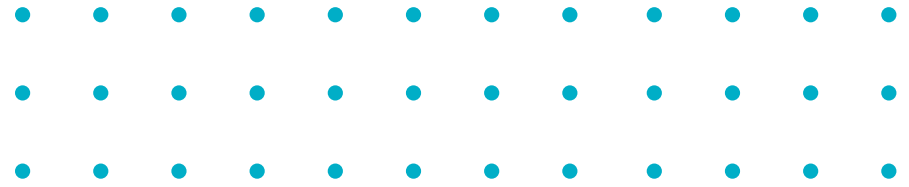
Since GSCs involve multiple parties across various parts of the globe, joint decision-making processes can be complicated (Qazi *et al.*, 2018). A lack of information transparency, process synergies, and managerial coordination among SC partners could introduce delays and even invoke mistrust between partners, which could result in erroneous decision-making, ultimately affecting SC performance (Fan *et al.*, 2017).

GSC operations in emerging markets such as India, where transportation infrastructure is relatively less mature, and countries suffering domestic instability face greater operational risks (Sreedevi and Saranga, 2017). Similarly, in the case of BRI GSCs, our literature review highlights that the lack of a robust cross-border payment system, inefficient payment and delivery processes, and underdeveloped and incompatible logistic infrastructure along BRI corridors induce operational risks (Notteboom and Yang, 2017). An Economist Intelligence Unit (2015) report suggests that most BRI-related trade and business activities entail high operational risks because of foreign trade and payment and financial issues. Other risk factors such as authority and power changes are unavoidable because of the long duration of most BRI engagements (Len, 2015).

In the broader BRI context, inefficiencies from miscommunication and process discrepancies between parties, unstructured appraisal processes, lack of administrative clarity, and lack of trace and track mechanisms induce operational risks for BRI GSCs (Zabakhidze and Beradze, 2017). Linguistic and cultural differences could affect day-to-day operational tasks because of difficulties in comprehension (e.g., of messages, processes, and instructions) and have been found to increase BRI GSC risks (Andrić *et al.*, 2017). In contrast, Wang, Jie, and Abareshi (2018) argue that the lack of innovation and creativity among parties involved in the BRI results in operational inefficiencies and increased logistical and SC risks.

Supply and demand risks

Supply risks are defined as “the distribution of outcomes related to adverse events in inbound supply that affect the ability of the focal firm to meet customer demand (in terms of both quantity and quality) within anticipated costs and time, or causes threats to customer life and safety”, while demand risks are defined as “the distribution of outcomes related to adverse events in the outbound flows that affect the likelihood of customers placing orders with the focal firm, and/



or variance in the volume and assortment desired by the customer” (Manuj and Mentzer, 2008a; p.197).

Supply risks may be induced by disruption of supply, inventory, and scheduling, price escalations, and frequent material design changes, while demand risks may be increased by variation in demand, the bullwhip effect, and new product introductions (Manuj and Mentzer, 2008b).

The mismatch between fixed supply capacity and dynamically changing demands is one of the most significant factors inducing GSC risk (Sreedevi and Saranga, 2017). In particular, for industries with a seasonal demand, parties involved in the SC are required to balance excess inventory and demand slacks (Tang and Musa, 2011; Sarker *et al.*, 2018).

Inconsistencies and imbalances in supply and demand are also a concern for BRI GSCs. Peak seasons (i.e., summer and winter) face disruption-related risks, while off-peak seasons, with their significantly lower demand, face efficiency-related risks from lower usage and thus low economic returns, while maintenance fees remain the same (Fu, 2018; Wang, Jie, and Abareshi, 2018). In addition, changing market needs could increase the vulnerability of the whole chain to disruptions (Sreedevi and Saranga, 2017). Therefore, a dynamic and accurate evaluation of vulnerability and trade patterns is required to make more informed decisions and mitigate supply and demand risks in BRI GSCs.

Improving SC visibility is particularly necessary to deal with both supply and demand risks because it will help remove uncertainty in decision-making (Ho *et al.*, 2015; Nooraie and Parast, 2015). Particularly, improved visibility of supply tiers could reduce issues in product quality in global SCs (Tse and Tan, 2011; Wu, Iyer, and Preckel, 2016). Andri *et al.* (2017) found similar evidence, suggesting that the poor quality of supplied materials remains one of the risk factors in BRI GSCs, possibly because of the lack of maturity and transparency of SCs.

Environmental/other risks

GSCs face a host of environmental and other risks from financial, economic, geopolitical, and security factors (Barnes and Oloruntoba, 2005). Issues such as fluctuations in exchange rates and commodity prices affects organizations’ net profits, increasing the financial volatility of parties involved in GSCs (Andri *et al.*, 2017; Wiengarten *et al.*, 2016). Profitability may also be affected by different

cross-border settlement systems (Tang and Musa, 2011), payment delays (Zeng and Yen, 2017), off-shore procurements, and possible hostile tariffs (Zeng and Yen, 2017). Similar concerns were also raised in an Economist Intelligence Unit (2015; p.7) report, which highlighted various BRI risks (ultimately affecting BRI GSCs) related to “security, legal and regulatory, government effectiveness, political instability and infrastructure.” Wong and Jia (2017; p.3) concur, suggesting that factors such as “foreign investment restrictions, antitrust regulations, tax, local employment and environmental laws” heighten BRI GSC risks.

The security of cargo and people are key GSC risk factors. For instance, long-distance transportation passing through some of the world’s volatile regions poses numerous security issues, including cargo theft, piracy, and compromised security of personnel involved in BRI GSCs (Choi *et al.*, 2018; Zabakhidze and Beradze, 2017). Geographically, difficult and rugged mountainous terrains that exist along BRI pathways give rise to several inherent security concerns for BRI GSCs (Shaikh, Ji, and Fan, 2016). The lack of appropriate insurance systems could also expose BRI GSCs to additional security concerns and reduced capacities to mitigate losses.

Compounding these traditional security concerns, cybersecurity is becoming a serious risk factor for businesses because the efficiency of GSCs is significantly dependent on the use of information technologies (Gu, 2017). Saran (2015) has reported that a large number of cross-border projects under the BRI involve frequent and large-scale data sharing and exchanges. Thus, businesses involved in the BRI, especially those that are less capable in terms of Internet security, must be acutely aware of possible cyberattacks or data leakages (Saran, 2015).

Other events such as natural disasters, sabotages, and logistical delays could also induce risks to GSCs (Kauppi *et al.*, 2016). In addition to security and nature-induced risks, the literature highlights that the management of environmental and social risks is also pivotal in achieving success in BRI trade and corresponding GSCs (Hahm and Raihan, 2018).

To conclude, the complex nature of GSCs and BRI GSCs means that they face a wide range of risks (see Appendix 1). However, knowledge about GSC risk remains fragmentary, and studies on BRI GSCs in particular are limited. Therefore, this study takes a theoretically driven approach to build knowledge on GSC risk using BRI GSCs as a case in point.



Discussion

Development of a GSC Risk Model Using BRI GSC

To build a model of GSC risk, this study drew upon the literature review and Manuj and Mentzer's (2008a) theoretical framework of GSC risk management to identify risk factors and develop propositions showing the relationships between risk factors and BRI GSC disruption (see Figure 2). Risk identification remains the most important step in the risk management process (Fan and Stevenson, 2018). Our approach of identifying and modelling risk factors is consistent with earlier studies (e.g. Liu, 2013; Wang, Jie, and Abareshi, 2018) in the BRI GSC context. We chose risk factors based on frequently reported concerns (e.g., logistics issues) in the literature (see Table 2).

Operational Risk Factors

Inability to develop managerial synergies

We define *managerial synergies* as the process of developing managerial cooperation with SC partners to improve the combined performance and value of SC management, which will be greater than total performance and value achieved by each partner working separately.

Among other aspects, SC management depends on the identification and establishment of managerial synergies within organizations involved in the chain (Srinivasan, Mukherjee, and Gaur, 2011). This becomes more important in GSCs such as the BRI because of the prevalence of a range of cultural, procedural, and working style differences that expose SCs to managerial incongruities (Harvey and Richey, 2001; Shaikh, Ji, and Fan, 2016). Wijeratne, Rathbone, and Wong (2018) concur, suggesting that governance and business management diversity exposes the BRI to managerial synergy risks. Wide-ranging cultural, social, and religious differences among BRI GSC partners affect managerial integration and coordination (Öztürk, 2019). Feng and Sun (2017) noted similar concerns, finding that cultural and corporate contradictions among BRI partners induce significant operational risks.

The oft-reported lack of transparency and insufficient information on BRI-related endeavors could lead to mistrust and difficulties in achieving managerial synergy among BRI GSC partners (Zabakhidze and Beradze, 2017). Instances

in which managers of various parties in the BRI GSC are unable to build personal rapport could slow decision-making and increase the likelihood of miscommunication, thus affecting SC performance (Wang, Jie, and Abareshi, 2018).

Malle (2017) has emphasized the importance of developing commercial relationships based on cumulative processes in cross-border SCs. Managerial synergies could help facilitate the efficient flow of goods, inventories, and information and enhance overall logistics, thus improving the performance of BRI GSCs, which may not otherwise be achievable in the lack of such cooperation (Sheu and Kundu, 2018).

We argue that given the unique governance, bureaucratic, cultural, and social settings in which businesses in BRI countries operate, achieving managerial synergy is pivotal for the stability of BRI GSCs (Wang, Jie, and Abareshi, 2018). The inability to develop such synergies is likely to lead to strategic mistrust among BRI partners (Len, 2015), operational bottlenecks, decision-making paralysis, and political and workflow ineffectiveness in BRI GSCs. Hence, we propose:

Proposition 1: The inability to develop managerial synergies is significantly associated with BRI GSC disruption.

Inability to establish an effective cross-border payment management system

We define a *cross-border payment management system* as a set of processes that ensure smooth transaction and settlement of payments to SC partners in a timely, accurate, transparent, and secure manner. Given the volatile economic and security situation in many BRI participating countries (Öztürk, 2019), establishing an effective cross-border payment management system is critical for BRI GSCs. Challenges such as higher transaction costs, the lack of full information for efficient payment reconciliation, the complexity and volume of account maintenance and administration, payment terms, and foreign currency exchange risks all necessitate establishing payment systems for efficient SC operations (Nguyen and Belaounia, 2019; Öztürk, 2019). Chan (2017) agrees, underscoring the need to establish cross-border payment settlement systems for BRI-related ventures.

This argument is further reinforced by the fact that banking and finance systems in many countries involved in the BRI are evolving (Deloitte Insights, 2018).



TABLE 2
Mapping of Risks in the BRI GSC Context

Risk Category	Focus of Risk	Relevant Studies	Proposed Risk Factors in the Context of BRI GSCs	Risk Orientation
Operational	Payment and productivity issues related to GSCs and BRI SCs	Cruz (2013); Manuj & Mentzer (2008b); Sarker <i>et al.</i> (2018); Tang & Musa (2011); Zeng & Yen (2017); Chan (2017); Hahm & Raihan (2018); Malle (2017)	Cross-border payment management systems; managerial synergies	Internal with external implications
	Managerial/partner synergies, collaboration	Cruz (2013); Fan <i>et al.</i> (2017); Huang (2016); Lavastre, Gunasekaran, & Spalanzani (2012); Sheu & Kundu (2018); Wang, Jie, & Abareshi (2018); Zeng & Yen (2017)		
Supply and demand	Building sustainable and economically and environmentally optimized BRI SCs	Fu (2018)	Supply chain visibility; vendor risks; logistics risks	Environmental (external)
	Logistics issues in GSCs and the BRI	Choi <i>et al.</i> (2018); Kuzmicz & Pesch (2018); Ma & Wong (2018); Min, Park, & Ahn (2017); Notteboom & Yang (2017); Seo, Chen, & Roh (2017); Sreedevi & Saranga (2017); Wang, Jie, & Abareshi (2018)		
	Strategic and political risks in the BRI	Len (2015)		
	SC visibility and risk sharing	Lehmacher (2017); Nooraie & Parast (2015); Tse & Tan (2011); Vilko, Ritala, & Hallikas (2019)		
	Vendor-related risks and profiling	Christopher <i>et al.</i> (2011); Wiengarten <i>et al.</i> (2016)		
Environmental/ other	Security risks in GSCs and the BRI (e.g., energy projects)	Bueno-Solano & Cedillo-Campos (2014); Manuj & Mentzer (2008a); Shaikh, Ji, & Fan (2016); Sofyalıoğlu & Kartal (2012)	Cargo and warehousing security	Environmental (combination of external and internal)

Note: BRI: Belt and Road Initiative; GSC: global supply chain; SC: supply chain

The need for maintaining healthy foreign exchange reserves often leads to banking red tape and overly complex procedures for making foreign currency transactions, posing risks to the sustainability of BRI GSCs (Albouy and Dupuy, 2017). Vulnerable local currencies, which depreciate against stronger currencies such as the dollar, euro, pound or renminbi, compound the risks for cross-border payment management in BRI GSCs (Sheu and Kundu, 2018).

In addition, given the economic context of countries participating in the BRI, parties involved in BRI GSCs will be a mix of small and large vendors, some with

little or no prior experience of working with international SC partners. These vendors may not have established payment systems and procedures or foreign currency bank accounts for sending and receiving remittances to ensure the smooth operation of BRI GSCs (Öztürk, 2019). Such unique circumstances require concerted efforts to establish cross-border payment systems and processes, and not doing so could significantly threaten the health of BRI GSCs.

Given the heightened security situation in many participating countries, BRI GSC-related payments may require additional scrutiny, leading to delays and



instabilities in payments. Further, with the BRI being a relatively new initiative, there are concerns about the lack of transparency, disparities in organizational financial management processes, and the financial and economic policies of involved parties. As such, the inability to establish a payment management system could lead to chaos and mistrust among parties involved in BRI GSCs, causing irreparable damage to the working of fragile partnerships and making these GSCs vulnerable to failure. Following these arguments, we propose the following:

Proposition 2: The inability to establish an effective cross-border payment management system is significantly associated with BRI GSC disruption.

Supply and Demand Risk Factors

Lack of SC visibility

Following existing definitions, we define *SC visibility* as the extent to which the actors in an SC have access to or share information about the identity, location, and status of entities transiting the SC that is accurate, trusted, timely, useful, and readily usable for their operations and which they consider will be of mutual benefit (Barratt and Oke, 2007, p. 1218; Francis, 2008, p. 182).

Visibility of workflow, demand, and supply and the movement of goods and information is considered pivotal to the efficiency, resilience, and performance of GSCs (Lehmacher, 2017). SC visibility improves collaboration, quality control, transparency, and risk assessment and helps avoid disruptions and non-compliance risks (Nooraie and Parast, 2015). Lehmacher (2017, p. 17) stresses that “in a recent market analysis, the advisory group ARC notes that supply chain visibility and collaboration will be inevitable in the future and will be the fastest-growing segment across a range of supply chain solutions.” A study by the Aberdeen Group revealed that 63% of respondent companies with global SCs consider visibility a top priority for supply/demand efficiency (Heaney, 2013).

In light of the above discussion and oft-cited issues such as the lack of transparency, complex processes, and security issues in relation to the BRI, establishing BRI GSC visibility becomes a priority for achieving resilient and sustainable chains (Kamalahmadi and Parast, 2016). Establishing BRI GSC visibility will enable timely information sharing, helping to improve flexibility of

GSCs, enhance the understanding of the effects of changes and customer demands, prevent the bullwhip effect, and improve forecasting across BRI GSCs (Hu, 2019; Tse and Tan, 2011). Social and economic diversity of participating BRI countries further increases the importance of developing SC visibility to improve collaboration with suppliers and customers at different points on the chain (Kamalahmadi and Parast, 2016).

Given the varying operational routines, information sharing behaviors, and control and tracking mechanisms used by parties involved in the BRI GSC, we assert that a lack of visibility will have a debilitating effect on SC efficiency (Haley, 2003). In addition, language and communication barriers that exist across BRI countries will further exacerbate the situation, leading to errors in managerial decision-making (Kamalahmadi and Parast, 2016). Establishing visibility is key to BRI GSC risk mitigation or avoidance (Nooraie and Parast, 2015). Hence, we propose:

Proposition 3: The lack of SC visibility is significantly associated with BRI GSC disruption.

Lack of vendor risk profiling

We define *vendor risk profiling* as the process of gathering, analyzing, and maintaining up-to-date information about vendors’ abilities to meet technical, quality, and scheduling commitments and corresponding risks (Arsenault, 1999).

Given their wide reach, GSCs inherently benefit from access to a large pool of vendors. Partnering with the right vendors reduces costs, brings experience to the overall operation, reduces quality risks, and helps achieve long-term goals. However, selecting the right vendors is not easy and remains one of the major risks in SC management (Cruz, 2013). Therefore, risk profiling of potential vendors becomes important to building a sustainable SC. Prior studies have recommended a range of criteria to evaluate vendors’ suitability and corresponding risks, including response time, on-time delivery capabilities, cost minimization, location of supplier, prior experience, history of working with other SCs, reliability, and ability to deal with emerging problems (Kamalahmadi and Parast, 2016).

Given that the majority of its vendors are located in developing countries, BRI GSCs operate in one of the world’s most challenging environments (Wang, Jie, and



Abareshi, 2018). The newness of BRI GSC relationships means that parties entering into SC arrangements may not know each other well enough. Such a scenario increases vendor risks and may affect the long-term effectiveness of BRI GSCs. To minimize vendor-related risks and SC disruptions, organizations intending to become part of a BRI GSC arrangement must perform due diligence to ensure they form stable partnerships. A lack of vendor risk profiling could lead to disastrous decision-making and financial losses.

We contend that given the unique economic, financial, sociopolitical, and security settings in which vendors in countries participating in the BRI operate, establishing a vendor risk profiling mechanism to minimize SC risks is critical. The lack of a vendor risk profiling mechanism will expose SC partners to a variety of challenges, including fraud, piracy, and quality- and vendor-related disruptions. Thus, we propose:

Proposition 4: The lack of vendor risk profiling is significantly associated with BRI GSC disruption.

Immaturity of logistics networks

A logistics networks is defined as “a set of nodes (for instance, warehouses or transshipment points) and transport connections, resulting from and being subject of a planning process of an economic actor or association of actors deciding together” (Liedtke and Friedrich, 2012; p. 1337).

Mature logistics networks play a vital role in cost savings and efficiencies through inventory and warehouse planning and understanding the trade-offs among inventory quantities (Sheu and Kundu, 2018). In a GSC benchmark report, the immaturity of logistics networks in low-cost countries has been cited as one of the top 10 risks (Aberdeen Group, 2006).

When established in developing economies with evolving business infrastructures, BRI GSCs face risks from the immaturity of logistics networks (Wang, Jie, and Abareshi, 2018). This can occur for multiple reasons, including the short life of BRI-based logistics networks, the lack of well-established infrastructure and facilities, the lack of seamless warehousing information systems and processes in many BRI countries, varying technologies used across different countries, and nascent SC relationships. As a result, developing the maturity of logistics networks remains a key element of efforts in BRI ventures (Sheu and Kundu, 2018).

Cullinane *et al.* (2018) have suggested that improving the efficiency of logistics networks is a primary aim of the BRI. The maturity of logistics networks is expected to help BRI GSC partners in many ways, including “making decisions regarding facility locations, distribution management, warehousing, inventory management, transportation management, coordination and contracts among members” (Sheu and Kundu, 2018, p. 6).

In particular, the coordination of the physical movement of goods across various regions participating in the BRI could be challenging because of the lack of substantial economic development. Consequently, immature logistics networks may not be able to support an efficient GSC operation, increasing the risks and chance of BRI GSC failure.

We posit that the immaturity of logistics networks poses a real threat to BRI GSC sustainability and may result in inefficiencies in inventory, distribution, and warehousing management, ultimately increasing costs and slowing decision-making processes. Drawing upon the above discussion, we propose:

Proposition 5: Immaturity of logistics networks is significantly associated with BRI GSC disruption.

Environmental/Other Risk Factors

Lack of cargo movement and warehousing security

Cargo movement and warehousing security is defined as the protection of goods, inventory, and information during storage and movement throughout the SC.

Effective SC management requires the smooth, secure, and transparent movement of cargo along the chain. SC costs may be significantly reduced by purchasing from suppliers from anywhere across the globe if the safety of cargo movement is assured. Suppliers or partners in locations facing security challenges may increase the risks to cargo movement and warehousing security (Barnes and Oloruntoba, 2005). Security issues remain a major risk to business endeavors along BRI corridors (Shaikh, Ji, and Fan, 2016). Unreliable transport services, high risk of cargo theft, and absence of technologies to trace and track cargo movements increases BRI GSC risk (Zabakhidze and Beradze, 2017). Given that the BRI covers long distances and traverses a number of regions, cargo movement and warehousing security risks are exacerbated (Choi *et al.*, 2018).



We contend that parties involved in BRI GSCs should prioritize investment in security systems to reduce external and internal risks. Key elements include securing warehousing infrastructure, providing transportation vehicles, education and training on security, and securing information systems and business communication. A lax approach in establishing and maintaining security apparatus will be costly and risky. Therefore, we propose:

Proposition 6: The lack of cargo movement and warehousing security is significantly associated with BRI GSC disruption.

Implications, Future Directions and Limitations

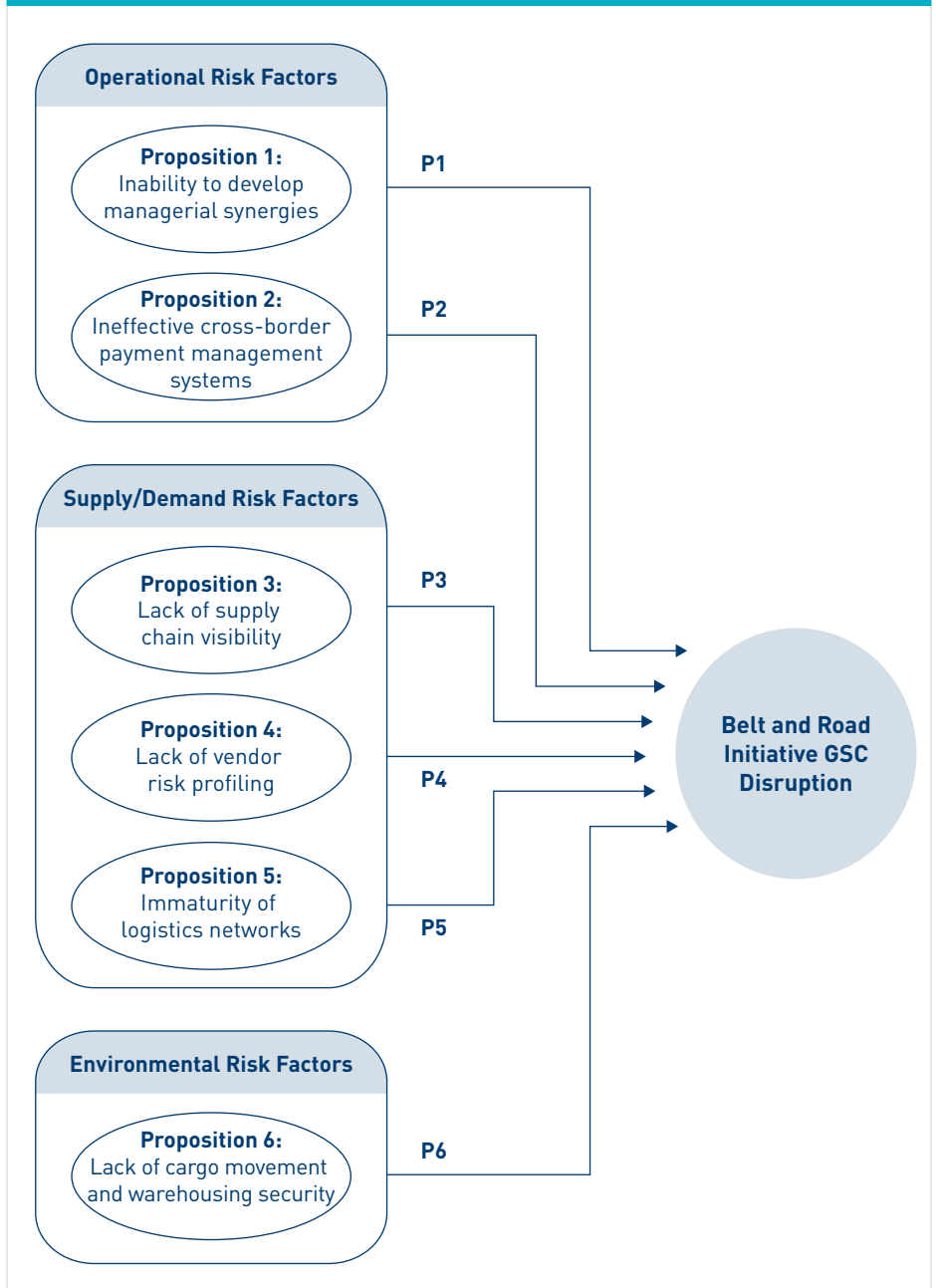
Implications of Model and Research for Theory and Practice

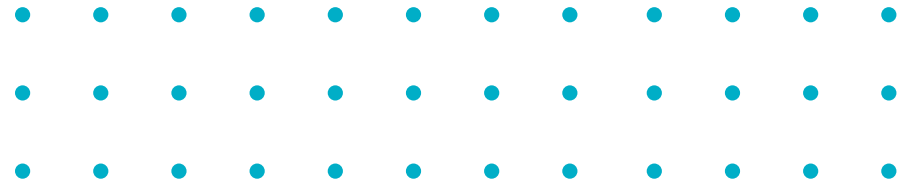
The study makes a number of significant contributions to theory and practice. Academically, the study develops a model of BRI GSC risks that proposes relationships between various operational, supply/demand, and environmental/other risk factors and BRI GSC risk disruption, thus advancing the knowledge about BRI risk, an area with little to no existing research. This will enable academics from various research domains (e.g., SCs or operations) to develop a common understanding of BRI GSC risks, while facilitating the consistent application of knowledge in practice. Given its scalability and encompassing nature, the model is extendable, allowing for the addition of more risk antecedents to develop a comprehensive knowledge of BRI GSC disruption.

It is also pertinent to note that the model developed in this study will serve as a platform upon which to develop an understanding of not only the individual and collective effects of factors on GSC disruption but also their interrelationships, resulting in comprehensive knowledge on risks to BRI GSCs.

Second, building on the theories of previous studies (e.g. Liu, 2013; Manuj and Mentzer, 2008a; Wang, Jie, and Abareshi, 2018), this study identifies and proposes six risk factors that have a potential influence on BRI GSC disruption. Such an understanding will help build a theory of SC risk management and will serve as guidance for future studies. Third, the model will help in understanding potential SC weaknesses, guiding future research on building strategies to mitigate or eliminate GSC risks. Fourth, underpinned by an existing theoretical framework, the study presents a structured review of the literature on GSC and

FIGURE 2
Belt and Road Initiative Global Supply Chain Disruption Model





BRI GSC risk using a classification involving operational, supply/demand, and environmental/other dimensions. The proposed classification will serve as a guide for other researchers, who can independently classify the most recent and upcoming scientific articles or use a large number of databases covering more articles, thus encapsulating a wider knowledge base. Further, the theoretical approach used in the study establishes a platform for knowledge development in a cohesive and theoretically informed manner and encourages future theory application in the SC risk context. Finally, the study and its findings will help concentrate academic knowledge development on the BRI GSC risk stream, which can be used by policymakers to reduce BRI GSC risks.

Managerially, the results provide a comprehensive SC risk framework to organizations to develop strategies to avoid, mitigate, transfer, or accept identified risks. Managers (e.g., SC, operations, risk management, production and logistics, and business executives) will be able to use the results to understand the various triggers and elements of GSC risk, helping them make better judgments in treating risk. The findings will encourage managers to build a complete picture of BRI GSC risk and consider potential mitigation strategies. They also provide managers with an understanding of the internal and external orientation of risk, helping them to coordinate with relevant stakeholders more effectively. Further, the issues highlighted in the consolidated literature review and model development section will provide guidance to managers about the characteristics of BRI GSC risks, which is expected to be useful for developing specific risk mitigation strategies.

The study findings will offer policymakers an understanding of the challenges associated with GSC and BRI GSC risk to develop regulatory infrastructure in relation to governance, environment, payment management, security, and logistics for the sustainable development of GSCs.

Future Research Directions

The study provides a number of avenues for future research to develop further knowledge. First, building on the knowledge developed in this study, qualitative empirical studies may be done to develop an understanding of how risk factors manifest, extending the BRI GSC risk model developed in this study. Second, quantitative empirical work will be needed to test the proposed relationships and validate the model proposed in this study to form a broader theory of BRI GSC

risk management. Third, more studies are warranted to identify additional risk factors to develop more comprehensive knowledge on the challenges to BRI GSCs and GSCs in general. Fourth, qualitative studies can be done to identify strategies to effectively treat or reduce the negative consequences of BRI GSC risks and resultant disruptions. Fifth, further work is warranted to examine SC risk factors that may be pertinent to GSCs to develop distinct pools of SC and GSC risk factors. Sixth, longitudinal studies comparing regional and global differences and factors triggering risk are needed to develop knowledge about cross-border SC risks. Finally, more studies are needed to build knowledge on the similarities and differences in SC risks related to the BRI compared with other regional economic endeavors such as BRICS to help improve SC risk management.

Limitations

The study also has some limitations. First, the identified list of GSC risks is not exhaustive and other existing risks must be investigated. Second, the risk factors proposed in the model are limited in number and are based on some of the key issues frequently discussed in the literature. While care was taken to exercise as much objectivity as possible in choosing BRI GSC risk factors for the model development, other risk factors may exist; thus, more work is needed to further expand the framework. Third, while the SC risk model developed in this study is theoretically well informed, it must be empirically validated. Finally, despite the efforts to conduct a comprehensive review of the literature and consider as many existing research articles as possible, some articles may not have been captured in the literature search.

Conclusion

The success of GSCs is pivotal to the success of the global economy. However, GSCs face diverse risks from legal, jurisdictional, cultural, and operational perspectives. The launch of the BRI, with its unique composition and context, offers new challenges for GSC management. The increasing influence and expansion of the BRI (e.g. the recent joining of Italy, entailing new perspectives for European SCs) is expected to have a significant impact on trade and business activities and corresponding SCs, as emphasized in a recent World Bank (2019) report. Given the relative newness and unique context of the initiative, building knowledge about GSC risks in general and BRI GSC risks in particular is necessary.



Underpinned by a theoretical framework of GSC risk, this study reviewed 178 articles and found that parties in GSCs and BRI GSCs face a variety of risks related to operations (e.g., risks driven by process variations, operation breakdown, transparency, and managerial coordination), supply (e.g., risks driven by disruption of supply, inventory, and scheduling and poor quality of supplies), demand (e.g., risks driven by variations and seasonality of demand), and environmental/other (e.g., risks driven by exchange rate fluctuations, security, and local employment and environmental laws).

In relation to GSC risks in the BRI context, operational risks driven by factors such as the inability to build managerial synergies or establish effective cross-border payment management systems weigh heavily on the success of BRI GSCs. Given the unique cultural and social context of the BRI, a lack of managerial synergies could increase the sources of risk by inducing decision-making paralysis, incongruence of SC objectives, lack of cooperation, and mistrust, among others. Such a situation will have a debilitating effect on the sustainability of BRI GSCs.

Transparency and access to information is critical in the delicate geopolitical and economic settings of BRI GSC relationships. Therefore, SC visibility is of paramount importance to ensure that the identity, location, and status of entities in the SC are known to all parties in the BRI GSC. The accuracy, timeliness, and accessibility of such information will lessen the risks arising from the bullwhip effect and improve the velocity and flexibility of GSCs.

SC visibility and information transparency will facilitate the profiling of vendors for their risk propensity (e.g., quality, timeliness, cooperation, flexibility, and security compliance). This will allow the safeguarding of SC interests by choosing appropriate vendors for SC activities, thus reducing overall risks and improving BRI GSC risk management.

GSC visibility is also affected by the immaturity of logistics networks, which will have serious consequences for decisions in relation to facility locations, distribution management, warehousing, and inventory and transportation management. To avoid disruptions to the physical flow of goods, BRI GSC partners must work together to strengthen their logistics capabilities through effective planning and strategizing of facilities and transportation. Security of cargo movement and warehousing can also be improved through maturity of logistics networks.

To conclude, BRI GSC disruptions stem from a number of operational, supply/demand, and environmental/other factors. This study has modelled some of these risk factors to understand the relationships between these factors and BRI GSC disruption. When statistically tested, the variance explained by these factors will show the effect of these factors on the BRI GSCs, contributing to an understanding of the possible interrelationships among factors as well. Minimizing the impacts or eliminating these risks will require a coordinated effort and commitment from all stakeholders involved in BRI GSCs.

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APPENDIX 1

Relevant Articles and References

No.	Category	Global Supply Chain Risks or Relevant Risk Issues	References
1	Operational	Proposed a system of information processing for SC risk management	Fan <i>et al.</i> (2017)
2		Proposed strategies and approaches to manage sustainability-related SC risks	Giannakis & Papadopoulos (2016)
3		Reviewed SC resilience to mitigate risks and discussed strategies and gaps for future research	Kamalahmadi & Parast (2016)
4		Discussed management and attitudes toward business risks associated with SCs. Effective collaboration and information exchange and establishment of joint processes is critical to manage SC risks	Lavastre, Gunasekaran, & Spalanzani (2012)
5		Proposed a risk assessment and management methodology	Tang <i>et al.</i> (2016)
6		Reputation risks	Tannous & Yoon (2018)
7		Developed an SC risk management approach based on Bayesian belief networks	Qazi <i>et al.</i> (2018)
8		Risk visibility and control-related issues and role of SC stakeholders	Vilko, Ritala, & Hallikas (2019)
9		Discussed the role of risk management practices in SC performance, particularly from a cost and innovation capability perspectives	Wiengarten <i>et al.</i> (2016)
10		Partnership and collaboration risks, payment delays	Zeng & Yen (2017)
11	Operational, supply	Product safety risks	Maruchek <i>et al.</i> (2011)
12	Supply	Disruption risks because of security-related events in global SCs	Bueno-Solano & Cedillo-Campos (2014)
13		Labor turnover because of job dissatisfaction	Jiang, Baker, & Frazier (2009)
14		Proposed a methodology for supplier risk evaluation	Liu <i>et al.</i> (2017)
15		Pandemic risks to global SCs	Thomsett (2010)
16		SC visibility, quality risks	Tse & Tan (2011)
17		Risk of disturbance in inventory flow resulting from a disruption to physical chokepoints along major trade routes in the context of the food trade	Wellesley <i>et al.</i> (2017)
18	Supply/demand	Supply disruption risks, social risks, demand uncertainty, payment delays, partner selection, and investment in corporate social responsibility risks	Cruz (2013)
19		SC visibility	Nooraie & Parast (2015)
20		Listed multiple SC risks related to suppliers, distributors, and manufacturing facilities	Soni & Kodali (2013)
21	Environmental/ other	Developed a methodology for calculating the SC risk index and discussed use of technology to manage global SC risks	Farahbod & Varzandeh (2018)
22		Country disruption risks (e.g., high operational contingency risks, natural hazards, and political instability)	Kauppi <i>et al.</i> (2016)
23		Discussed global SC risks in the context of emerging markets (e.g. BRICS)	Lehmacher (2017)
25		Social risks	Zimmer <i>et al.</i> (2017)

APPENDIX 1

Relevant Articles and References

No.	Category	Global Supply Chain Risks or Relevant Risk Issues	References
26	Operational, supply/demand, environmental/ other	Proposed risk classification under four categories: supply risks, process and control risks, environmental and sustainability risks, and demand risks. Discussed strategies for SC risk management	Christopher <i>et al.</i> (2011)
27		Identified and classified food SC risks into eight categories: policy and institutional, political, logistical/ infrastructural, biological and environmental, market (demand and supply), green mandate, managerial and operational, weather/natural disasters	Enyinda & Mbah (2017)
28		Proposed a closed-loop risk management/assessment system with inputs, outputs, and feedback	Kumar, Boice, & Shepherd (2013)
29		Listed and categorized multiple SC risks such as internal, global environment, supplier, customer, and third-party logistics providers	Ma & Wong (2018)
30		Classified SC risks as operational, supply, demand, and other (e.g., security). Discussed six risk management strategies with respect to environmental conditions	Manuj & Mentzer (2008a)
31		Classified risk in eight categories: operational, supply, demand, security, macro, policy, competitive, and resource risks. Listed multiple risks for each category, including cashflow and payments	Manuj & Mentzer (2008b)
32		Wealth creation efficiency, logistics efficiency, business friendliness, political risk, macroeconomic risk, social service risk, input market risk associated with operations in low-cost countries	Min, Park, & Ahn (2017)
33		Identified and proposed SC risk management strategies for various risks across four categories: operational, supply, demand, and security risks	Sofyalioğlu & Kartal (2012)
34		Supply, delivery, manufacturing process, environmental uncertainty, distribution/logistics flexibility risks	Sreedevi & Saranga (2017)
35		Identified major risk issues based on literature review, classifying them as material flow, financial flow (timely payments), and information flow risks	Tang & Musa (2011)
36		Classified multiple risks into five categories: economic, environmental, geopolitical, relational, and technological. Emphasized that more needs to be done to deal with global SC risks	Varzandeh, Farahbod, & Zhu (2016)
BRI SC Risk-Related Articles			
37	Operational	Environmental risks related to BRI SCs	Fu (2018)
38	Supply	Logistics and distribution risks in BRI SC. Discussed Internet of Things-based container tracking systems	Choi <i>et al.</i> (2018)
39		Logistics and distribution risks in BRI SC. Discussed empty container problems arising from trade imbalances	Kuzmicz & Pesch (2018)
40		Logistics risks related to port operations	Notteboom & Yang (2017)
41		Logistics network risks. Proposed strategies to optimize logistics and transportation decisions for parties involved in BRI SCs	Sheu & Kundu (2018)
42		Logistics risks to optimize route performance	Seo, Chen, & Roh (2017)
43	Supply; environmental/ other	Security risks in relation to BRI oil SCs	Shaikh, Ji, & Fan (2016)
44	Environmental/other	Political and strategic distrust risks in BRI SCs	Len (2015)
45	Operational, supply/demand, environmental other	Political, financial viability, lack of central coordination mechanisms risks for BRI SCs	Huang (2016)
46		Investigated political risk, economic risk, investment environment, resource potential, and environmental risks for the oil, gas and energy industry SCs under the BRI	Sarker <i>et al.</i> (2018)
47		Focused on logistics risk to improve SC performance and discussed various risks classified as company-side risks, customer-side risks, and environmental risks	Wang, Jie, & Abareshi (2018)

Note: BRI: Belt and Road Initiative; GSC: global supply chain; SC: supply chain